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ABSTRACTS OF THE ANNUAL MEETING 2022

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Willkommen zum 82. Jahreskongress

Liebe Kolleginnen und Kollegen,

Endlich ist es wieder so weit: Ich freue mich, Euch möglichst zahlreich endlich wieder *in praesentiam* am diesjährigen 82. Jahreskongress in Basel begrüssen zu dürfen. Wie bei der letzten Mitgliederversammlung festgelegt, werden wir dieses Jahr zwei für uns alle wichtige Themen besprechen.

Orthopädie – quo vadis? Wie wird sich unsere Spezialität in den kommenden Jahren entwickeln? Wie können wir eine gute Weiterbildung mit genügender chirurgischer Exposition garantieren, trotz Arbeitszeitverminderung und Plethora von Assistenten und Oberärzten? Wie können wir unsere fertig ausgebildeten Oberärzte und Leitenden Ärzte an den grossen Häusern halten und wie können wir mit in der Schweiz ausgebildeten Kollegen leitende Positionen in wichtigen Kliniken besetzen? Warum hat die Attraktivität von leitenden Stellen abgenommen und warum sind diese schwierig zu besetzen?

Im zweiten Hauptthema bearbeiten wir die Frage: **Trauma oder degenerativ.** Ist eine Rotatorenmanschettenruptur immer degenerativ? Wie sieht es mit der Begutachtung solcher Läsionen aus? Wie können wir unsere Patienten am besten betreuen? Was sagt die moderne Literatur? Wie sieht es versicherungstechnisch aus?

Neben diesen Hauptthemen wird es ICL's geben, welche wie jedes Jahr auf höchstem Niveau wichtige Informationen liefern werden.

Die **MEM-Lecture** wird dieses Jahr von einem höchst ehrwürdigen Kollegen aus Oxford gehalten werden. Mister **Martin McNally** wird über seine immense Erfahrung bei der **Behandlung von akuten aber auch chronischen Infektionen des Bewegungsapparates** berichten. Ich kann es kaum erwarten, diesem brillanten Sprecher gebannt bei seinem Rückblick auf die Entwicklung der modernen septischen Knochenchirurgie zuzuhören.

Speziell freut es mich, dass wir dieses Jahr zum ersten Mal einen speziellen **Workshop für unsere Kolleginnen** organisieren können. Es ist der ausdrückliche Wunsch des Vorstandes der Gesellschaft, eine Plattform für weibliche Orthopädinnen zu schaffen, um Frauen in unserer Spezialität optimal während der Weiterbildung aber auch in der späteren Karriereplanung zu unterstützen. Im Anschluss an den Workshop soll eine Arbeitsgruppe gegründet werden, welche als Ansprechpartnerin mit dem Vorstand Bedürfnisse und Wünsche der Kolleginnen diskutieren kann.

Eine Vorschau der diversen eingereichten (ersten) Freien Mitteilungen und Poster ist in dieser Abstract-Ausgabe abgebildet. Herzlichen Dank für die zahlreichen spannenden Beiträge, welche jedes Jahr wiederum einen Grossteil des Kongressprogramms bilden.

Ich freue mich enorm auf diese 3 Tage am Rheinknie und Euch wiederum vor Ort anzutreffen.

Prof. Dr. med. Olivier Borens

Präsident swiss orthopaedics

Bienvenue au 82e congrès annuel

Chers et chères collègues,

Nous y voilà enfin: Je me réjouis de pouvoir vous accueillir le plus nombreux possible à Praesentiam lors du 82e congrès annuel de cette année à Bâle. Comme convenu lors du dernier assemblée générale, nous aborderons cette année deux thèmes importants pour nous tous.

Orthopédie – quo vadis? Quelle évolution notre spécialité connaîtra-t-elle dans les années à venir? Comment pouvons-nous garantir une bonne formation postgraduée avec une exposition chirurgicale suffisante, malgré la réduction du temps de travail et la pléthore de médecins-assistants et de chefs de clinique? Comment pouvons-nous garder nos chefs de clinique et nos médecins-chefs dont la formation est terminée au sein des grands établissements et comment pouvons-nous occuper des postes de direction au sein d'importantes cliniques avec des collègues formés en Suisse? Pourquoi l'attractivité des postes de direction a-t-elle diminué et pourquoi ces postes sont-ils difficiles à pourvoir?

Nous aborderons en tant que second thème principal la question suivante: **Traumatique ou dégénératif.** Une rupture de la coiffe des rotateurs est-elle toujours dégénérative? Qu'en est-il de l'expertise de telles lésions? Comment pouvons-nous prendre en charge au mieux nos patients? Que dit la littérature moderne? Qu'en est-il du point de vue des assurances?

Outre ces thèmes principaux, auront lieu des ICL qui, comme chaque année, fourniront des informations importantes au plus haut niveau.

Cette année, la **conférence MEM** sera animée par un collègue très honorable d'Oxford. Monsieur **Martin McNally** parlera de sa riche expérience dans le **traitement des infections aiguës et chroniques de l'appareil locomoteur**. J'ai hâte d'écouter ce brillant orateur retracer l'évolution de la chirurgie osseuse septique moderne.

Je me réjouis tout particulièrement à l'idée de pouvoir organiser pour la première fois cette année un **atelier spécial pour nos collègues de la gent féminine**. Le comité directeur de la société souhaite expressément créer une plateforme pour les femmes orthopédistes afin de les soutenir de manière optimale dans notre spécialité pendant leur formation postgraduée, mais aussi au cours de leur carrière. A l'issue de l'atelier, un groupe de travail qui aura pour mission de discuter des besoins et des souhaits de nos collègues femmes avec le comité directeur verra le jour.

Un aperçu des (premières) communications libres et des posters soumis est présenté dans ce numéro de l'Abstract Supplementum. Nous vous remercions chaleureusement pour les nombreuses contributions passionnantes qui constituent chaque année une grande partie du programme du congrès.

Je me réjouis de vous rencontrer de nouveau sur place lors de ces trois jours au coude du Rhin.

Meilleures salutations,

Prof Dr méd. Olivier Borens

Président swiss orthopaedics

FREE COMMUNICATIONS: SHOULDER / ELBOW PART 1

FM001*

Une dose unique d'acide tranexamique réduit les pertes sanguines après arthroplastie d'épaule inversée ou anatomique: essai contrôlé randomisé (11281)

Benoît Borner; Grégory Cunningham

Introduction

La formation d'hématomes et la nécessité de transfusions sanguines sont des complications fréquemment rencontrées après une arthroplastie de l'épaule. L'acide tranexamique (tranexamic acid − TXA) a été largement utilisé dans les arthroplasties de la hanche et du genou pour réduire les pertes sanguines périopératoires. Le rôle du TXA est encore en cours d'établissement dans l'arthroplastie de l'épaule.

Methods

Nous avons mené un essai contrôlé randomisé en double aveugle comparant le TXA intraveineux au placebo chez 60 patients subissant une arthroplastie primaire anatomique ou inversée de l'épaule. Parmi ces patients, 29 ont reçu un placebo tandis que 31 ont reçu une dose unique de 2 g de TXA intraveineux. Les caractéristiques démographiques des patients, ainsi que le débit du tube de drainage, la perte de sang, la formation d'hématomes, le besoin de transfusion, la durée de l'hospitalisation et la douleur ont été enregistrés. Les patients ont été suivis pendant 12 semaines pour évaluer l'apparition de complications.

Results

Les patients qui ont reçu du TXA démontraient une extériorisation par drain plus faible à tous les points de temps: 41 mL contre 133 mL à 6 heures, 75 mL contre 179 mL à 12 heures, et 94 ml contre 226 ml à 24 heures (P <0.001 pour tous). Ils avaient également un taux d'hémoglobine (Hb) postopératoire plus élevé (12.3 g/dL contre 11.4 g/dL, P = 0.009), un changement plus faible du taux d'Hb (1.7 g/dL contre 2.3 g/dL, P = 0.011), une perte totale d'Hb plus faible (0.078 g contre 0.103 g, P = 0.042), une perte de volume sanguin plus faible (0.55 L contre 0.74 L, P = 0.021), un taux d'hématocrite postopératoire plus élevé (36.7% contre 34.6%, P = 0.020), et une chute d'hématocrite plus faible (5.4 % vs. 7.6 %, P = 0.022). Il n'y a pas eu de différence significative dans le score de douleur ou la durée du séjour à l'hôpital, et aucun patient n'a eu besoin d'une transfusion.

Conclusion

Une dose unique de 2 g de TXA intraveineux diminue la perte de sang et le débit du tube de drainage dans les arthroplasties primaires anatomiques et inversées de l'épaule. Aucune différence n'a été détectée dans la survenue de complications, le besoin de transfusion, le score de douleur ou la durée de l'hospitalisation. Avec les preuves de plus en plus nombreuses maintenant disponibles, les patients subissant une arthroplastie primaire élective de l'épaule devraient recevoir du TXA intraveineux pour diminuer la perte de sang périopératoire.

FM002

Incidence, radiographic predictors and clinical outcome for acromial stress reaction and acromial fractures in reverse total shoulder arthroplasty (11118)

Philipp Kriechling; Sandro Hodel; Alexander Paszicsnyek; Ines Schwihla; Paul Borbas; Karl Wieser

Balgrist University Hospital, Zurich, Switzerland

Introduction

Acromial and scapular spine fractures (ASF) are known complications following implantation of Reverse Total Shoulder Arthroplasty (RTSA). The entity of acromial stress reaction (ASR) without fracture has recently been described. The purpose of this study was to analyze the incidence, radiographic predictors, treatment options, healing rate and clinical outcome of ASF and ASR compared to a control group.

Methods

A total of 854 primary RTSAs were implanted between 2005 and 2018 in a single shoulder unit of a tertiary referral hospital and retrospectively reviewed for the incidence of ASF and ASR. ASR was defined as pain at the acromion or scapular spine after fracture exclusion on CT scans. The ASF group was matched to a control group. Preoperative and postoperative radiographs were analyzed for radiographic predictors of ASF or ASR. The impact of ASF and ASR, operative versus non- operative treatment and fracture union on clinical outcome (Constant-Murley-Score, Subjective Shoulder Value and range of motion) with minimum follow-up of 2 years was analyzed.

Results

A total of 46 ASF (5.4 %) in 44 patients and 44 ASR (5.2%) in 43 patients were detected at a mean of 16 ± 24 months and 20±23 months postoperative, respectively. Predictive radiographic factors were an increased critical shoulder angle (CSA) and lateralization shoulder angle (LSA). The overall union rate was 55% (22/40) but significantly higher following operative treatment (9/11, 82%) compared to non- operative treatment (13/29, 45%). Patients with ASF/ASR demonstrated inferior clinical outcome (CS 44 ± 21 and 48 ± 18; SSV 52 ± 25 and 57 ± 27) compared to the control group (CS 66 ± 14; SSV: 82 ± 22) independent of bony union or treatment at mean of 59 ± 33 months (ASF) and 61 ± 38 months (ASR).

Conclusion

ASF and ASR are frequent complications following RTSA implantation with similar poor clinical outcome measures. The healing rate was shown to be much higher with a surgical approach. Nevertheless, fracture consolidation does not result in better clinical outcomes compared with nonunion.

FM003

Total shoulder arthroplasty with a new cementless glenoid component. Short term results (11412)

Richard Nyffeler[1]; Georges Kohut[2]

[1] Orthopädie Sonnenhof; [2] Clinique Générale Ste-Anne

Introduction

Glenoid loosening is the most common complication of anatomic total shoulder replacement. Medical companies are therefore looking for new solutions. The aim of this study was to evaluate the clinical and radiological short-term results of a new cementless glenoid component.

Material and Methods

The glenoid component is made of highly cross-linked polyethylene with vitamin E and has a thin layer of non-correlating, individually anchored titanium particles on the backside and on the two fixation pegs. It is a mono-block implant. The primary stability is ensured by the press-fit of the pegs. The macrostructure and the coating promote osteointegration and secondary stability. Thirty-three patients (19 women and 14 men) with an average age of 66 years (range 52 to 76 years) were treated with this implant and have a minimum follow-up of 12 months. The initial diagnosis was primary osteoarthritis in 30 and posttraumatic osteoarthritis (fracture sequelae) in 3 cases. Seventeen patients had a physiologic glenoid version (type A1 or A2) and 16 patients had eccentric glenoid wear (type B2, B3 or D). In 20 cases, the component was fixed directly on the native bone after minimal reaming. In thirteen cases, additional bone augmentation was done with a structured graft (13) or with bone chips (2) from the humeral head. This off-label procedure was performed to improve the component seating or to correct a non-physiologic glenoid version. The coating was sufficient to hold the added bone in place without additional fixation.

Results

There were no intra- or postoperative complications. After one year, all patients were satisfied with their result. All glenoid components were radiographically stable. No radiolucent lines around the pegs and no graft

resorptions were detectable. Abnormal glenoid version could be corrected in 15 cases.

Conclusions

Early results of this new glenoid component are promising. The cementless fixation seems to work well and the coating on the backside allows the use of autografts to compensate for eccentric glenoid wear and to recenter the joint by bone apposition instead of bone resection. At the moment, however, bone grafting with the use of this component is still an off-label procedure.

FM004

Reverse total shoulder arthroplasty in wheelchair-dependent patients: a matched cohort study (11184)

Anna-Katharina Calek[1]; Bettina Hochreiter; Laura Victoria Saager; Philipp Kriechling; Florian Grubhofer; Karl Wieser

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Background

Shoulder function in wheelchair-dependent patients is critical for preserving independence and quality of life. The purpose of this study was to report the revision rate as well as clinical and radiological outcome in wheelchair-dependent patients treated with RTSA and to compare them to an ambulating population.

Methods

Prospectively obtained data of 21 primary RTSAs in 17 wheelchair-dependent patients with a median age of 72,4 years (range: 49-80) and minimum follow up of 2 years were analyzed retrospectively. Revision rate, clinical (Subjective Shoulder Value = SSV, relative Constant-Murley Score = rCS, wheelchair user's shoulder pain index = WUSPI) and radiological (glenoid loosening, scapular notching, glenoid inclination) outcome as well as implant-related parameters (baseplate peg length, glenosphere size, bony augmentation) were compared with a 2:1 matching cohort of 42 ambulating patients with a median age of 72,5 years (range: 56-78).

Results

Revision rate was 9.5% in both cohorts. In the wheelchair cohort two shoulders had to be revised due to a complete baseplate dislocation. In the matching cohort four shoulders had to be revised due to one prosthetic dislocation, one traumatic and one atraumatic scapular spine fracture with glenoid baseplate dislocation and one fracture of the greater tuberosity.

Median preoperative SSV and rCS did not differ significantly between cohorts. Postoperative SSV was also comparable (wheelchair: median 70 (range: 10-99) vs. matching: median 70 (30-100), p = n.s.). Relative CS was significantly lower in the wheelchair cohort (65% vs. 81.4%, p = 0.004). Median postoperative WUSPI was 35 points (range: 13-40) for difficulty and 0 points for pain (range: 0-29). The highest difficulty and pain were found for: "hygiene behind the back" and "propulsion of wheelchair up a ramp or on uneven surface". Glenoid loosening, scapular notching and postoperative baseplate inclination did not differ significantly between cohorts. In the wheelchair cohort, glenoid autograft augmentation (38.1% vs 7.1%, p = 0.002) and implantation of baseplates with longer pegs were performed more often (≥ 25mm: 38.1% vs. 7.1%, p = 0.004).

Conclusion

RTSA is a valuable therapeutic option for the treatment of advanced OA or irreparable rotator cuff tears in wheelchair-bound patients with high patient satisfaction. Postoperatively, poorer function and a higher rate of baseplate dislocations might be anticipated compared to ambulating patients.

FM005

Lateralisierte inverse Schulterprothese vs. inv. Schulterprothese mit Lat. Dorsi transfer für Defektarthropathie mit ARO Lag – Aussenrotationsverbesserung ohne Entwicklung eines Innenrotationsdefizits (11372)

Florian Freislederer[1]; Philipp Moroder[1]; Laurent Audigé[1]; Giovanni Spagna; Yacine Ameziane; Tim Schneller; Markus Scheibel[1]

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Hintergrund

Eine schwere Beeinträchtigung der Außenrotation (ARO) bei Patienten mit Defektarthropathie (CTA) ist ein häufiges Problem. Ein klassischer Ansatz, um diesen Zustand zu beseitigen, ist die Kombination einer inversen Schulterprothese (invSP) mit einem Lat. Dorsi-Transfer (LDT). Ziel dieser Studie war es zu analysieren, wie ein lateralisiertes RSA-Design bei schwerem Außenrotationsdefizit im Vergleich zu einer medialisierten Prothese mit LDT funktioniert.

Material & Methoden

In dieser retrospektiven Kohortenstudie wurden 34 CTA-Patienten mit einer stark gehemmten Außenrotation (positives Lag-Zeichen und maximale aktive ARO von 0°) zwischen September 2007 und Dezember 2018 mit einer invSP operiert und mindestens bis 2 Jahre nach der Operation nachuntersucht. Gruppe T (n = 13) erhielt eine klassische medialisierte Prothese (155° Halsschaftwinkel (NSA)) und einen Lat. Dorsi-Transfer (LDT). Gruppe L (n = 21) wurde mit einer lateralisierten Prothese (135° NSA) behandelt. Prothetische Offset-Parameter wurden auf postoperativen ap-Röntgenaufnahmen gemessen. Der Bewegungsumfang einschließlich des Apley-Scratch-Tests, des ARO-Lag-Zeichens, der Abduktionsstärke, des Constant-Murley (CS)und des SPADI-Scores wurden dokumentiert. Vergleichende Analysen mit statistischen gemischten Modellen wurden durchgeführt.

Ergebnisse

Der Muskelstatus nach Goutallier war ähnlich. Beide Gruppen zeigten eine verbesserte Außenrotation 2 Jahre postoperativ (Gruppe T 22°, Gruppe L 19°, p = 0.35), aber das ARO-Lag-Zeichen blieb bei 77 % der Patienten der Gruppe T bestehen (vs. 30% Gruppe L, p = 0.024). Die Patienten der Gruppe T verschlechterten ihre Innenrotation drastisch (23 % erreichten L3 gegenüber 85 % der Ausgangswerte) und zeigten ein Innenrotationsdefizit (77 % der Patienten konnten L3 nicht erreichen) im Vergleich zu Gruppe L (40 %) (p = 0,01). Alle Offsetparameter waren in Patienten ohne postoperatives AROLag höher und das glenoidale Offset (p = 0.01) und humerale Offset (p = 0.03) waren signifikant höher. Ein höheres glenoidales Offset korrelierte mit einer besseren postoperativen Außenrotation.

Fazit

Ein lateralisiertes prothetisches Design ist im Vergleich zu einer medialisierten Prothese mit LDT effektiver ein ARO Lag zu beseitigen. Eine lateralisierte Prothese zeigt eine ähnliche Verbesserung der Außenrotation mit dem Vorteil ein LDT-bedingtes Innenrotationsdefizit zu verhindern.

FM006

Virtual Global ROM After RSA: An Analysis Based on 10'000 Scapula (11150)

Alexandre Lädermann[1]; Sidi Wang

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Introduction

Virtual range of motion (ROM) has been used in several studies to provide recommendations on the ideal implant position and size to avoid bony impingement after reverse shoulder arthroplasty (RSA). The majority of these studies have used a model based on one scapula from a single patient. As such, they do not typically account for variability in anatomy or provide objective recommendations for variances observed in patient size or anatomy, or corresponding implant size or position. The primary goal of the current study was to assess ROM in a virtual RSA simulation using

a Statistical Shape Model, derived from over 10,000 pathologic patients presenting for shoulder surgery, along with controlled incremental normalized variances thereof to include a complete representation of all variations of scapula anatomical shape and size. The secondary goal was to provide guidelines for clinical selection of implant position and size. The hypothesis is that optimal implant position, component size, and COR should vary based on native glenoid size, and scapula shape.

Methods

5 scapula based on statistical modeling representing spectrum of scapula shape and size. The scapula will be derived from a database of over 10,000 patients.

The following baseline measurements has been performed: 1) glenoid and scapular size, 2) critical shoulder angle (CSA) and inclination, 3) scapular neck angle, 4) scapular neck length.

The glenosphere size (33, 36, 39 and 42 mm), the glenosphere eccentricity compared to glenoid (0, 2.5, 5, 7.5 mm), and the glenosphere lateral offset (0, 2, 4, 6, 8, 10 and 12 mm) were analyzed, representing more than 40'000 combinations. The neck shaft angle was fixed at 135°.

Results

For each variable, we observed better global ROM for larger glenospheres and a progressive increase for inferior eccentricity (until 5 mm) and lateralization (until 10) before reaching plateau or a drop. The most important factors for each variable were systematically eccentricity>lateralization>glenosphere size.

Conclusion

We have been able to analyze precisely best configuration for a specific morphology. Inferior eccentricity seems to be the most important factor. Extremes variables lead to a drop in ROM

More precise ROM such as internal rotation has to be investigated separately to better answer patient's expectations. Artificial intelligence will help to find the perfect prosthetic design according to patient's specific anatomy and expectations.

FM007

Stemless reverse shoulder arthroplasty clinical and radiological outcomes with minimum two years follow-up (11410)

Tiago Martinho[1]; Philippe Collin[2]; Alexandre Lädermann[1]

[1] Hôpital La Tour; [2] Clinique Victor Hugo

Background

Recently, a stemless reverse shoulder arthroplasty (RSA) design was developed in order to preserve bone stock. Clinical and radiological studies of such design with a cohort above 100 patients are rare. Purpose: To present clinical and radiological results of this newly developed stemless RSA.

Hypothesis

Such design would provide similar clinical and radiological results compared to other stemless and stemmed implants.

Methods

Between September 2015 and December 2019, all patients who had a primary EASYTECH® stemless RSA were considered potentially eligible for inclusion in this prospective multi-center study. The minimum follow-up was two years. Clinical outcomes consisted of Constant score, Quick dash, and subjective shoulder value (SSV). Radiographic parameters like radiolucency, loosening, scapular notching and different geometrical parameters were assessed.

Results

Stemless RSA were implanted in 115 patients (61 women and 54 men). The average age of the included patients was 68.7 years at the time of surgery. The average Constant score was 61.8 at the latest follow-up. Significant improvements from preoperative to latest follow-up were documented for Constant score (32.5 pts to 61.8 pts, p <0.001), SSV (27.0 pts to 77.5 pts, p <0.001). We observed scapular notching in 28 patients (24.3%), humeral loosening in 5 patients (4.3%) and glenoid loosening in 4 patients (3.5%). We found complications in 14% of patients. Seven patients (4 women and 3 men) had to be revised due to implant-related complications.

Conclusion

The stemless RSA shows promising short-term clinical and radiologic results. The results are comparable to those of other similar stemless RSA and stemmed RSA, despite a substantial revision rate. Further studies with a longer follow-up to better understand the longevity and performance of stemless RSA.

FM008

The outcome and complications at 10-years observation period after primary reverse total shoulder arthroplasty for proximal humerus fractures: A subgroup analysis of our institutional shoulder prosthesis registry (11310)

Ines Unterfrauner; Vilijam Zdravkovic; Christian Spross; Martin Olach; Bernhard Jost

Kantonsspital St. Gallen

Introduction

Reverse total shoulder arthroplasty (RTSA) evolved as a reliable treatment option in complex proximal humerus fractures (PHF) in the elderly. However, long-term outcome studies with large patient numbers are lacking. The aim of this study was to analyze clinical and radiographic outcomes, complications and revisions of primary RTSA for PHF at ten years of observation period.

Methods

Patients from our institutional shoulder prosthesis registry treated with RTSA for isolated PHF since July 1st 2011 were included in the analysis. All patients were traced for status on January 1st 2022: alive or deceased, complications or not, and revised or not. Clinical and radiographic follow-up data at one, two and five years were retrieved to analyze complications, revision surgeries and outcome (CSS-Constant Shoulder Score, SSV-Subjective Shoulder Value). Kernel Density Estimations for instability, fracture and death (for any reason) were calculated, and survival analyzed in the light of competing risk for death.

Results

185 patients (43 men, mean age 77 years, SD 10; 142 women, mean age 79 years, SD 8) with primary RTSA for PHF were included. The observation period was longer than five years and up to 10.5 years for at least 50% of patients (median 58.9 months). 33 patients (18%) died within the observation period and not related to shoulder surgery. Of all observed patients, 117 patients (63%) had at least a one-year follow-up, 79 patients (43%) a two-year follow-up, whereas 35 patients (19%) presented at the five-year complete clinical and radiographic follow-up. The mean time-period for the last documented complete follow-up was 33 months (range 8-87). At last follow-up, the mean CSS was 64 points (SD 16, range 10-89), and the mean SSV 78% (SD 25, range 0-100). During the observation period, three patients suffered from instability (1.6%; two needed closed reposition and one surgical revision), three periprosthetic fractures (1.6%; all needed surgery), one loosening (0.5%; revised) and one infection (0.5%; revised). The risk of death (competing with risks of complications) appeared to be elevated between five and six years after the fracture.

Conclusions

Considering the age of patients, primary RTSA for PHF is a reliable option with very good clinical and radiographic outcome, few complications and a low reoperation rate. The risk of late complications is low also due to competing risk of death in elderly population receiving RTSA.

FM009*

Does malunion of the greater tuberosity after reverse shoulder arthroplasty in patients with complex proximal humerus fracture cause impaired clinical outcomes? A prospective cohort study (11124)

Janic Fischer[1]; JoEllen Welter; Nils Horn; Simon Graber; Laurenz Jaberg; Hans-Christoph Pape[2]; Florian Hess

[1] Kantonsspital Frauenfeld; [2] Universtitätsspital Zürich

Introduction

Reverse shoulder arthroplasty (RSA) is increasingly used to treat complex proximal humerus fractures. Evidence suggests anatomic greater tuberosity (GT) healing is crucial for good clinical outcomes. However, even after proper refixation, many tuberosities show slight cranial migrations, resorption, or deformity.

Methods

This prospective study included 56 patients who underwent RSA (DELTA XTEND TM, DePuy Synthes, Warsaw, IN, USA) to treat a proximal humerus fracture. We used a standardized suture technique to reattach the tuberosities. Demographic, comorbidity, and radiological parameters were collected before and immediately after surgery. At 2-year follow-up (n = 49), range of motion (ROM), pain level, Constant Murley Scores (CS), Subjective Shoulder Value (SSV), and tuberosity healing were assessed. Seven patients died before follow-up.

Results

Anatomic healing of the tuberosity was achieved in 31 (55%) patients (Group 1), 14 (25%) had a malunion (Group 2), and complete migration occurred in 11 (20%) (Group 3). No statistically significant differences between Groups 1 and 2 were detected for any variables, including CS (p = 0.53), SSV (p = 0.07), or ROM (forward flexion (FF) p = 0.19, internal rotation (IR) p = 0.34, external rotation (ER) p = 0.76). Group 3 had poorer outcomes (median [IQR]) than Group 1: CS (59 [50-71]) vs. 72 [65-78]), FF (120 [100-150]) vs. 150 [125-160] and ER (-20 [-20--10] vs. 30 [20-45], respectively. Two minor complications (Group 1) occurred: (i) one-stage revision after low-grade infection, and (ii) hematoma due to early rivaroxoban intake. One patient (Group 1) underwent open reduction and internal fixation for acromion insufficiency fracture. No patients showed signs of stem or glenoid loosening after two years.

Conclusion

Despite the relatively high rates of malunions, we found no significant effect on clinical outcomes when compared to those with an anatomically healed GT.

FM010

The direction of rotator cuff muscle resultant force is associated with scapulohumeral subluxation and glenoid vault morphology in non-osteoarthritic shoulders (11401)

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Introduction

Static posterior subluxation of the humeral head (SPSH) is clinically relevant, but its pathomechanics remains unclear. There is a growing interest in evaluating rotator cuff (RC) muscles in SPSH, particularly due to a possible transverse force imbalance. Previous studies focused on RC muscle volume in SPSH, with conflicting results. The aim of this study was to assess the transverse resultant force angle (TRFA) of RC muscles in relation to scapulohumeral subluxation and glenoid vault morphology in non-osteoarthritic shoulders.

Methods

CT scans of 55 trauma patients (31±13 years, 36 males) with non-osteoarthritic shoulders were analyzed. All measurements were performed in 3D. We automatically computed the glenoid version angle (GVA), glenoid antero-posterior offset angle (GOA), glenoid depth (GD), glenoid width (GW), and glenoid radius (GR). The humeral head center and RC muscle insertions were defined by landmarks, placed manually at the tendon insertion footprints. The scapulohumeral subluxation index (SHSI) was determined from these landmarks, with a ratio of 50% being centered according to Walch. The contours of RC muscle cross-sectional areas in a plane perpendicular to the scapula were automatically predicted, and used to define the RC muscle directions from the tendon insertion landmarks. These RC muscle vectors were normalized, weighted by the muscle degeneration ratio, and summed vectorially to obtain the resultant force vector (RFV) of each of the four RC muscles, corresponding to the RC muscle action line. The RFV was projected on the axial plane, and its angle with the scapular medio-lateral axis determined the TRFA.

Results

Mean GVA, GOA, SHSI, TRFA were -1.1±5.6°, 18.6±17.8°, 52.4±5.7% and 10.6±6.1°, respectively. TRFA was very strongly correlated with SHSI (r = 0.86) and GOA (r = 0.77). SHSI was very strongly correlated with GVA (r = 0.90) and strongly with GOA (r = 0.66). GVA was very strongly correlated with TRFA (r = 0.87) and GOA (r = 0.82). In contrast, GOA, GVA, SHSI and TRFA were not correlated with GD, GW, GR, age, or sex.

Conclusion

The increase in SHSI is associated with more posteriorly oriented resultant force of RC muscles, and with increased glenoid anterior offset and glenoid retroversion. The strong positive correlations between TRFA, SHSI, GVA, and GOA reveal the association between the glenoid vault morphology and the variation in the compressive force of RC muscles across the scapulohumeral joint in non-osteoarthritic shoulders.

FM011*

Will this proximal humeral fracture dislocate during conservative treatment? – Validation of previously defined risk factors (11411)

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Introduction

Conservative treatment of non-displaced proximal humeral head fractures is the treatment of choice; however, we previously (Frank et al., Bone Joint J 2020;102-B(7):881–889) reported that 25% of these fractures displace to a degree that operative treatment is indicated. We also identified clinical and radiological risk factors that predict secondary displacement. In this study, we evaluated and validated the newly defined risk factors in a new subset of patients and developed a computer-assisted application that facilitates calculation of probability for secondary displacement.

Methods

Between June 2018 and December 2020, a total of 113 patients with conservatively treated isolated proximal humeral fractures were included. The mean age was 70 years (range 29 to 94). Translation of the head on follow-up radiographs of more than 10 mm was defined as displacement.

The previously identified clinical (neurological disorder, alcohol abuse) and radiological risk factors including disrupted medial hinge, Deltoid Tuberosity Index (DTI), and the Eccentric head index (EHI) describing the offset of the humeral head center in relation to the humeral shaft axis in anterioposterior and Neer views were assessed.

Results

Secondary fracture displacement occurred in 25 patients (22.1%). As in our previous finding, alcohol abuse was shown to put patients at risk for displacement (odds ratio (OR) 2.5; 95% confidence interval (CI) range 0.4 to 15.6, p = 0.339). Radiological risk factors such as osteoporosis measured by the DTI (<1.4, OR 2.8; 95% CI 1.1 to 7.2; p = 0.032), a high EHI (AP/Neer >0.4, OR 4.7; 95% CI 1.7 to 12.9, p = 0.003), and a disrupted medial hinge (OR 2.8; 95% CI 1.1 to 7.0; p = 0.030) increased the risk of secondary displacement significantly.

The newly developed app made radiological risk factor assessment significantly quicker and reduced inter- and intraobserver variability of DTI and EHI measurements.

Conclusion

Both studies combined, a relevant fraction of patients (66 of 276, 23.9%) with proximal humeral fractures showed secondary displacement of at least 10 mm during conservative treatment.

In this validation study, earlier defined radiological factors (low DTI, disruption of medial hinge, high EHI) proved to be relevant predictors of secondary displacement. A newly developed computer-assisted application facilitates assessment of the overall risk for secondary dislocation.

FM012

The "Ball and Socket" phenomenon in valgus impacted proximal humerus fractures – a risk factor for failure of open reduction and internal fixation (11294)

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Background: The relatively benign nature of valgus impacted proximal humerus fractures (PHF) for open reduction and internal fixation (ORIF) may lead to an underestimation of the fracture type und to a difficult intraoperative reduction. We found a high incidence of conversion or early revision to hemiarthroplasty (HA) or reverse total shoulder arthroplasty (RTSA) in such fractures. It was the aim of this study to look for radiographic predictors to avoid such unpleasant situations.

Methods

At a level 1 trauma center with a prospective database for isolated PHF, the clinical and radiographic data of all patients with ORIF for PHF between 2014 and 2020 were analyzed. On the ap fracture radiograph, bone quality (DTI – deltoid tuberosity index) and head shaft angle were assessed and specifically screened for valgus impaction (>140°). The metaphyseal head extension as well as the calcar dislocation were measured on the preoperative CT scan. Intraoperative imaging and operation reports were screened for documentation of difficult ORIF or conversion to HA or RTSA.

Results

In the mentioned time period, 112 patients (61% females; mean age 58.4 years, range 17-86) were planned for ORIF, whereof 47 fractures (42%; 68% females; mean age 61.7 years, range 28-87) were valgus impacted. In the valgus impacted fractures, the mean DTI was 1.48 (range 1.25-1.88), and the mean metaphyseal head extension 8.9mm (range 0-32), whereas it was ≤3mm in 11 patients (23%). The mean calcar dislocation was 7mm (range 0-38). All the patients with intraoperative difficulties to achieve a stable reduction (n = 5, 4.4%) showed a metaphyseal head extension ≤3mm. The intraoperative difficulty in all those cases was a free rotation of the cartilage bearing head fragment into the metaphysis. Therefore, we called this observation the "ball and socket" phenomenon. Two of those patients were converted to HA directly and one after 19 months. Two patients needed revision surgery (one conversion to RTSA, one implant removal) due to necrosis of the head fragment after two and ten months.

Conclusions

In case of valgus displaced PHF with a very high surgical neck fracture (metaphyseal head extension ≤3mm), the surgeon should be aware of a possible difficult intraoperative reduction due to the "ball and socket" phenomenon of the humeral head fragment. The reduction technique should be adapted, and the patient as well as the surgeon should be prepared for a high chance of direct conversion to HA.

FM013

Radiographic Factors Determine Functional Outcome Following Nonoperative Treatment of Proximal Humeral Fractures (11329)

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Kantonsspital Sankt Gallen

Introduction

The influence of radiographic parameters on functional outcome following nonoperative treatment of proximal humeral fractures (PHF) is still poorly understood. Therefore, it was aimed to determine whether and to what degree functional outcome is affected by radiographic factors in these patients.

Methods

Between 2014 and 2019, patients with an isolated, nonoperatively treated PHF involving the surgical neck were prospectively followed. Clinical and conventional radiographic evaluation took place at <2, 6, 12, and 52 weeks. Radiographic parameters included fracture configuration, fracture displacement, bone quality, and the critical shoulder angle (CSA). The neck-shaft-angle (NSA) and humeral head offset assessed humeral head displacement. The ratio between the circle matching the humeral articular surface and the concentric circle tangent to the greater tuberosity (GT), i.e. greater tuberosity index (GTI), addressed GT displacement. The two circles defining GTI in relation to the concentric circle tangent to the acromion, i.e. impingement index, addressed GT displacement relative to the acromion.

Results

In 185 consecutive patients (mean age: 66 years; 128 women, 57 men), nonoperative treatment resulted in a mean absolute Constant Score (CS) of 75 points, a mean relative CS of 97%, a median Subjective Shoulder Value of 95%, a mean elevation of 140°, and a mean external rotation of 50° at 1-year follow-up. Multivariate regression analysis identified female gender and older age as demographic determinants for lower CS and poorer elevation ($p < 0.001$). Higher degrees of varus displacement assessed on anteroposterior (AP) views in internal rotation (IR), larger GTI assessed on the Y-view and larger CSA were the radiographic determinants associated with lower CS and poorer elevation ($p < 0.001$). Recursive partitioning generated thresholds to partition the data according to meaningful functional outcomes.

Conclusion

Demographic and radiographic factors affected functional outcome following nonoperative treatment of patients with PHF at 1-yeat follow-up. Varus-valgus displacement on the AP view in IR and GT displacement on the Y-view were the important fracture-related radiographic parameters while functional outcomes were further influenced by the surrounding acromial anatomy by means of CSA. The defined thresholds of these important radiographic parameters guide patients in their treatment-related expectations of functional outcome.

FM014

Complications of Long Head of the Biceps Tenotomy in Association with Arthroscopic Rotator Cuff Repair: Risk Factors and Influence on Outcomes (11152)

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Background

Long head of the biceps (LHB) tenotomy is a common procedure performed in association to rotator cuff repair (RCR), however controversies exist regarding his results. This study aims to report the rate of biceps-related complications after LHB tenotomy, investigating related risk factors and influence on the outcome. The hypothesis is that these complications have a limited clinical influence.

Methods

A single-center prospective observational study was performed between 2015 and 2017 on consecutive patients who underwent RCR associated with LHB tenotomy. Patients were clinically and radiologically evaluated preoperatively, at six months and one year, and screened for postoperative popeye deformity, cramps, and bicipital discomfort. Each complication was analyzed for the following risk factors: age, sex, BMI, dominant arm, manual work, tear patterns, and tendon healing. Finally, clinical outcome was compared between patients with and without complications.

Results

207 patients were analyzed. Cramps, popeye deformity, and discomfort, were, respectively, present in 16 (7.7%), 38 (18.4%) and 52 (25.1%) cases at 6 months and 17 (8.2%), 18 (8.7%) and 24 (11.6%) cases at 1 year. Cramps were associated with lower age (P = 0.0005), higher BMI (P = 0.0251), single tendon tear (P = 0.0168), manual work (P = 0.0086) at 6 months and manual work (P = 0.0345) at 1 year. Popeye deformity was associated with male sex at 6 months (P <0.0001). Discomfort was associated with lower age (P = 0.0065), manual work (P = 0.0099), popeye deformity (P = 0.0240) at 6 months and manual work (P = 0.0200), single tendon tear (P = 0.0370), popeye deformity (P = 0.0033) at 1 year. Patients without complications showed a significant higher Constant score, pain and SSV (75.4 vs 70.4, P = .00252; 0.9 vs 1.9, P <0.00001; 80.2 vs 76.4; P = 0.00124) at 6 months and pain and SSV (0.6 vs 2.0; P = 0.00044; 91.1 vs 77.8; P = <0.00001) at 1 year.

Conclusions

Younger age, male sex, higher BMI, manual work, and single tendon tears are risk factors associated with the development of biceps-related symptoms during the first year after tenotomy in association with rotator cuff repair. Nevertheless, the clinical influence of these symptoms on shoulder outcomes is limited.

FM015

Hydrotherapy versus Standard Rehabilitation after Surgical Rotator Cuff Repair: A Randomized Prospective Study (11406)

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Hôpital La Tour

Background

Postoperative rehabilitation following rotator cuff tear repair (RCR) is important to promote tendon healing, restore strength, and recover normal function. Aquatic therapy in hot water allows body relaxation, which promotes patient conditioning for efficient rehabilitation.

Purpose

To assess whether aquatic therapy is more efficient than standard (land-based) rehabilitation in terms of range of motion (ROM), function, and pain after arthroscopic RCR.

Hypothesis

The hypothesis was that aquatic therapy would provide faster recovery than standard rehabilitation.

Methods

We prospectively randomized 86 patients scheduled for arthroscopic RCR to either aquatic therapy (n = 44) or standard rehabilitation (n = 42) using block sizes of four or six. Patients were evaluated clinically at 1.5, 3, 6, and 24 months and using ultrasound (US) at 6 months. Two-way mixed ANOVA tests were performed to evaluate the effects of rehabilitation type (between-subjects factor) on ROM and patient reported outcome measures (PROMs) over time (within-subjects factor). Post-hoc inter-group comparisons at each time point were also conducted using Wilcoxon rank sum tests or unpaired Student t-tests and adjusted for multiple comparisons using the Bonferroni correction.

Results

The two groups did not differ significantly in terms of demographic data or pre-operative characteristics, except for the Single Assessment Numeric Evaluation (SANE) score which was lower in the aquatic therapy group (37.9±23.6 vs. 55.6±24.9, p = 0.019). The mixed model revealed the absence of interaction effect between the type of rehabilitation and time on PROMs and ROM except on the SANE score (p <0.001), which was biased by the existing pre-operative difference mentioned above. Furthermore, none of the post-operative outcomes were statistically different between the two groups at 1.5, 3, 6, and 24 months. No significant difference could be also noted regarding tendon healing rate (p = 0.443), complication (p = 0.349), workstop duration (0.585) or patient satisfaction (p = 0.663).

Conclusion

Compared to the standard rehabilitation, the aquatic therapy did not yield superior clinical and functional outcomes after arthroscopic RCR when started immediately after the surgery.

FM016*

MRI FINDINGS OF TRAUMATIC AND DEGENERATIVE ROTATOR CUFF TEARS AND INTRODUCTION OF THE "COBRA SIGN" (11305)

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Introduction

A rotator cuff tear (RCT) is a common shoulder disease and its etiology may be acute traumatic or chronic degenerative. Differentiation between the two etiologies may be important for multiple reasons, yet only in the minority of cases can be related to one or the other easily. Knowledge about particular MR findings distinguishing traumatic from degenerative RCT is limited.

Methods

We analyzed MR-arthrographies (MRA) of 96 patients, which were matched according to age and the affected rotator cuff muscle in traumatic or degenerative full-thickness superior RCTs. Patients older than 66 years of age were excluded to avoid extensive degenerative findings and the date of injury had to be no longer than 3 months apart from the MRA obtained in the traumatic group. Various parameters of the supraspinatus muscle-tendon unit were assessed, including tendon thickness, remaining tendon stump at the greater tubercle, retraction and layer appearance within the unit. The length of the two SSP layers were individually measured, so their difference of retraction could be determined. Additionally, edema of the tendon and muscle, the Tangent- and Kinking-sign as well as the newly introduced Cobra-sign (bulging of the distal part of the ruptured tendon with slim configuration of the medial part of the tendon) were analyzed.

Results

The mean age was 55 years in both groups, in the traumatic 46% were females and 40% in the degenerative group. Analyzation of the MRA showed significantly more edema within the supraspinatus (SSP) muscle (Sensitivity 13%, Specificity 100%, p = 0.011) and the tendon (sensitivity 86%, specificity 36%, p = 0.014) in traumatic RCT. The same association was found for the Kingking sign (sensitivity 53%, specificity 71%, p = 0.018) and the Cobra sign (sensitivity 47%, specificity 84%, p = 0.001). No significant difference, though tendencies were seen toward thicker tendon stumps in traumatic RCT, and greater difference in retraction between the two SSP layers in the degenerative group. The groups had no difference in presence of a tendon stump at the greater tubercle.

Conclusion

The results of this study show that MRA may be used to differentiate between traumatic and degenerative RCTs. The Cobra sign was added to the established, and in our study confirmed, aspects of a torn SSP tendon such as intramuscular or intratendinous edema and the Kingking sign, of which all indicate a traumatic RCT.

FM017

Sling vs Brace after Surgery for Supraspinatus Tears: A Randomized Controlled Trial (11332)

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Introduction

After surgical treatment of the supraspinatus tendon lesions, the rehabilitation protocol can include the use of braces that keep the limb in an established position (commonly at 15° or 30° of abduction) or a support mitella, less voluminous and with lower limitations in terms of movements of the articulation. The purpose of this study is to compare brace vs mitella in patients surgically treated for supraspinatus lesions.

Methods

110 patients treated surgically for a lesion of the rotator cuff are enrolled and randomly assigned to use an ultrasling brace positioned at 15 °in abduction for 6 weeks or to use a mitella for 2 weeks. Patients are re-evaluated at 6 weeks, 3 months, and 6 months with clinical questionnaires (VAS scale, DASH Score, Oxford Shoulder Score) a physical examination (Jobe, LiftOff, Palm-up, Yocum, and Napoleon tests) and, only at the 6-month visit, with a magnetic resonance imaging.

Results

Fifty-nine patients (30 braces, 29 mitella) have now completed the 6-month follow-up. Baseline data of the two groups, including gender distribution, were uniformly distributed. There were no statistically significant differences in terms of improvement in the DASH score, Constant score, and VAS 0-10 for pain at any of the 3 follow-ups (6 weeks, 3 months, and 6 months) between the two groups. Moreover, no difference was also found for any of the clinical tests.

Conclusions

The use of mitella and the use of a 15° abduction brace show both satisfactory clinical recovery, with no difference in clinical results after the surgery for the lesion of the supraspinatus tendon. This finding, based on a large and homogeneous series of patients, is an important key point to be considered by the surgeons when choosing the appropriate post-operative protocol for their patients.

FM018

ARCR_Pred: the Swiss multicenter cohort study for the evaluation and prediction of core outcomes in arthroscopic rotator cuff reconstruction (11336)

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Introduction

Valid clinical outcome data are essential to assess the safety and effectiveness of surgical interventions. A multicenter cohort study of patients sustaining an arthroscopic rotator cuff repair (ARCR) was initiated to describe their baseline profiles across practices, assess their clinical, patient-reported and adverse event outcomes, and develop prediction models for these outcomes. We aim to describe the documentation process and key baseline, injury and operative characteristics of included patients.

Methods

Adults patients with a partial or full-thickness rotator cuff tear that was primarily repaired per arthroscopy were recruited from 18 sites in Switzerland and one in Germany. The patient demographics, history, shoulder status, injury and operative details were recorded. Patient outcomes including clinical examinations, patient-reported questionnaires and adverse events were documented up to 24 months after surgery.

Results

We recruited 981 participants operated by 54 surgeons between June 2020 and November 2021, including 974 ARCRs. Follow-up was on-going with a rate of 77 to 90% of the enrolled patients up to 12 months post-operatively. Overall, 97% of 8783 forms were completely documented. Participants (57 ± 9 years; 63% men) reported shoulder complaints for at least 6 months in half of them (49%), and 53% suffered from a traumatic tear. Before surgery, patients reported a pain level of 6 (±2) points on numeric rating scale and an average Oxford Shoulder Score of 27 (± 9) points. Based on arthroscopic findings, tears involved 92%, 41% and 47% of the supraspinatus (SSP), infraspinatus and subscapularis tendons, respectively. There were 16% of partial tears, 26% of single full tear and 16% of massive tears. The 907 SSP tears were repaired using the techniques of single row (21%), double row (27%), transosseous equivalent (TOE) with knots (36%), and TOE without knots (16%). Acromioplasty was performed in 61% of interventions. Biceps tenotomy and tenodesis were performed during 38% and 48% of surgeries, respectively.

Conclusions

This project provides benchmark data regarding ARCRs in Switzerland, and initiates the development of personalized risk predictions to support the surgical decision process. The wide variability of patient, injury and treatment factors supports the implementation of an intensive comparative research agenda, as well as fosters the condition towards the development of a Swiss national ARCR register.

FM019

Long-term Results and Failure Analysis of the Open Latarjet Procedure and Arthroscopic Bankart Repair in Adolescents (11222)

Manuel Waltenspül; Lukas Ernstbrunner; Jakob Ackermann; Katja Thiel; Joseph William Galvin; Karl Wieser

Balgrist

Background

To analyze long-term results of arthroscopic Bankart repair versus open Latarjet in adolescents who are at high-risk for recurrent anterior shoulder instability. We hypothesized that long-term stability rate of open Latarjet will be superior compared to arthroscopic Bankart repair.

Study-Design

Retrospective Cohort Study; Level-of-Evidence, 3

Methods

Thirty-four patients (35 shoulders) of 40 patients (41 shoulder), with a mean age of 16.4 (range, 13-18) years who underwent arthroscopic Bankart repair, were compared to 30 patients (31 shoulders) of 37 patients (40 patients) with a mean age of 16.7 (range, 14-18) years following open Latarjet (follow-up 66/81 shoulders; 82%). Clinical and radiographic results were obtained after a mean follow-up of 12.2 (range, 8-18) years.

Results

Bankart repair failed in 20 shoulders (57%) and in two shoulders (7%) after open Latarjet ($p < 0.001$), leading to a significantly higher revision rate for instability in the Bankart vs Latarjet-group, respectively (14 vs. 1; $p < 0.001$). In patients without recurrent shoulder instability (15 Bankart, 29 Latarjet), there was a significant improvement in Constant Score ($p = 0.006$ and $p < 0.001$) and Subjective Shoulder Value ($p = 0.009$ and $p < 0.001$) without any difference between the two groups. Younger age was the only variable significantly associated with failure following a Bankart repair ($p = 0.01$).

Conclusion

Adolescents are at a high risk for failure after the Bankart repair and therefore the Latarjet should be strongly considered as a primary procedure for recurrent anterior shoulder instability in this population.

FM020

The Primary Open Latarjet Procedure Results in Functional Differences but No Structural Changes in Subscapularis Muscle Quality Compared With the Healthy Contralateral Shoulder at Long-Term Follow-Up (11221)

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Balgrist

Background: There are concerns that the Latarjet procedure results in loss of glenohumeral rotation/strength and subscapularis dysfunction. The long-term effect of this procedure on subscapularis quality, glenohumeral rotation and strength is unknown.

Purpose

To analyze the long-term effect of the primary open Latarjet procedure using a muscle-splitting approach on internal and external rotation and strength, as well as subscapularis muscle quality compared to the healthy contralateral side. We hypothesized that the primary open Latarjet procedure is associated with a reduction of long-term shoulder strength and function, and decreased subscapularis quality.

Study Design

Retrospective case-control study, Level of evidence, 3

Methods

A total of 42 patients that underwent primary open Latarjet procedure at a mean age of 26 (range, 18-36) years for recurrent anterior shoulder instability were personally reviewed after a mean of 8.4 (range, 5-12) years. Subscapularis muscle volume and fat fraction of both shoulders were assessed. Bilateral active internal rotation (IR) and external rotation (ER), as well as IR and ER strength were assessed by isokinetic testing (concentric, eccentric, and fatigability).

Results

Active IR (0.6 points difference; $p < 0.001$) and ER (4° difference; $p = 0.010$) were significantly higher in healthy contralateral shoulders. IR strength of the operated shoulder was significantly lower compared with the healthy shoulder in concentric and eccentric testing (range of deficit, 4-6%; $p < 0.05$). Also, ER strength of the operated shoulder was significantly lower compared with the healthy shoulder in concentric testing (11% deficit; $p < 0.05$). Subscapularis muscle volume was significantly higher in the operated shoulder (4% difference, $p = 0.022$), and there was no significant difference in fat fraction ($p = 0.114$).

Conclusions

The primary open Latarjet procedure is associated with significantly decreased active internal and external rotation and strength when compared to the healthy contralateral shoulder. The clinical influence of these findings is yet to be defined. There is no increased subscapularis muscle fatty degeneration but a minimal hypertrophy on the operated side at long-term follow-up.

FM021

Biomechanical properties of a novel AC and CC stabilization technique using a novel cadaveric system with integration of the deltoideotrapezoideal fascia (11382)

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Introduction

The goals of this study were twofold. First we aimed to validate a novel cadaveric testing system for the acromioclavicular (AC) joint which includes the deltoideopectoral fascia as secondary stabilizer. Using the validated testing set up, we then intended to biomechanically assess a novel AC and CC stabilizing system for the treatment acute AC joint injuries.

Methods

For all testings, the scapula of an entire cadaveric shoulder was mounted on a socket. SI-, AP- and rotational loads were applied to the AC joint over 1000 cycles via a propellor-shaped connector fixed to the medial clavicle. The resulting AC joint kinematics, i.e. AP, SI-translations and rotations, were registered by an optical navigation system.

For validation of the novel test set up, repeated ($n = 3$) measurements were compared to fluoroscopic quantifications of AC joint kinematics in one Thiel fixed shoulder.

The novel AC and CC stabilizing system was biomechanically tested in 10 fresh frozen shoulders. CC and AC stabilization was achieved by bone anchors implanted in the coracoid process and the acromion. The sutures were connected to a metallic eyelet within the clavicle.

Results

The validation of the testing set up showed a high reliability for the measurements of rotations and AP/ SI translations and a high correlation with fluoroscopic measurements. Implantation of the novel implant reduced the mean SI -and AP translations, but not rotations compared to those of the uninjured shoulder.

Conclusion

In a reproducible, accurate and more natural testing set-up, implantation of our novel AC and CC stabilization technique restored vertical and horizontal, but not rotational AC joint stability.

FREE COMMUNICATIONS: INFECTIONS / TUMORS

FM022

SHORT VERSUS LONG POSTSURGICAL ANTIBIOTIC THERAPY FOR SPINAL INFECTIONS (SASI Trials) – SECOND INTERIM ANALYSIS (11251)

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Introduction

The optimal duration of antibiotic treatment in spinal infections, with or without an infected implant, is unknown. We display the results of the second interim analysis of the prospective randomized multicenter trial (SASI).

Methods

A multicenter prospective cohort of 236 spine infections undergoing surgical treatment is included into the SASI trial. A 1:1 randomization allocated patients into a short or long postoperative antibiotic treatment group. The short and long treatment group were defined as 3 vs. 6 weeks in absence of a residual infected implant and 6 vs. 12 weeks in case of remaining implants. Non-inferiority was defined at 10%. For the interim analysis a minimal follow-up of 1 year was defined to investigate two distinct outcomes: "clinical failure" (reoperation due to known, or new infections or mechanical problems) and "microbiological recurrence" (microbiologically-identical relapses with the same pathogen after therapy). 96 (56%) Patient could be included in this interim analysis.

Results

Clinical failures were found in four (4/96; 4%), of which two were true "microbiological recurrence" due to Staphylococcus aureus; occurring in the same patient; and equally distributed in the short and long arms. Two other clinical failures are a secondary endocarditis during treatment and clinical failure without the proof of recurrent pathogens, also distributed equally in both groups. Adverse events of antibiotic therapy were equally distributed between the treatment groups: Among all 59 single adverse events, 36 (61%) yielded a link to the antibiotic treatment. In the Per-Protocol analysis, only the outcome “microbiological recurrence” fulfills the statistical non-inferiority (5.6% percentage points [90%CI 9.2% to 9.8%]).

Conclusion

In this second interim analysis, a shorter period of antibiotic treatment was noninferior to longer treatment duration in terms of remission of spine infections after surgical debridement, also with no difference of adverse events.

FM023*

Soft-tissue reconstruction in lower-leg fracture-related infections: an orthoplastic outcome and risk factor analysis (11307)

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Introduction

Fracture-related infection (FRI) is a severe post-traumatic complication which is occasionally accompanied by a deficient or even avital soft-tissue envelope. In these cases, a thoroughly planned orthoplastic approach is imperative as a vital and intact soft-tissue envelope is mandatory to achieve fracture union and infection eradication. The aim of this study was to analyse the outcome of soft-tissue reconstruction (STR), and to investigate if primary flap failure presents a risk factor for fracture nonunion and recurrence of infection.

Methods

Patients with a lower leg FRI requiring STR (local, pedicled and free flaps) who were treated from 2010-2018 at the University hospital of Basel were included in this retrospective analysis. The primary outcome was the success rate of STR, the secondary outcome was fracture nonunion and recurrence of infection.

Results

Overall, 145 patients with lower leg FRI were identified, of whom 58 (40%) received STR (muscle flaps: n = 38, fascio-cutaneous flaps: n = 19; composite osteo-cutaneous flap: n = 1). In total seven patients required secondary STR due to primary flap failure. All failures and flap-related complications occurred within the first three weeks after surgery. Secondary STR was successful in all cases. A high Charlson Comorbidity Index Score was a significant risk factor for flap failure (p = 0.011). Out of the 43 patients who completed the 9-month follow-up, 11 patients presented with fracture nonunion and 12 patients with a recurrent infection. Polymicrobial infection was a significant risk factor for fracture nonunion (p = 0.002). Primary flap failure was neither a risk factor for compromised fracture consolidation (p = 0.590) nor for recurrence of infection (p = 0.508).

Conclusion

As STR in patients with local and systemic risk factors is associated with a considerable number of flap related complications, management in an interdisciplinary bone infection unit is highly recommended. If the primary flap fails, the soft-tissue defect can successfully be reconstructed with a second flap. This scenario does not represent a risk factor for compromised fracture union or recurrence of infection.

FM024*

Orthoplastics in periprosthetic joint infection of the knee: Treatment concept for composite soft-tissue defect with extensor apparatus deficiency (11308)

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Introduction

Reconstruction of composite soft-tissue defects with extensor apparatus deficiency in patients with periprosthetic joint infection (PJI) of the knee is challenging. We present a single-centre multidisciplinary orthoplastic treatment concept based on a retrospective outcome analysis over 22 years.

Methods

A prospectively maintained database of patients treated at the University Hospital of Basel from 1999 until 2021 was retrospectively searched for patients with PJI after TKA and concomitant soft-tissue defects with extensor apparatus deficiency. The presence and extent of extensor apparatus deficiency was intraoperatively defined by the orthopaedic surgeon.

Results

One-hundred eighty-eight patients had PJI after total knee arthroplasty. Plastic surgical reconstruction of a concomitant perigenicular soft-tissue defect was indicated in 55 patients. Of these, 12 presented with extensor apparatus deficiency. One patient underwent primary arthrodesis and 11 patients underwent reconstruction of the extensor apparatus. The principle to reconstruct missing tissue ‘like with like’ was thereby favoured: Two patients with a wide soft-tissue defect received a free anterolateral thigh flap with fascia lata; one patient with a smaller soft-tissue defect received a free sensate, extended lateral arm flap with triceps tendon; and 8 patients who did not qualify for free flap surgery received a pedicled medial sural artery perforator gastrocnemius flap. Despite good functional results 1 year later, long-term follow-up revealed that two patients had to undergo arthrodesis because of recurrent infection and one patient was lost to follow-up.

Conclusion

These results show that PJI of the knee and extensor apparatus deficiency is a dreaded combination with a mediocre long-term outcome. Standardization of surgical techniques for a defined PJI problem and consensus on study variables may facilitate interinstitutional comparisons of outcome data, and hence, improvement of treatment concepts.

FM025

Fibula for biological reconstruction after tumor resection at the extremities – non-vascularised or vascularised option? (11276)

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Introduction

Vascularised (VFG) and Non-vascularised fibula grafts (NVFG) were widely used in reconstruction of segmental bone defect after bone tumor resection. We compared both types of autograft and its results, its risk factors and complications.

Methods

Between 1976 and 2018, our institute performed bone tumor resection and reconstruction by using VFG (n = 17) and NVFG (n = 36) in 53 patients (3- 65 years age, mean: 21.2 ± 13.2 years) with 24 of them were female. Malignant bone tumors were diagnosed in 29 patients (VFG = 16 patients – 94%). 41 at the lower limb and 12 at the upper extremities. The mean follow-up was 14.9 years (range from 1.5 to 43 years). Factors like fracture, non-/union, infection, graft size and donor site morbidity were analyzed.

Results

All over 75 struts of fibula totally were taken. The mean length of fibula was 11.3 cm (10.2 in NVFG and 14.9 in VFG). The mean union time was 13 months (6 to 25 months) overall. However, VFG revealed union after a mean of 10.5 months, NVFG after 5.9 months. The overall hypertrophy was found in 65 of 75 grafts (86.7%) and consolidation was found in 69 (92%). Hypertrophy rate was similar in VFG (85.3%) and NVFG (87.1%). Complication rate in VFG was 41 % and in NVFG 25 %. There was found fractures in 7 (13%), 4 infections (7.5%) and nonunion in 5 patients (9.4%). The chemotherapy was the only negative prognosis factor of the union time (p = 0.021).

Conclusion

Vascularised and Non-vascularised fibula grafts were both techniques with effective and successful results in reconstruction of segmental tumor bone defects. NVFG showed comparable results to the VFG with lower complication rate but it is limited in indication by the size for greater defects, malignant tumors and the site. Chemotherapy is an adverse factor leading to prolonged union time in both techniques.

FM026

Patient-Specific Cutting Guides for the Resection of Bone Tumors involving the Iliosacral Joint at the Pelvis (11397)

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Balgrist Universitätspital

Introduction

The correct resection of malignant bone tumors affecting the pelvis remains a challenging surgery. If the tumor involves the posterior ilium, the medial part of the resection is usually performed through the iliosacral joint (Ennecking Type 1). However, if the tumor invades the iliosacral joint the osteotomy has to be performed more medially through the sacrum. This poses the risk of injuring vascular structures, such as the A. and V. iliaca communis, especially when performing the osteotomy from posterior. This study evaluates if the use of patient-specific guides, limiting the depth of the osteotomy, enable a safe tumor resection.

Method

3 patients with a mean age of 33 years (range: 24-50 years) suffered from either an Ewing-sarcoma (n = 2) or Chondrosarcoma (n = 1) in the posterior pelvis. In all patients, the iliosacral joint was affected necessitating an osteotomy through the sacrum. No distant metastasis were noted on PET/CT-scans in any patient. A virtual 3D model was created fusing the CT scan and the MRI. The resection through the ilium and the sacrum was carefully planned on the computer. According to the preoperative model, patient-specific cutting guides were produced. The cutting guide has been designed to block the chisel at the correct height, therefore limiting the depth of the osteotomy and reducing the risk of injuring neurovascular structures anterior to the sacrum. For stabilization, a lumbopelvic spondylodesis with interposition of either allo- or autograft followed.

Results

In all 3 patients the preoperative planning could be realized without any intraoperative deviations. All tumors were resected with sufficient margin (R0-resection). No vascular or focal neurological injuries were noted, even though the osteotomies were done from posterior without any dissection of the iliac vessels. The bone defects were bridged by an iliosacral spondylodesis and interposition of either bone allo- or autograft in order to restore the posterior pelvic continuity. One patient underwent a revision surgery due to a superficial skin necrosis without a deep infection. No hardware failure or secondary dislocation was observed in the follow-up consultations.

Conclusion

Patient-specific cutting guides enable a safe and reliable osteotomy medial to the iliosacral joint, while preventing an anterior perforation through the sacrum.

FM027

Intercalary prosthetic reconstruction of the femur with custom made stems for short fixation length (11366)

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Universitätsklinik Balgrist

Introduction

In elderly patients the reconstruction of diaphyseal bone defects after tumor resections is preferably performed by an intercalary prosthesis. These implants allow an almost immediate weight-bearing and provide a shorter rehabilitation time compared to biological reconstructions. However, if the tumor extension is large the intramedullary stems must be implanted in short residual bone segments, risking a reliable and long-lasting fixation. This study highlights the use of custom made non-cemented stems for intercalary prosthesis at the femur.

Method

3 patients with a mean age of 61 years (range: 55-70 years) underwent a resection of a sarcoma localized around the femoral diaphysis (1 solitary fibrous tumor, 1 dedifferentiated liposarcoma, 1 undifferentiated pleomorphic sarcoma). The resulting bone defect had a mean length of 16cm (range: 13-18cm). In all three patients the bone length of the residual proximal femur was □ 85mm, which meant that a conventional stem was not suitable. In one patient also the distal length was too short for the safe fixation of a conventional stem (<90mm).

The custom made non-cemented stems had an octagonal diameter and additional lag screws through the femoral neck for increasing the rotational stability.

Results

In all 3 patients the preoperative planning could be realized without any intraoperative deviations. All tumors were resected with sufficient margin (R0-resection). The custom-made stems fitted exactly the remaining bone length. The most difficult part was the insertion of the stem in the right rotation for the correct positioning of the femoral neck screw. No perioperative complications were observed.

At the last follow up (one patient died 12 months after the surgery due to the disease) all implants were intact without any signs of aseptic loosening. One patient fell 4 months postoperatively, fracturing the lag screws in the distal stem.

Probably the stem sintered in the process, but the further controls were always radiologically inconspicuous, and the patient remained pain-free. Therefore, no revision surgery was necessary.

Conclusion

Non-cemented custom-made stems with lag screws into the femoral neck provide a reliable fixation of intercalary prosthesis at the femur even in short residual proximal bone fragments.

FM028

The effect of preoperative embolization in giant cell tumors of the bone localized in the iliosacral region of the pelvis (11375)

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Introduction

Giant cell tumors of the bone (GCTB) are local aggressive tumors with usually high vascularization. They rarely occur in the posterior pelvis and sacral area (2-8%). However, at the posterior pelvis and at the sacrum no tourniquet can be applied, and cementation is often not possible due to the proximity to the lumbosacral nerves. Therefore, the curettage of GCTB in this anatomical region is associated with high blood loss, resulting in a poor visibility of the operating field and a higher complication rate. Preoperative embolization of the main tumor vessels is a feasible option to reduce intraoperative blood loss. This monocentric case control study evaluates the effect of the preoperative embolization in GCTB localized at the iliosacral region.

Methods

3 patients with GCTB in the sacrum (n = 1) or in the posterior ilium (n = 2) underwent a total of 4 surgeries from May 2021 to December 2021 in our institution. In all patients a preoperative CT-guided biopsy was perfor One patient developed an early local recurrence in the sacrum requiring revision surgery. In all the patients, the tumor was carefully removed with a curettage, whereas in one patient the bone cavity was filled with cement.

The first two surgeries in this consecutive series were done without any preoperative treatment (1 sacrum, 1 posterior ilium). In the second two surgeries (1 sacrum, 1 posterior ilium) an embolization of the feeding tumor vessels was successfully accomplished 24 hours prior to surgery. None of the patient received a denosumab treatment.

Results

In the two surgeries without any preoperative embolization the mean intraoperative blood loss was 3250 ml. The mean perioperative erythrocyte transfusion volume was 1125 ml and the mean surgical time was 114.5 min. For the 2 surgeries with preoperative embolization the mean intraoperative blood loss was 1850 ml, no perioperative erythrocyte transfusion was needed, and the mean surgical time was 68 min. There were no significant differences regarding the tumor volume in the preoperative MRI detected.

Conclusion

Curettage of GCTB in the posterior pelvis and sacrum results in a significantly high blood loss. Although preoperative embolization is not routinely performed for GCTB, in our experience it should be considered at the pelvis because it may reduce blood loss and surgical time.

FM029

Enchondromas of long bones and other skeletal lesions found incidentally need critical evaluation, but rarely systematic follow-up. (11216)

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Introduction

Incidental bone lesions are a challenge for the specialist who has to give recommendations for further management. Historically it was felt mandatory − though generally neglected − to follow incidentally found enchondromas in order to assess possible malignant transformation. Some authors (e.g. 1) still recommend curettage and adjuvant measures as standard treatment of enchondromas and atypical cartilaginous tumors of long bones.

This study and review of the literature (e.g. 2) is intended to question the 'dogmatic' rule for follow-up imaging and to assist in the decision, which cases of incidental long bone findings need further evaluation or can be left to observation by the patients.

Methods

153 cases of incidental bone findings were presented to our musculoskeletal tumor service for evaluation from July 2008 through June 2021. 73 of them were cartilaginous tumors and 63 of these were diagnosed as enchondroma of a long bone based on X-Ray and MRI.

Results

Follow-up imaging of the enchondroma patients had been recommended for all patients, finally however performed for 35 patients only at 1 to 13 years (mean 4.3y). Enchondroma in these patients did not increase in size except for one femoral diaphyseal enchondroma with increasing diameter from age 18 to 20 years. 14 additional patients answered to written contact stating that they remained asymptomatic at 2 to 12 years (mean 5.6y) follow-up. None of the patients has been reported to the Swiss Federation Malignancy Registry to have developed malignancy.

Among the 10 other cartilaginous tumors were one chondrosarcoma grade II exhibiting different image pattern, 3 non-long-bone localizations (pelvis, scapula and rib), 2 Ollier-type enchondromas, and 2 osteochondromas. Incidental findings other than cartilaginous tumors were fibrous dysplasia (n = 31), non-ossifying fibroma (n = 31) and 18 other 'sporadic' entities.

Conclusions

Incidentally found enchondromas not exhibiting aggressive features need no systematic follow-up and patients can be 'discharged' with the advice to present if symptoms would develop. This also applies for fibrous dysplasia and the other sporadic lesions.

1. Deckers C et al. Curettage and cryosurgery for enchondroma and atypical cartilaginous tumors of the long bones: Oncological results of a large series. J Surg Oncol 2021;123:1821-27

2. Ahmed S et al. Incidental long bone cartilage lesions: is any further imaging workup needed? Skeletal Radiol 2021;50:1189-96

FM030

Safe surgical margins in Ewing's sarcoma (11199)

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Introduction

There is recent evidence advocating the use of post-chemotherapy MRI for safe resection of primary bone sarcoma in providing a clear margin of disease. This paper challenges this view by providing evidence obtained from comparing surgical resection margin measurements calculated off the pre- and post-chemotherapy MRIs to the post-operative histological analysis.

Method

A retrospective patho-radiological analysis of 10 patients treated for long bone Ewing's sarcoma. The pre- and post-chemotherapy MRI radiological measurements were correlated with the post-operative gross and microscopic histological specimens with the principle aim of determining which represented the accurate histological extent of disease and therefore which image set should be used in determining the surgical resection margins.

Results

In the 10 cases there was a discrepancy in the extent of pathological disease on comparative histological and radiological assessment. The mean age at presentation was 19.5years [4-45 years], with a female bias (n = 7/10). The lower limbs were more commonly involved than the upper limb (femur n = 2/10, tibia n = 3/10, fibula n = 2/10, humerus n = 2/10, ulna n = 1/10). There was no correlation between the percentage reduction in measured volume/length of pathological bone on sequential MRI and the percentage necrosis on histology. The average discrepancy between the length of pathological bone on histology and on MRI was 2.7cm. Using the baseline pre-chemotherapy MRI to plan the surgical resection margins, 7/10 patients had their surgical resection margins through radiologically clear but pathologically abnormal bone (without histological evidence of residual tumour). Had the post-chemotherapy MRI been used a further 3 patients would have had their tumour resected through pathologically abnormal bone. No patients had or would have had tumour resected through residual tumour.

Conclusions

The use of the post-chemotherapy MRI for planning surgical resection margins increases the risk of resecting through histologically abnormal bone that may have been previously contaminated by tumour, without significant benefit of preserving sufficient bone to facilitate joint or physeal sparing surgery. The evidence from this study supports current guidelines recommending the use of pre-chemotherapy MRI to plan safe surgical resection margins in Ewing's sarcoma.

FM031*

Time to Treatment Initiation: An Analysis of Sarcoma Patients treated at Multidisciplinary-Team/Sarcoma-Board (MDT/SB's) over a four-year period (11337)

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Introduction

It is hypothesized that in the treatment of patients with soft tissue sarcomas (STS) the interval from establishing the diagnosis until initiation of treatment is relevant for the overall survival. Therefore, time to treatment initiation (TTI) was defined as a quality indicator for monitoring the treatment standard. The primary objective of this study was to find out how long (in days) it takes from establishing the sarcoma diagnosis through biopsy until initiation of treatment in patients suffering from STS. Secondary objectives were defined as the comparison between the different dignities, the different institutions and how the Swiss Sarcoma Network (SSN) cohort compares to the international standard.

Methods

This is a retrospective analysis of prospectively collected data from the SSN. All patients being presented to the MDT/SB within a four-year period from 2018 to 2022 were included in this study. TTI and secondary objectives were determined using non-parametric summary statistics and presented as median and interquartile range. Ethic approval was granted for this study.

Results

In total 420 patients were recorded in the respective time period in the SSN. In this study 309 patients with a malignant or intermediate STS according to WHO2020 were included. Patients with a recurrence as diagnosis were excluded. There were 69% (n = 212) with a malignant and 31% (n = 97) with an intermediate STS. The median TTI was 23 (6-52) days. In the malignant group, the median TTI was 21 (4-46) days and in the intermediate group 30 (11-58) days. In the different institutions the median TTI's were 10 (-6-30), 28 (12-78), 24 (10-58), 24 (10-53), 12 (-12-54) and 26 (-1-54) days.

Conclusion

In the SSN cohort the overall median TTI was 23 days. In the literature, a TTI delay of more than 42 days led to a slightly reduced overall survival. Compared to the international standard, we conclude that within the SSN network, patients face an adequate waiting time until treatment initiation with no potential restrictions to overall survival.

FM032*

The role of the pedicled, chimeric, musculo-cutaneous gastrocnemius flap for soft-tissue reconstruction in periprosthetic joint infection of the knee: indications and pitfalls (11367)

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Introduction

The knee region presents with particular specificities which make reconstruction challenging. Specifically, in the context of total knee arthroplasty (TKA), soft tissue defects can expose critical structures such as the joint, bone or extensor apparatus besides the implant itself, with dramatic consequences in terms of periprosthetic joint infection. This work reports our experience in soft-tissue reconstruction (STR) using a pedicled, chimeric, musculocutaneous gastrocnemius flap in infected, complex TKA scenarios. Outcomes and complications are critically analysed, and the orthoplastic surgical planning outlined.

Methods

Prospectively maintained databases of three university hospitals were retrospectively searched for adult patients with infected TKA and soft-tissue defects between 2018 and 2021. Only patients who underwent STR with a pedicled, medial or lateral chimeric musculo-cutaneous sural artery perforator gastrocnemius flap were included in this study. The orthoplastic timing of STR was assessed as well as the orthoplastic outcome, in particular in the setting of a two-stage approach, where the flap would have to be re-raised for reimplantation of the TKA at the second stage.

Results

Twelve patients were included in this study. Ten times a medial and two times a lateral sural artery perforator gastrocnemius flap was used. In ten patients an extensor apparatus / capsular defect was reconstructed with the tendinous part of the dorsum of the flap. In one patient with complete extensor apparatus rupture, the flap was extended with Achilles tendon for reconstruction. Four patients underwent a one-stage approach, eight patients a two-stage approach. Soft tissue reconstruction was performed as early as possible but timing was not always ideal, as most patients were referred and operated elsewhere before. All donor sites were closed directly. Three patients showed partial skin necrosis of the flap, of which one patient needed surgical revision. In five of eight patients undergoing a two-stage approach, STR was performed before the second stage. Here, no flap related complications were seen during the second stage.

Conclusions

The chimeric musculo-cutaneous gastrocnemius flap is a robust option to reconstruct composite soft-tissue defects around an infected TKA. It can be extended with Achilles tendon in cases of complete extensor apparatus rupture. Furthermore, it can be re-raised in a staged procedure, no microsurgical skills are needed.

FREE COMMUNICATIONS: PAEDIATRIC ORTHOPAEDICS

FM033*

Prevalence of femoral Retroversion of pediatric patients with slipped capital femoral epiphysis using preoperative MRI based measurement of femoral version (11174)

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Introduction

Slipped capital femoral epiphyses (SCFE) and Perthes disease are pediatric hip diseases. SCFE was associated with femoral retroversion. SCFE patients were associated with femoral retroversion but few studies investigated femoral version (FV) on MRI.

Objectives: Therefore, we report(1) mean FV, (2)prevalence of femoral retroversion (3)side-to-side difference for SCFE patients.

Study Design & Methods

A retrospective MRI analysis involving 52 hips (26 patients, 01/2017-10/2021) was perfor Inclusion criteria were pediatric hip disease (16 SCFE patients and 10 Perthes patients, 10-16 years of age).

We evaluated FV using the Murphy method on rapid bilateral T1 VIBE Dixon MRI sequence (AT 32-40 seconds) of the pelvis and knee (was added to the routine MRI protocol). FV was compared to the contralateral side. Five Perthes patients(mean age 11±2 years) were treated surgically. The mean age of SCFE patients was 13±2 years and 12 patients presented with moderate or severe slips and were treated surgically. SCFE patients underwent contralateral prophylactic pinning.

Results

(1)Mean FV of SCFE patients (1±2°) was significantly ($p < 0.001$) lower compared to contralateral side(16±14°) and compared to Perthes patients(18±16°).

(2)Ten SCFE patients (63%) had FV >0°. Six patients(37%) had femoral retroversion (FV <0°). Of the contralateral side, two patients (12%) had femoral retroversion. Two Perthes patients (20%) had femoral retroversion.

(3)Side-to-side difference of FV was higher for SCFE patients(17±16°) compared to Perthes patients(13±9°).

Conclusions

SCFE patients undergoing the modified Dunn procedure or in situ pinning showed a considerable prevalence of femoral retroversion and showed lower FV compared to Perthes patients. Theoretically, SCFE patients treated with in situ pinning are at risk for femoral retroversion and residual deformity. This underlines the importance for longterm followup for SCFE patients.

FM034

Long-term evolution of walking in unilateral cerebral palsy: A 12-years follow-up of 40 children (11186)

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Introduction

Unilateral spastic cerebral palsy (USCP) is the most prevalent subtype of CP. Assessment of their gait evolution and effects of surgical treatments on this is often performed in short-term studies. This study aimed to analyze the long-term evolution of gait in USCP by examining patients' modified Gait Profile Score (mGPS without hip rotation), Gait Variable Scores (GVS), walking speed, and the influence of single-level surgery (SLS).

Methods

Forty patients with USCP (GMFCS I) who had undergone two clinical gait analyses (CGAs) were enrolled (mean age: 9.8 (3.2) years at the first CGA and 21.6 (6.0) years at the last CGA), corresponding to an evolution of 12 (5) years. Evolution of mGPS, GVS, and dimensionless walking speed were calculated. The values of the affected and unaffected side were calculated for the gait scores. Patients were divided into categories: 'No surgery' and 'Single-level surgery' (SLS). Statistical analyses (paired t-tests) were performed between first and last CGAs all patients together and for each treatment categorie.

Results

Mean mGPS of the affected side was significantly improved at last CGA, regardless of the treatment category: baseline = 8.0° (2.2) vs. follow-up = 6.4° (1.5), effect size = 0.69, $p < 0.001$. It was also observed a significant improvement for the unaffected side (baseline = mGPS: 6.8° (1.8) vs. follow-up mGPS = 5.6° (1.5)). In addition, significant improvements were observed for the two categories (SLS and No Surgery) in terms of mGPS for the affected and unaffected sides (SLS category – affected side: baseline = 8.1° (2.2) vs. follow-up = 6.5° (1.6), effect size = 0.65, $p = 0.002$ and No surgery category (affected side: baseline = 7.9° (2.9) vs. follow-up = 6.1° (1.1), effect size = 0.88, $p = 0.01$). Finally, for the SLS's category, significant improvements were observed for the mean GVS of the hip, knee, ankle flexion-extension angles and the foot progression angle. No significant changes were observed in mean dimensionless walking speed.

Conclusions

This study highlights that patients with USCP have a positive evolution in terms of gait function over time with and without surgery. In addition, regarding specifically GVS values, we observed a positive impact of orthopedic surgeries at the knee, ankle and foot levels and more particularly for those with poor gait quality at baseline.

FM035

Practice variation and factors influencing indications for interventions for hip displacement in non-ambulant children with cerebral palsy (11196)

Max Mifsud [1]; Unni Narayanan[2]; The CHOP study group

[1] Oxford University Hospitals NHS Foundation Trust; [2] The Hospital for Sick Children

Introduction and Objective

There are many treatment strategies for hip displacement in non-ambulant children with CP, with variation in indications, timing and choice of procedures. CHOP is an international prospective cohort study comparing different strategies. This paper quantifies practice variation among CHOP surgeons, experts in CP, and explores factors influencing decision-making.

Materials and Methods

71 case vignettes were presented from CHOP database capturing spectrum of age, GMFCS level, Migration Percentage (MP), uni/bilateral hip involvement, acetabular dysplasia, femoral head-shape, reduction of abduction, hip ROM (R1/R2), presence of hip symptoms. 28 clinicians (mean 10 years CP practice) from 17 sites globally made recommendations on treatment. Options were A-D: (A) Watchful waiting, (B) Botulinium toxin +/- bracing, (C) Soft tissue surgery only, (D) Bony reconstructive surgery, and (E) Salvage surgery. They were blinded to others' responses. Factors influencing decisions were analysed using logistic regression.

Results

Average age was 6.9 years old (2-17.5yrs); MP 58% (0-100); 37/71 had symptoms. 40% chose watchful waiting for MP up to 50%, with others recommending botox(15%); soft-tissue releases(18%); or bone-reconstruction(27%). Decision to operate was influenced by symptoms. When MP>50%, 95% recommend surgery, predominantly VDRO. Acetabuloplasty was added when children >5 years with increasing dysplasia and MP. Wide variation in indications for open reduction, recommended by 40% to 60% of surgeons with increasing MP. Salvage was preferred for high-riding/irreducible dislocations (OR:23); severely dysplastic (OR:16), and symptomatic (OR:8.7).

Conclusions

MP and patient symptoms are major drivers of surgical recommendations. Although treatment recommendations vary among experienced CP surgeons world-wide, some factors reached consensus and this can be used to drive recommendations in treatment of CP hips.

FM036

The use of clinical photographs and patient reported outcome questionnaire as a tool to predict functional outcome in supracondylar humeral fractures treated operatively (11198)

Marie-Caroline Nogaro; Senol Bekmez; Mark Camp; Unni Narayanan

Purpose

Over 500 supracondylar humeral fractures (SCHF) are treated at our institution each year. Our standard post-operative pathway includes a 3-week visit for splint removal, wire removal and radiographs. Subsequent follow-up occurs at 12 weeks for a clinical examination. In an effort to minimize unnecessary follow-up visits, we investigated whether photographs and/or patient-reported outcome measure (PROM) scores could identify patients who do not need 3-month in-person follow-up.

Materials and Methods

At the 3-month visit, 248 SCHF patients (mean 6.2 yrs; 0.75-11yrs) had bilateral elbow motion (ROM) and carrying angles measured; and photographs of full length frontal and sagittal alignment, and maximum elbow flexion/extension. Two independent assessors made the same measurements off the clinical photographs to compare these with the clinic measurements. Two PROMs: Self-Assessment Questionnaire (SAQ: 0 best to 14 worst) and QuickDASH (0 best to 100 worst) were completed at the 3-month visit.

Results

Inter-rater reliability of the photograph measurements was excellent (Kappa: 0.88-0.93), but weakly concordant with clinical measurements (carrying angle Kappa = 0.51;max flexion Kappa = 0.68;max extension Kappa = 0.64). SAQ moderately correlated with QuickDASH (Kappa = 0.59) and performed better at identifying patients with abnormalities. SAQ score≥4 identified patients meeting 3-month follow-up criteria, with sensitivity:36.1%; specificity:96.8% and negative-predictive-value(NPV):87%.

Conclusions

We did not find that photographs were reliable. Although SAQ-score has high NPV, a more sensitive fracture-specific PROM is needed to identify patients who do not need a 3-month follow-up visit.

FREE COMMUNICATIONS: MAURICE E. MÜLLER BEST PAPER SESSION

FM037*

DIABETIC AND NON-DIABETIC CHARCOT NEUROOSTEOARTHROPATHY DEMONSTRATE SIMILAR CLINICAL COURSES (11291)

Sabrina Weber; Farah Selman; Tobias Götschi; Martin Berli; Madlaina Schöni; Felix W. A. Waibel

Introduction

The literature reports that Charcot neuroosteoarthropathy (CN) is of diabetic origin in around 75%. Most literature reporting on the clinical course and complications of CN focusses on diabetic CN. Reports on non-diabetic CN are scarce. The aim of the present study was to compare treatment outcome of diabetic versus non-diabetic CN. We hypothesized that diabetic CN leads significantly more often to complications such as pressure ulcers, CN reactivation, and limb loss.

Methods

Retrospective cohort study with inclusion of patients that had been treated for CN at our institution. All patients were eligible in whom treatment for CN started between January 1st 2006 to December 31st 2018. Exclusion criteria were age <18, corrective surgery for CN performed as the first step, singular appointments with the purpose of a second opinion and missing general consent. Statistical analysis included a Student t-test for the comparison of continuous variables and Fisher`s exact test for the comparison of categorical data. Kaplan-Meier survival estimates were constructed and Log Rank tests were performed to compare minor and major amputation free survival between diabetic and non-diabetic CN.

Results

Out of 293 CN that were included, 89 (30.4%) were non-diabetic. Mean overall follow-up was 5.4 years. Major amputation was necessary in diabetics in 6% and in 2% in non-diabetics (p = 0.25; Log Rank test p = 0.22). Minor amputations were also more frequent in diabetics but insignificantly (17% vs. 11%; p = 0.22; Log Rank test p = 0.37). Diabetics demonstrated an elevated risk for ulcer recurrence (46% vs 30%; p = 0.013). When patients presented with unilateral CN, time to contralateral CN was significantly faster in non-diabetics (mean 6 vs. 19 months; p = 0.04). All other complications and therapy modalities (duration of total contact cast until resolution of active CN, first time ulcers, CN reactivation, need for reconstructive surgery, time to ulcer, time to ulcer recurrence) demonstrated no statistically significant differences.

Conclusion

Complication rates in diabetic and non-diabetic CN are similar. Only ulcer recurrence was significantly more often in patients suffering from diabetes.

FM038*

Long-Term Recurrence Rate In Anterior Shoulder Instability After Bankart Repair Based On The On- And Off-Track-Concept (11229)

Ines Schwihla; Stefan M. Zimmermann; Florian Grubhofer; Karl Wieser

Background

Since its first proposal the concept of on- and off-track lesions in anterior shoulder instability has gained clinical relevance as a tool to predict the failure rate of arthroscopic Bankart repair. Current literature only reports either short term follow-up or long-term results of small sample sizes. The aim of this study was to provide a long-term evaluation of recurrent instability following arthroscopic Bankart repair in a large cohort utilizing the on-track vs off-track concept as a predictor for failure.

Methods

We retrospectively analyzed 271 patients that underwent primary arthroscopic Bankart repair for anterior shoulder instability between 1998 and 2007. All patients with a minimum follow up of 78 months and a preoperative CT or MRI scan were included into the study. Preoperative CT- and/or MRI-scans were used to determine the glenoid track and width of Hill-Sachs lesion. Recurrence of instability was defined as presence of instability symptoms (dislocation, subluxation and/or apprehension) or revision surgery (stabilization procedure) and was assessed as the primary outcome parameter.

Results

The glenoid track of 163 patients was assessed (female n = 51, male = 112) with a mean follow up of 124 months (99.4 – 145.6, SD = 2.5) and a mean age of 24 years (20 – 34.). An off-track Hill-Sachs lesion was found in 77 patients (47%), and 86 patients (53 %) were on-track. The rate of recurrent instability in the off-track group was 74% (n = 57) compared to 27% (n = 23) in the on-track group (p-value <0.001). The overall rate of revision surgery due to instability was 29% (n = 48) after a mean time of 50.9 months (±42.8) following Bankart repair. The rate of revision surgery in the off-track group was 48% (n = 37) after a mean of 53.5 months (±42.0)

vs. 13% (n = 11) after 42.3 months (±46.3) in the on-track group (p-value <0.001).

Conclusion

This study shows that the on- and off-track concept helps to distinguish for which patients an isolated arthroscopic Bankart repair yields long term benefits. Due to the high rate of recurrent instability in the off-track group, an off-track lesion should be treated surgically in such a way that the off-track lesion is converted into an on-track lesion.

Level of Evidence: Level III, retrospective cohort study.

Keywords: anterior shoulder instability; recurrence; long term result; on- and off-track; engaging; Hill-Sachs lesion.

FM039

Five-year outcomes of anatomic total shoulder arthroplasty with posterior augmented glenoid implants in Walch B2 and B3 glenoids (11373)

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Introduction

Posterior glenoid wear and persistent static posterior subluxation of the humeral head (SPSH) is associated with early failure of anatomic total shoulder arthroplasty (aTSA). In patients with Walch type B2 or B3 glenoids, posterior augmented glenoid (PAG) implants were reported to successfully correct SPSH on short-term follow-up. However, medium and long-term clinical and radiological outcomes of PAG remain unclear.

Method

We prospectively followed ten consecutive patients (mean age, 67.9±8.9 years; 5 females) with primary glenohumeral osteoarthritis and type B2 or B3 glenoids, who underwent aTSA with cemented keeled PAG implants (posterior augments of 15, 25, or 35 degrees). Clinical outcomes were assessed using Constant and Quick-DASH scores. All patients underwent preoperative shoulder computed tomography (CT) scans with 3D surgical planning combined with patient specific instrumentation at the time of surgery. Postoperative shoulder CT scans were performed at 3 months and 5 years postoperatively. Glenoid version (GV), inclination (GI) and SPSH were measured in 3D, on both pre- and postoperative CT scans, using the same reliable quantitative method. Glenoid implant loosening was defined as the presence of a radiolucent line (thickness >1.5 mm) at the glenoid bone-cement interface, and/or migration (>5 mm) and/or tilt (>5°) of the glenoid component.

Results

Five-year clinical outcomes revealed a mean Constant score of 78.2±8.9 and a Quick-DASH of 8.4±8.2. Mean GV and SPSH significantly decreased from -17.1±8.9 degrees and 70.3±5.9% preoperatively to -4.2±7.7 degrees and 55.5±8.1%, respectively, at three-months post-operatively (p <0.001). At 5-year follow-up, GV and SPSH only varied by 0.9±3.4 degrees and 1.7±6.2% compared to three-month postoperative values (p >0.39). However, GI significantly increased by 3.6±3.3 degrees (p = 0.004). Finally, five patients (50%) had signs of aseptic glenoid loosening.

Conclusions

Our five-year outcomes reveal a high rate of radiological glenoid implant loosening. While patient satisfaction currently prevails, these patients should be carefully monitored as radiographic signs of aseptic loosening unfortunately precede the clinical signs. Correction of glenoid retroversion and SPSH might be insufficient to prevent aseptic loosening. Long-term comparative studies are awaited to guide patients between aTSA and reverse shoulder arthroplasty in the setting of B2 and B3 glenoids.

FM040

Increase of cellular senescence in chronic human shoulder tendinopathies and its attenuation by Enhancer of Zeste 2 inhibition (11119)

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Introduction

Cellular senescence is a state of permanent cell cycle arrest that affects tissue regeneration. In recent years, it has been shown to play a key role in musculoskeletal diseases like osteoarthritis, but has not been addressed in tendinopathies so far. This study investigates cellular senescence in tendons from patients with shoulder tendinopathies and its correlation with Enhancer of Zeste 2 (Ezh2), previously described in fibroblast senescence. In addition, reversibility of senescence in response to senotherapeutic compounds is evaluated.

Methods

Human proximal long head of biceps tendons were obtained from patients with shoulder pathologies (proximal humerus fracture, superior labrum anterior to posterior tear, rotator cuff tear, osteoarthritis) and from healthy controls (cadavers). Biopsies were histologically scored for degeneration (Bonar score) and analyzed by RT-PCR and immunofluorescence to assess expression of tendon specific factors (tenomodulin, scleraxis), senescence markers (p16, p19) and Ezh2. Expression of these genes and of apoptotic markers was assessed in tendons exposed to senotherapeutic compounds (Dasatinib/Quercetin, AG490, ABT-263) or an Ezh2 inhibitor (EPZ-6438).

Results

Expression of p16, p19 and Ezh2 was significantly increased in chronic shoulder tendinopathies and correlated with the degree of degeneration (Spearman's r(p16) = 0.556 p <0.001; r(p19) = 0.663 p <0.001; r(Ezh2) = 0.507 p <0.001), but did not correlate with patient age. Immunofluorescent stainings demonstrated co-localization of Ezh2 with p16 and p19 in tenocytes.

Treatment with the senotherapeutic AG490 reduced expression of p16 (fold-change to control: FC = 0.46, p = 0.003), induced apoptosis of senescent cells by downregulation of the anti-apoptotic factors Bcl2 (FC = 0.16, p <0.001) and Bcl-XL (FC = 0.21, p <0.001), while anabolic factors (tenomodulin, scleraxis) were upregulated. A senolytic effect was also observed in presence of the Ezh2 inhibitor EPZ-6438, demonstrated by reduced expression of p16 (FC = 0.23, p = 0.002) and p19 (FC = 0.43, p = 0.036) as well as of Bcl2 (FC = 0.20, p <0.001).

Conclusion

Senescent cell traits accumulate in tendons from patients with shoulder tendinopathies irrespective of their age and the expression of p16 and p19 correlates with increased expression of Ezh2. Reduction of cellular senescence by Ezh2 inhibition suggests a new potential therapeutic approach for enhancing regeneration in tendinopathies.

FM041*

SEX, AGE, AND MUSCLE STRENGTH AFFECT SINGLE LEG HOP DISTANCE (11189)

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Introduction

Single leg hop (SLH) for distance are relevant to test knee injury risk and are used to assess return to sports readiness after injury and/or surgery. Factors influencing SLH distance in recreational athletes of various ages

are unknown. We assessed whether maximal SLH distance can be predicted by sex, age and isokinetic knee peak torque, in healthy recreational athletes.

Methods

36 female (age, 36.6 ± 12.0 years; age range, 19-59 years, body mass index (BMI), 22.7 ± 3.3 kg/m2) and 29 male (age, 33.7 ± 8.9 years; age range, 21-53 years; BMI 23.9 ± 3.5 kg/m2) healthy volunteers without previous lower extremity injuries were included. All participants had a maximum of 6 trials per side to reach their best SLH distance. Trials were excluded if the participant lost balance or had to readjust their foot after landing. Isokinetic knee extensor and flexor muscle strength was tested at 60°/s using a dynamometer (Biodex System 4) in two series of 4 extension-flexion repetitions. For the dominant side the maximal SLH distance and the predictor variables sex, age and to body mass normalized maximal peak torque in extension or flexion were included in two multiple linear regression models in RStudio ($p < 0.05$).

Results

Higher relative extension peak torque increased SLH distance by 14.0 cm per 1 Nm/kg ($p = 0.033$), every year of age reduced SLH distance by 1.1 cm ($p < 0.001$) and being female by 25.3 cm ($p < 0.001$; adjusted R2: 0.53). Higher relative flexion peak torque increased SLH distance by 33.9 cm per 1 Nm/kg ($p < 0.001$), every year of age reduced SLH distance by 1.2 cm ($p < 0.001$) and being female by 22.8 cm ($p < 0.001$; adjusted R2: 0.58). All results were confirmed when calculated for the non-dominant side.

Conclusion

These results confirmed that sex, age and isokinetic peak torque were predictors of SLH distance in recreational athletes aged 20 to 55 years. By adding peak extension or flexion torque to the regression analysis, the amount of explained variability of SLH distance increased to 53% or 58%, respectively. Interestingly not only extension but also flexion torque was a predictor of SLH distance confirming previous reports of a greater positive correlation between hamstring than quadriceps strength. Other factors not considered here, such as balance or flexibility may explain remaining variability in SLH distance. Our findings highlight the importance of a high muscle strength to maintain or regain knee function with aging or after injury.

FM042

Where does the pedicle screw get its hold? (11250)

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Introduction

Pedicle screw loosening in lumbar spinal fusion poses a relevant clinical complication, especially in situations with reduced bone quality. The aim of this study was to quantify the distribution of the screw hold along the pedicle screw at different loading amplitudes and in relation to bone quality.

Methods

Seven human cadaveric L5 vertebrae were used for this study. CT-data was used to classify the bone quality of the specimens into normal, moderate (osteopenic) and bad (osteoporotic). The vertebrae were instrumented bilaterally with pedicle screws following the traditional trajectory. Micro-CT images were acquired to analyze the screw location. The vertebrae were split in the midsagittal plane and both halves were split horizontally along the screw axis to allow for imprint tests with 6 mm long sections of the pedicle screws in a caudal direction. The force-displacement curves in combination with the micro-CT data were used to reconstruct the resistance of the pedicle and corpus region at different loading amplitudes.

Results

Bone quality was classified as normal in 3 specimens, as moderate in 2 and as bad in 2 specimens, resulting in 6, 4 and 4 pedicle screws per group. The screw length in the pedicle region in relation to the inserted screw length was measured at an average of 63%, 62% and 52% for the three groups respectively. At a calculated 100 N axial load acting on the pedicle screw, the pedicle region was contributing an average of 53.9%, 53.6% and 55.3% resistance for the normal, moderate, and bad bone quality specimens respectively. With 500 N load, these values were measured at 55.9%, 61.3% and 72.8% and with 1000 N load, they were quantified at 71.1%, 77.9% and 77.4%.

Conclusion

At lower loading amplitudes, the contribution of the pedicle and corpus region on pedicle screw hold are largely balanced and independent of bone quality. With increasing loading amplitudes, the contribution of the pedicle region increases disproportionally, and this increase is even more pronounced in situations with reduced bone quality. These results demonstrate the importance of the pedicle region for screw hold, especially in situations with reduced bone quality.

FREE COMMUNICATIONS: FOOT

FM043

Algorithm for surgical treatment of iatrogenic transfer metatarsalgia after hallux valgus surgery – the 3 plane approach (11144)

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Background

Iatrogenic transfer metatarsalgia is a distinctive complication after hallux valgus (HV) surgery with an incidence of 6.3% found in a systematic review of Barg et al. Various procedures have been described in the literature to address selected causes for this complication; however, to date no comprehensive and extensive treatment algorithm has been published to help surgeons solve this challenging and recurrent issue.

Method

We defined iatrogenic transfer metatarsalgia after HV surgery as pain in the lesser metatarsals after isolated surgery of the first ray, under the condition that the lesser rays were asymptomatic prior to the index surgery. We have classified the causes of this complication by a multiplanar assessment of the alignment of the operated first ray. According to the type of malalignment of the first ray leading to the said postoperative transfer metatarsalgia we present a comprehensive and complete algorithm for surgical treatment based on this biomechanical understanding.

Results

The deformity of the operated first ray after HV surgery resulting in iatrogenic transfer metatarsalgia can be understood as a biomechanically relevant malalignment of the first ray and classified according to the plane(s) in which it occurs. In the sagittal plane tarsometatarsal or cuneiform instability or extension malunion of the first ray are the identified causes, various stabilizing or correcting surgical steps are suggested depending on the assessment. In the frontal plane shortening of the first metatarsal leads to pain of the lesser rays; solutions are being suggested depending on the amount of shortening. In the transverse plane under correction of the intermetatarsal angle during index surgery will lead to failure and is addressed differently depending on whether the initial procedure was well chosen but badly performed or the chosen technique was inadequate from the start.

Conclusions

We present a comprehensive and complete algorithm to understand and treat iatrogenic transfer metatarsalgia as a complication of isolated HV surgery. Our algorithm is based on the assessment of the underlying malalignment of the first ray in the frontal, the sagittal and the transverse plane and offers an 'a la carte' treatment suggestion to help surgeons solve this challenging and recurrent issue.

FM044

Résultats à 3 ans de correction d'Hallux Valgus sévère selon Lapidus avec plaque plantaire et vis de compression plantaire. (11399)

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L'arthrodèse de Lapidus est une procédure puissante qui peut être utilisée pour corriger les hallux valgus sévères et pathologiques du pied. De nombreuses méthodes de fixation pour cette procédure ont été rapportées. Il a été démontré que l'utilisation de plaques offre une stabilité accrue par rapport aux constructions à vis uniquement.

Nous relatons notre expérience à trois ans selon la technique qui consiste en une vis de compression rétrograde plantaire à dorsale sur le site de l'arthrodèse, couplée à une plaque de verrouillage médiale à bas profil. Au total, 60 pieds ont été traités avec cette modification de la procédure Lapidus par 2 chirurgiens et ont été évalués prospectivement. Tous les patients ont suivi un protocole de charge totale avec un Vacopedes immédiatement en postopératoire pour 6 semaines. L'Âge du patient, le sexe, la durée du suivi, et la fusion radiographique ont été documentés. L'angle intermétatarsien préopératoire et postopératoire, l'ablation du matériel, les scores préopératoires et postopératoires du milieu du pied et de la cheville de l'American Orthopaedic Foot and Ankle Society ont été analysés. La période de suivi moyenne était de 25 ± 5,9 (plage de 12 à 36) mois, et toutes les fusions guéries ont démontré une union radiographique à une moyenne de 58 ± 19,1 (plage de 40 à 89) jours. Les complications comprenaient 22 pieds (37 %) nécessitant un retrait du matériel, 4 cas (7 %) d'hallux valgus radiographique récidivant. Aucun cas de metatarsalgie de transfert n'a été souligné.

Les résultats de la présente étude montrent que la fixation par vis de compression plantaire avec augmentation de la plaque de verrouillage médial pour l'arthrodèse Lapidus pour les Hallux Valgus sévères permet une mise en charge précoce avec des résultats satisfaisants, un meilleur alignement clinique et radiographique et de meilleurs scores de l'American Orthopaedic Foot and Ankle Society.

FM045

The percutaneous learning curve of 3rd generation minimally-invasive chevron and akin osteotomy (MICA) (11420)

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Introduction

Minimally-invasive Chevron and Akin osteotomy (MICA) represents the third-generation percutaneous hallux valgus surgery which is characterized by an extra-articular osteotomy, stable internal fixation and a high potential for correction. Compared to other percutaneous techniques of the foot, MICA is generally regarded as an advanced and demanding surgical procedure with a prolonged learning curve. The aim of this study is to analyze a single-surgeons experience with his first 50 consecutive MICA procedures.

Methods

Between May 2018 and February 2021, 50 consecutive MICA procedures performed by the author with the "K-wires first technique" were prospectively analyzed focusing on surgery duration, number of fluoroscopies, radiological correction results and surgery-associated complications.

Results

The mean preoperative intermetatarsal angle I/II (IMTA) was 17,5°, the mean hallux valgus angle (HVA) 32,1°. The average amount of radiological correction was 11,2° for the IMTA and 23,0° for the HVA. There was no statistical difference of radiological correction comparing the first 10 vs. the last 10 MICAs in this series.

Overall, the mean surgery duration was 48,2min. (min.29, max.90min.), the number of fluoro shots (fs) was 130,8 (min.65, max.186). Comparing the first 10 MICAS vs. the last 10 procedures, both surgery duration and amount of fluoro shots decreased significantly (58,8min vs. 35,0min and 165,9fs vs. 82,2fs).

One out of 50 MICAs required intraoperative conversion to open hallux correction. There were three feet in two patients where removal of the Chevron screws was performed after 7, 9, and 12 month due to prominent and disturbing screw heads at the medial cortex. There were no other secondary revision surgeries.

Conclusions

Although the learning curve of 3rd generation MICA is prolonged and requires specific training and intensive practice, the rate of complications is not increased compared to traditional open surgical hallux valgus techniques. The learning curve manifests itself predominantly in a decreasing operation time and reduced fluoroscopy. Strict adherence to the principles of 3rd generation MICA with stable fixation and meticulous intraoperative control of each surgical step helps to reduce surgery-associated complications and allows for adequate correction from the beginning.

FM046

Patient reported outcomes after dorsal closing wedge calcaneal osteotomy in patients with Haglund exostosis associated heel pain (11176)

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Schulthess Klinik Zürich

Introduction

Dorsal closing wedge osteotomy (DCWCO) is among other surgical options a valuable solution to treat patients with recalcitrant Haglund exostosis associated heel pain.

Hypothesis

1) Positive correlation exists between the amount of shortening of the lever arm of the Achilles tendon and the reduction of pain. 2) Shortening of the lever arm is not associated with residual postoperative functional impairment.

Study design

Case series; Level of evidence 4

Methods

134 patients were treated with DCWCO between January 2016 and June 2019. All patients were followed 24 months postoperatively. Besides specific radiographic parameters patient reported outcome scores (PRO) were obtained.

Results

8 patients had to be excluded from the study leaving 126 in the final cohort. The latter consisted of 68 males and 58 females (mean age 51.9 years and 47.5 years respectively). All radiographic parameters (truncated foot length [mm], Achilles tendon lever arm length [mm], vertical distance of Achilles lever arm [mm]) except calcaneal inclination angle showed significant change postoperatively (7.88 [6.5-9.2] , 8.11 [7.5-8.8], 7.15 [6.1-8.3]). All PRO scores showed gradual improvement 6, 12 and 24 months postoperatively. Based on the Global treatment outcome (GTO) 88% of the patients were satisfied or very satisfied with the result after 24 months. Small correlations were found between height of the Achilles lever arm and FFI disability at 24 months and FFI disability score change at 12 months (0.25 and 0.19 respectively).

Conclusion

This is the so far highest case number study showing that DCWCO leads to significant improvement of PRO scores and patient satisfaction 24 months postoperatively. Small correlations were found between height of the Achilles lever arm and FFI disability at 24 months and FFI disability score change at 12 months. Gradual improvement of PRO score and GTO was observed until 24 months postoperatively.

FM047

Reliability of a new device to measure medial column hyperlaxity of the foot (11147)

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Introduction

Hyperlaxity of the medial column of the foot is associated with several forefoot disorders such as hallux valgus, metatarsalgia, stress fractures, flatfoot, Lisfranc chronic dislocation or dislocation of MTP2 joint.

Its clinical measurement is highly subjective and consists of manually applying pressure under the metatarsal heads and estimating the differential dorsal sagittal translation between the 1st and 2nd-5th rays. This manual examination is neither reliable nor repeatable, since it strongly depends on the experience of the clinician along with the difficulty to apply an equal magnitude of force.

We have developed an apparatus that follows the biomechanical principles of the ground reaction forces during gait. This device applies a standardized, electronically controlled and precise similar force under the first metatarsal head as well as under the heads of M2 to M5 while measuring the relative sagittal displacement between these two bearings.

The purpose of this work is to validate the intra- and inter-observer reliabilities of the measurements obtained with our device.

Methods

Our protocol included 2 examiners and 30 feet (15 volunteers). Each subject had 15 consecutive measurements per foot divided into 3 sets of 5 trials per set. To assess the intra-observer reliability the first examiner did the first 3 and the last 3 trials. The 2nd examiner did the set of 3 trials in between to assess the inter-observer reliability. We used the intraclass correlation coefficient (ICC) to validate the reliability of the measures.

ICC values between 0.75 and 0.9 indicate good reliability, values greater than 0.90 indicate excellent reliability.

Results

The intra-observer reliability showed an ICC of 0.979 within a 95% confidence interval.

The inter-observer reliability showed an ICC of 0.977 within a 95% confidence interval.

Conclusion

This study showed that the inter- and intra-observer reliability tests were rated as excellent in measuring hypermobility of the 1st ray. This is a promising 1st step for further studies that will help to better understand, qualify and quantify hyperlaxity the 1st ray.

FM048*

Semi-automated 3D Analysis of the Hindfoot following Total Ankle Replacement for Varus Ankle Osteoarthritis (11263)

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Background

In advanced stages of ankle osteoarthritis (OA) with accompanying deformity, peritalar structures are often involved and progressive destabilization of the hindfoot complex is present. Deformity correction and neutrally hindfoot is one important key to success when ankle replacement is considered. Residual deformity may lead to early implant failure. Even severe deformity is correctable with TAR and detailed knowledge about the tibiotalar joint alignment changes are available in the literature. Information, particularly about changes in the subtalar joint following TAR, is scarce. Semi-automated measurements on weight-bearing computed tomography (WBCT) scan may allow in-depth analysis inframalleolar, therefore we aimed with this study to evaluate the subtalar joint position with such advanced imaging modality before and after TAR.

Methods

This single-center cohort study included 14 patients (15 ankles), who were treated with TAR without additional bony procedures for varus ankle OA between 2000- 2021. Semi-automated measurements of the hindfoot were performed based on pre-and postoperative WBCT. Clinical outcomes included range of motion (ROM), pain on visual analog scale (VAS), and American Orthopedic Foot and Ankle Society Hindfoot Score (AOFAS) and were assessed preoperatively and at the last follow-up.

Results

The time between pre-and postoperative WBCT was on median 1.1 years (range 0.3 – 5.3). All measurements of interest showed a significant improvement including talocalcaneal angle sagittal, talocalcaneal angle coronal, talocalcaneal angle axial, talar horizontal inclination angle, and hindfoot angle. Pain on VAS and AOFAS score improved significantly from pre- to postoperative.

Conclusion

TAR for varus ankle OA without additional bony procedures achieved significant correction of preoperative deformity at the level of the subtalar joint based on novel semi-automated 3D measurements on WBCT. TAR is able to restore not only ankle joint alignment but with its powerful potential to restore intrinsic stability enables the realignment of the subtalar joint. The results may help surgeons and impact their decision-making intraoperative process.

FM049*

A novel approach for joint line restoration in revision total ankle arthroplasty based on the three-dimensional registration of the contralateral tibia and fibula (11317)

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Introduction

The use of total ankle arthroplasty (TAA) is increasing over time, as so will the need for revision TAAs in the future. Restoration of the ankle joint line (JL) in revision TAA is crucial but often difficult due to severe bone loss.The primary aim of this study is to analyze the accuracy of a three-dimensional (3D) registration of the contralateral tibia and fibula to restore the ankle joint line (JL). The secondary aim is to report side-to-side differences of anatomical landmarks with respect to the ankle JL.

Methods

3D triangular surface models were generated from computed tomographic data of 96 paired lower legs (48 cadavers) without signs of pathology. Three segments of the tibia and fibula, excluding the distal tibial plafond, were defined (distal, middle, proximal). A surface registration algorithm was applied for superimposition of the mirrored contralateral lower leg onto the original lower leg. JL approximation for each segment was measured. Distances of the distal fibular tip, anterior and posterior medial colliculus to the JL were measured and absolute side-to-side differences reported. Anterior lateral distal tibial angle (ADTA) and lateral distal tibial angle (LDTA) were measured.

Results

Mean JL approximation was most accurate for the distal segment (0.1 ± 1.4 mm (range: -3.4 to 2.8 mm)) and middle segment (0.1 ± 1.2 mm (range: -2.8 to 2.5 mm)) compared to the proximal segment (-0.2 ± 1.6 mm (range: -3.0 to 4.9 mm)) ($p = 0.007$). Distance of the distal fibular tip, the anterior, and posterior medial colliculus to the JL were 22.0 ± 3.8, 12.8 ± 1.9 and 7.6 ± 1.9 mm respectively without significant side-to-side differences (n.s.). Mean ADTA and LDTA were 82.8 ± 2.4 ° and 87.5 ± 2.2 ° respectively without significant side-to-side differences (n.s.).

Conclusion

3D registration of the contralateral tibia and fibula reliably approximated the original ankle JL and the inclusion of the distal fibular tip, the anterior and posterior medial colliculi, as robust anatomical landmarks, improved the accuracy of JL restoration. The contralateral distal fibular tip, anterior and posterior medial colliculi, ADTA and LDTA can be used reliably for the planning of revision TAA with small side-to-side differences reported.

FM050

Subtalar Joint Coverage in Varus Ankle Osteoarthritis (11219)

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Introduction

The phenomenon of peritalar compensation of a supramalleolar and/or trans-articular deformity in end-stage varus ankle osteoarthritis (OA) is not yet fully understood. A possible reason for this lack of knowledge may be that peritalar joint assessment is difficult on conventional radiographs. As newer imaging technologies allow for a more detailed evaluation of the peritalar joints under load, we aimed compare subtalar (ST) joint coverage in patients suffering of varus ankle OA with/without peritalar deformity compensation.

Methods

In this study 20 patients (age 62± 10 years; 2 females) presenting with end-stage varus ankle OA underwent WBCT scans (Planmed Verity) with IRB approval. For each participant, CT images were auto-segmented to create 3D models of the tibia, talus, and calcaneus (DISIOR 2.1), then manually segmenting to finalize models (Mimics 22.0). The talar tilt (TT) and hindfoot alignment angle (HAA) were assessed in 3D using a specific software (DISIOR 2.1). Subgroups were performed containing each 10 patients with either a neutral (compensated) or varus (non-compensated) HAA. Analysis of the articular coverage in the ST joint (antero-medial/posterior facet) were performed for each participant using the 2nd principal curvature to identify regions of intersecting normal vectors (PostView, v2.2). Statistical analysis was performed to correlate 3D measurements to the ST joint coverage in each subgroup.

Results

The TT was comparable between compensated (7± 3 degrees) and non-compensated (10± 3 degrees) ankles, while the HAA did significantly differ (1± 5 versus 23± 6 degrees). Joint coverage at the antero-medial facet of the ST joint was significantly lower in compensated feet, while the joint coverage at the level of the posterior facet did not significantly differ.

Conclusion

Our data suggest that in case of posttraumatic end-stage varus ankle OA, the ST joint can either slow down or accelerate the progression of the deformity. The antero-medial articular facet of the ST joint seems to play a key role in preventing the hindfoot from rapid deterioration. It is yet unclear which factors impact on how the subtalar joint reacts in case of a supramalleolar/trans-articular varus deformity. Nevertheless, the two described entities may need to be differentiated as the surgical approach to ensure a neutral and stable hindfoot may differ between ankles which are compensated or non-compensated.

FM051*

Short-term Outcomes of a Two-Component Total Ankle Replacement in Revision Arthroplasty (11262)

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Background

Given the growing number of primary total ankle replacements (TAR) with expanding target population, an increase in the numbers of failed ankles and consecutive revisions is expected. Loss of bone stock and progressive destabilization of ankle joint complex are difficult challenges. Most revision implants compromise the already damaged bone stock. Standard components may not provide sufficient stability in revision setting without additional procedure. A novel versatile semi-constrained implant design may allow a desirable solution respecting the remaining bone stock but providing sufficient intrinsic stability. The purpose of this study was to present short-term results of a new two-component implant design in revision ankle arthroplasty.

Methods

This single-center retrospective cohort study included 57 patients (57 ankles) treated for failed TAR with the semi-constrained HINTERMANN Series H2© (H2) implant between 2018 and 2021. Survival analysis was performed and potential risk factors using Cox regression, were assessed. Clinical and radiological outcomes were assessed preoperatively and at the last follow-up. Clinical outcomes included pain on a visual analog scale (VAS), the American Orthopaedic Foot & Ankle Society (AOFAS) ankle hindfoot score and patient satisfaction. Radiological outcomes were tibial articular surface angle (TAS), tibiotalar surface angle (TTS), talar tilt angle (TT) in the coronal plane and anteroposterior offset (AP-Offset) ratio in

the sagittal plane, as well as signs of radiolucency and/or loosening on plane weightbearing radiographs.

Results

The median follow-up was 2 (0.3-3.1) years. The mean patient age was 63±13 years. The cumulative incidence for secondary revision after 1 and 2 years was 5.1% (95%CI 0-11) and 7.4% (0-14) respectively. Four patients needed a secondary revision. We observed a significant improvement in the clinical outcome following the primary revision. Radiological measurements showed steady periimplant forces on short-term without signs of increased shear-forces.

Conclusion

The novel semi-constrained total ankle implant design results in desirable short-term implant survival with an acceptable revision rate. It provides improved clinical and satisfactory radiological outcomes without any sign of increased shear forces in terms of lucency and/or loosening on short-term.

FM052*

The Weber Conundrum: Outcomes of Conservative versus Surgical Treatment of Weber B Ankle Fracture after 10 years (11296)

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HFR -Hopital Cantonal Fribourgeois

Ankle fractures make up one of the most common fracture type in traumatology. They most frequently involve the distal fibula. Whilst there is a clear consensus on the treatment of Weber A and C fractures, the treatment of Weber B fractures remains controversial. The decision on whether to operate or not on an isolated Weber B fracture is still highly dependent on the orthopedist's expert opinion. Conservative treatment consists usually of a short-leg walking cast/boot for 6 weeks. Several studies have shown that both treatments (surgical versus conservative) result in similar outcomes on the short term (1 to 2 years following injury). The literature lacks however conclusive studies over the long term outcomes (10 or more years post injury). Retrospective and prospective follow ups as well as trials are thus required in order to assess long term results and to guide treatment of this select group of patients. Our study reviews all patients with isolated Weber B fracture treated at our hospital (HFR-Fribourg) 10 years ago. Those are split into two groups: operative versus conservative. Patients are assessed using the EFAS score as well as the SF-12 survey. They will receive weight bearing X-rays which will be used to assess the grade of ankle arthrosis. Preliminary results show equal outcomes when it comes to functionality and ankle osteoarthritis in isolated Weber B fractures. Patient selection and proper initial radiological assessment remains however the key criteria for decision making in the treatment of these fractures.

FM053*

Influence of 2nd metatarsal length on transfer ulcers after first ray amputation in diabetic feet (11289)

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Introduction

Loss of the first metatarsal head in diabetic foot amputation leads to increased peak plantar pressure underneath the adjacent rays. Transfer ulcers (TU) underneath the second metatarsal head following first ray amputation occur frequently and lead to adjacent ray re-amputations in up to 22%. A length excess of the 2nd metatarsal of >4 mm compared to the 1st metatarsal using Coughlin's method is defined as "excess length" in the literature. We hypothesized that 2nd metatarsal length (2ML) is significantly longer in patients developing TU underneath the second metatarsal head.

Materials and Methods

Forty-two subjects with a mean age of 73 years and a history of 1st ray amputation due to diabetic foot complications as the first amputation of the corresponding foot were retrospectively analyzed. 2ML was assessed by the three methods described by Coughlin, Hardy & Clapham, and Maestro by two investigators (I1: resident in orthopedic surgery, I2: consultant in radiology). Investigator 2 was blinded to the study outcomes. Additional risk factors for TU were tested using Fisher's exact tests and Mann-Whitney U tests as applicable. The effect of MT length in the presence of potential confounders was assessed with Cox regression models. Interrater reliability for the different MT length measurement methods was quantified by the intra-class correlation coefficient (ICC).

Results

Mean follow-up was 59 months. Interrater reliability was excellent for all three methods. Using Coughlin's method, 2ML was insignificantly longer in patients with (5.3mm) than without transfer ulcers (4 mm; p = 0.33). Hardy's and Maestro's methods demonstrated similar results (4.3/2.7 mm; p = 0.16) and (2.4/0.8 mm; p = 0.16). Insulin dependency was the only significant risk factor for transfer ulcer development in the cohort (p <0.003). Grouping patients according to their 2ML using Coughlin's method into "normal" (≤ 4mm) and "relative excess length" (>4mm), ulcer-free survival was shorter in patients with "relative excess length" (63 versus 91 months).

Conclusion

Patients with transfer ulcers after 1st ray amputations have longer 2nd metatarsals on average, but statistically insignificant. Transfer ulcers occur faster in patients with 2nd metatarsal "relative excess length" of >4mm. Insulin dependency seems to have a protective effect on the risk of TU development but may represent reduced physical activity.

FM054

Epidemiology of patellar tendinopathy in athletes and general population: A systematic review and meta-analysis (11322)

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Purpose

To determine the prevalence of patellar tendinopathy (PT) in athletes and the general population.

Methods

A systematic review of the literature was performed on January 17, 2022 and conducted in the bibliographic databases PubMed, Web of Science, and Wiley Cochrane Library.

Epidemiological reports of any level of evidence, clinical studies reporting data of incidence or prevalence, written in English language, was included.

Results

Out of 11.488 retrieved records, 28 studies on 28.171 participants were selected and used for the qualitative and quantitative analysis. An overall PT prevalence of 0.1% and 18.3% were reported in the general and athletes' populations, respectively. In athletes, PT prevalence was 11.2% in women and 16.4% in men (n.s.). PT prevalence in individuals under 18 years of age was 10.9%, while in adults it was 21.2% (p = .009). PT prevalence was 6.1% in soccer players, 20.7% in basketball players, and 24.8% in volleyball players. There were heterogeneous PT diagnosis approaches. Higher prevalence values were found when PT diagnosis was formulated via patient-reported outcomes versus clinical evaluation (p = .005).

Conclusions

PT prevalence is a common problem in the male and female sport active population, whereas it is negligible in the overall population. Sportspeople over 18 years old have twice the prevalence of younger players. Volleyball and basketball players are most affected by PT.

FM055

Assessment of Peritalar Joint Subluxation in Flatfoot Deformity (11217)

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Introduction

Studies have shown that semi-automated 3D measurements derived from weighbearing computed tomography (WBCT) scans can reliably assess the hindfoot deformity in patients with flatfoot deformity (FFD). However, the literature fails to report whether such measurements correlate with subtalar (ST) and talo-navicular (TN) joint subluxation. The aim of the study was to evaluate whether two widely used WBCT derived measurements, the talo-calcaneal overlap (TCO) and talo-navicular coverage (TNC), correlate with peritalar joint subluxation in case of FFD.

Methods

In this study 20 patients presenting with various stages of FFD (age 60 ± 18 years; 12 females) underwent WBCT scans (Planmed Verity) with IRB approval. For each participant, CT images were auto-segmented to create 3D models of the talus, navicular, and calcaneus (DISIOR 2.1), then manually segmenting to finalize models (Mimics 22.0). 3D measurement including the TCO and TNC were performed using a specific software (DISIOR 2.1). Analysis of the articular coverage in both the ST and TN joint were performed for each participant using the 2nd principal curvature to identify regions of intersecting normal vectors (PostView, v2.2). Statistical analysis was performed to correlate the TCO/TNC with the articular coverage of the ST (antero-medial/posterior facet) and TN joint.

Results

While the TCO and TNC significantly correlated with subluxation of the antero-medial calcaneal facet of the ST joint (Pearson's correlation coefficient -0.5251 and 0.5131), no significant correlation of each parameter was evident for the posterior articular facet coverage. TNO significantly correlated with TN joint subluxation (talar and navicular facet; Pearson's correlation coefficient -0.6205 and -0.5853).

Conclusion

TCO and TNC are useful to estimate the severity of ST and TN joint subluxation in case of FFD. In addition, the level of subluxation (ST and/or TN joint) can also be identified. This finding simplifies radiographic assessment of patients with FFD as a detailed understanding of peritalar joint congruency becomes possible by using only two measurements. Such information may help the surgeon to decide which operative strategy (e.g., osteotomies versus fusions) should be used in case operative treatment is required.

FM056

Typical Complications after Autologous Matrix Induced Chondrogenesis (AMIC) for the Treatment of Osteochondral Lesions of the Talus (11224)

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Balgrist

Purpose

To report and analyze typical complications and their etiology after autologous matrix-induced chondrogenesis (AMIC) for osteochondral lesions of the talus (OLT).

Methods

A total of 127 consecutive patients with 130 AMIC for OLT were retrospectively assessed. Isolated AMIC was performed in 86 cases (66.2%), while 44 cases (33.8%) underwent concomitant surgery such as ankle stabilization (20%), corrective osteotomies (9.2%), and soft tissue procedures (3.9%). All AMIC-procedures were performed in an open fashion with 106 (81%) patients requiring a medial and/or lateral malleolar osteotomy. Bone grafting with autologous spongiosa was utilized in 44 cases (34%). Persistent clinical symptoms without need for revision surgery was reported in 18 patients (14%), meanwhile 71 patients (54%) underwent subsequent surgery. These cases were evaluated for patient factors, OLT size and location, complications, postoperative imaging and intraoperative findings during revision surgery. The mean time of follow-up for patients after AMIC was 3.1 (+/- 2.5) years.

Results

Among all patients that required revision surgery, 18 cases (25%) demonstrated AMIC-related complications with deep fissuring (77%), thinning (17%) and softening (5%) of the AMIC graft. Revision cartilage repair with AMIC or microfracture was performed in 10/18 cases (56%) at a mean follow-up of 3.7 +/- 2.8 years. The remaining either underwent careful debridement (n = 2), arthrolysis (n = 1), arthrodesis (n = 1), arthroplasty (n = 1), or hardware removal with non-operative management using cortisone injections (n = 3). Conversely, 53 cases (75%) underwent subsequent surgery due to AMIC-unrelated reasons including isolated symptomatic hardware (38%) and concomitant pathologies with (40%) and without symptomatic hardware (23%). Complications without the need for revision surgery were reported in 16 cases (12%) with the majority presenting with persistent unspecific pain (56%) and anterior ankle impingement (31%). Among age, body mass index, defect size, smoking and bone grafting, smoking was the only factor approaching statistical significance with an odds ratio of 2.3 for AMIC-related complications (95% CI, 0.91-6.0; p = 0.077).

Conclusion

The majority of revision surgeries after AMIC for OLT are unrelated to the performed AMIC-graft but frequently address symptomatic hardware and concomitant pathologies. Yet, smoking seems to increase the risk for AMIC-related complications requiring revision surgery.

FM057*

Centromedial location of talar osteochondral lesions leads to superior outcome 2 years after autologous matrix-induced chondrogenesis (11350)

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Introduction

Most osteochondral lesions of the talus (OLT) are located on the medial or lateral talus shoulder. Raikin et al established a nine-zone anatomical grid system on the talar dome to locate osteochondral lesions. The centromedial zone is the most commonly involved. However, it is unclear, if the outcome correlates with the location of the lesion.

The aim of this study was to correlate the OLT location with the outcome 2 years after autologous matrix-induced chondrogenesis (AMIC).

Methods and patients

Twenty-seven consecutive patients between 18 and 66 years (mean 36 years) undergoing AMIC for OLT between 2012 and 2018 were included. Minimum follow up was two years.

The following clinical scores were acquired: American orthopaedic foot and ankle society (AOFAS) score, foot-function index (FFI), and visual analogue scale (VAS) pain.

Results

The OLT locations were as followed: 12 (44%) centromedial, 15 (56%) other locations including 3 anteromedial, 5 posteromedial, 1 anterolateral, 5 centrolateral, 1 posterocentral.

Over all patients, the AOFAS score improved from 62.7 ±14 preoperative to 75.5 ±20 at two years follow up (p-value: 0.013). FFI improved from 54.3 ±21 to 34.3 ±26 (p-value: 0.006). VAS pain improved from 5.7 ±2.1 to 3.4 ±2.7 (p-value: 0.004).

Preoperative, there was no significant difference in clinical scores between patients with a centromedial lesion and patients with a lesion in another location. However, two years postoperative, clinical scores were

significantly superior in patients with a centromedial lesion. The AOFAS-score was 87.5 ± 9 in patients with a centromedial lesion compared to 64.57 ±21 in patients with the OLT in another location (p-value: 0.002). FFI and VAS pain were significantly lower in patients with a centromedial location (25.1 ±19 versus 45.5 ±27, p-value: 0.045, respectively 2.5 ±2.2 versus 5.0 ±2.6, p-value: 0.018).

Discussion

Centromedial was the most common location. Patients with OLT improved 2 years postoperatively after AMIC procedure. Patients with the osteochondral lesion located centromedial showed superior results.

FM058*

Where are the isometric points in lateral ankle ligament reconstruction? A three-dimensional kinematic study (11132)

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Background

Long term clinical studies support the choice of anatomic above non-anatomic lateral ankle ligament reconstruction. However, among the numerous techniques described, no biomechanical studies did show the superiority of one reconstruction above the other. To optimize the biomechanical outcomes and avoid stiffness or residual laxity, finding an isometric point for the anterior lateral talofibular ligament (ATFL) and the calcaneofibular ligament (CFL) is mandatory.

Method

Three-dimensional (3D) surface models were generated from computer-tomography scans of ten patients with healthy ankles. 30 insertion points of the CFL were defined on the lateral side of the calcaneus each 10% of its total length in the dorsal-to-ventral and proximal-to-distal plane. 5 insertion points were defined at the ventral ridge of fibula and 5 insertion points along the lateral talar process. The tibiotalar and subtalar joint were simulated based on previous 3D anatomical studies of the talus. The insertion points of the CFL and ATFL were rotated around the tibiotalar axis in flexion at 45°, 30° and 15°, and in extension at 15°, 30°. The CFL insertions were rotated around the subtalar axis in inversion at 6°, 4°, and 2° and eversion at 2° and 4°, leading to 36 combinations of hindfoot positions. The distances between each point were calculated using the Euclidian distance in 3D space.

Results

The isometric point of CFL on the calcaneus is located at about 60% along the dorsal-to-ventral and between 60 to 70% along the proximal-to-distal plane. From maximal extension to flexion, these points present respectively a length variation of -0.8 to -1.1 mm ($p = 0.46$) and -1.1 to -0.8 mm ($p = 0.56$) and are located respectively between 4.2 and 7.5 mm from the peroneal tubercle. A fibular insertion at 5 mm proximal to the malleolar tip present a length variation ranging from -0.1 to 1 mm ($p < 0.001$) for ATFL and from -0.7 mm to 0.5 mm ($p < 0.001$) for CFL, which are the lowest variations among all the fibular insertions. A talar insertion point of the ATFL located 5 mm proximal to the subtalar joint present the lowest variation, ranging from -1.1 to 0.7 mm ($p < 0.001$).

Conclusion

This study shows that the 3D kinematic isometric points correspond to the true anatomic insertion of the ATFL and CFL and that an anatomic reconstruction avoid excessive stiffness or laxity.

FREE COMMUNICATIONS: BASICS / QUALITY / HAND

FM059

Women in Orthopaedics: Where do the female students disappear? (11416)

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Introduction

The number of female students in medical schools is rapidly increasing, reaching two-thirds of the student population in Switzerland last year. However, the percentage of female full members of the Swiss Orthopedics Society is approximately 8%. The purpose of this study is to analyse the different career stages and discover when there is this enormous gap.

Methods

The female to male ratio of current medical students in Switzerland was obtained as well as the number of candidates for the Orthopaedics and Traumatology board examinations and the number of junior and full members of the Swiss Orthopedics Society.

Results

Our results show that women comprise approximately 67.2% of medical students; however, only 8.4% of the full members of the Swiss Orthopaedics Society are women increasing by around 4% over the last 12 years.

Of the 366 candidates for the board examinations in 2020 and 2021, 103 were women comprising 28.1%, while of the 91 actual junior members, 24 were women (26.4%).

Conclusion

At the start of residency, many women choose not to go into Orthopaedics. This could be due to limited exposure to musculoskeletal medicine during medical school, negative perception of the field, lack of female mentors, promotion barriers, senior faculty acceptance, or work-life balance. Our analysis, however, shows an increasing percentage of female candidates for the board examinations and female junior members. We are hopeful that these numbers will be reflected in the upcoming years on the number of full members.

FM060

Outcome Oriented Clinical Research and Quality Measurement in Fracture Care (11156)

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Introduction

The paradigm shift according to the principles of Value-Based Healthcare is receiving growing attention. In Orthopedic Trauma care, there are no defined standards to provide an incentive system to recompensate for quality instead of quantity. The definitions of quality from the patient's view have to be validated and included in the reimbursement cycle. In our Department, we now have fully standardized and structured documentation and outcome measurement workflow from the clinical point of view.

Material and Methods

We set up a Fracture Registry with a REDCap® Database to document every patient with surgical treatment. Included are all surgically treated fractures of the extremities, excluding the hand. Furthermore pelvic, acetabular, and periprosthetic fractures, joint dislocations, and tendon ruptures. With interfaces to our Clinical Documentation Systems, the administrative effort became very efficient. The interfaces provide a possibility to identify every patient with inclusion criteria and implement reminder feedback for Surgeons. We collect PROMs with the heartbeat-Software, and document CROMs with REDCap®. We merged these data using the software 'R'. The documentation of each patient is completed with a database for Adverse Events.

Results

Data-entry rates were less than 50% in 2018 and have reached 99.1% for 2020 and 99.5% for 2021 for surgically treated fracture patients. Until the submission of this abstract, 2382 surgical procedures have been performed at our Department on 2073 hospitalized patients. 972 patients were included in the Fracture Registry (47%). In a feasibility study, we have merged clinical data with the PROMs of patients treated for distal radius (DR) and proximal humerus (PH) fractures. The baseline values for DR of the quality-of-life questionnaire EQ5D was 0.83 (n = 144), after 3months 0.9 (n = 58) and 0.97 one year after treatment (n = 6). Although not more than a trend, we realized the same pattern for PH-patients with an EQ5D-Baseline of 0.75 (n = 63), three months values of 0.75 (n = 58), and one-year results of 0.87 (n = 6).

Conclusion

Collecting structured data allows combining routine clinical data with PROMs and CROMs. This information is of inestimable value to define the quality of care for Orthopedic Trauma Surgery. Our combination of Databases to collect diagnosis, subjective and objective outcome measures has been proven feasible and showed high data quality.

FM061

Effect of the surgical approach on the introduction of an enhanced recovery pathway for elective total hip arthroplasty (11180)

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Introduction

Enhanced recovery programs in total joint arthroplasty have been shown to reduce length of stay without compromising results. In 01/2014 a standardized fast-track treatment protocol was introduced in a Swiss hospital by one surgeon using the anterior approach. This program was extended to an enhanced recovery program involving all care providers in 01/2018 together with a second surgeon using the lateral approach. The effect of the implementation of the enhanced recovery program and of the used surgical approach should be studied.

Methods

Patients were documented prospectively and analyzed retrospectively. All patients with primary osteoarthritis without previous surgery were included consecutively. The preoperative workup was made with surgeons, anesthesiologists, nurses, physiotherapists, and case-managers, including a joint-school and a detailed information-flyer. Discharge was suggested when the patient fulfilled defined criteria and felt prepared to leave the hospital. Patients had follow-up at two, six weeks, and three months postoperatively. 450 patients were included from different time periods between 2013 and 2019, each consisting of 50 patients per surgeon.

Results

The mean length of stay (LOS, postoperative nights) was 9.9 days before introduction of the pathway and 4.9 (S1, surgeon one) and 5.5 (S2, surgeon two) respectively at 2019 ($p < 0.001$). Patients admitting at day of surgery were initially 2% and increased to 95% (S1 and S2, $p < 0.001$). Patients without dispense of opioids increased from 10% to 36% (S1) and 18% (S2) ($p < 0.05$). Rate of blood transfusion decreased from 10% to 4% (S1) and 0% (S2, $p < 0.01$). The number of patients discharged directly home increased from 66% to 84% for S1 ($p > 0.01$), while it remained stable for S2 (60%, $p = 0.39$). There were 12 adverse events without difference between the series ($p = 0.33$). The positive effects on LOS, opioid use, transfusion rate, and rate of adverse events were independent of the used approach.

Conclusion

The enhanced recovery program was appreciated by patients and staff. The decreased LOS and increase in discharge directly home was a consequence of the better integrated care process. The introduction of a fast-track program seems not to be affected by the used surgical approach.

FM062

3D Printed Pectin-scaffolds for the regulation of mesenchymal stem cell differentiation in an endochondral ossification in vitro model (11324)

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Introduction

Endochondral ossification (ECO) is one of the main processes for bone development, which involves the formation of a cartilage template, followed by a phase in which stem cells undergo hypertrophy and finally conversion to bone tissue. Thus, the scaffolds for ECO engineering should be able to support cells during chondrogenic differentiation while promoting the calcification of a cartilage template into bone. Pectin is a structural polysaccharide of plant cell walls and it has been increasing applied in tissue engineering thanks to its biocompatibility, biodegradability and gelling capability. However, the inadequate rheological properties limit its use in 3D printing. In our previous work, we addressed this challenge by introducing (3-Glycidyloxypropyl) trimethoxysilane (GPTMS) as pectin crosslinker.

Methods

In this work, we aim at expanding the application of pectin as building block of 3D printed scaffolds for an in vitro ECO model. In particular, three different pectin-based inks were developed by tuning GPTMS content and by adding nHA (50% w/w) as a filler. 3D woodpile-shaped scaffolds were printed and used in combination with fibrin gel (fibrinogen 2.5 mg/ml and 0.5 U/ml thrombin). Scaffolds were characterized by ESEM and µCT analysis, and their mechanical properties were confirmed by uniaxial compressive test. Subsequently, a pool of human bone marrow-derived stem cells (hBMSCs), isolated from four different patients, was loaded into the fibrin gel and used to assess the influence of the scaffold stiffness and composition on cell viability, proliferation and differentiation towards a chondrogenic and hypertrophic phenotype by performing Live/Dead and Alamar Blue assay, matrix deposition quantification, gene expression.

Conclusions

All scaffolds showed a good printability that allowed to generate self-supporting woodpile scaffolds with interconnected macroporosity/mesoporosity, as confirmed by SEM and µCT analysis. Pect1, the pectin scaffold with the lowest GPTMS concentration (0.92 ml/g pectin) showed the lowest compressive modulus both alone (48 kPa) and with the addition of the fibrin coating (55 kPa). hBMSCs embedded in fibrin at 7.5 M/ml were homogeneously distributed on the struts of the scaffold and, additionally, they showed an elongated shape both at 2 weeks in chondrogenic medium and 4 weeks in hypertrophic medium. Pect 1 showed both the highest expression of chondrogenic genes (Col2, ACAN, SOX9) after 2 weeks of

FM063

Enhancement of Spinal Fusion through BMP2 and L51P in an in vivo Rat Spinal Fusion Model (11385)

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Introduction

After spinal fusions surgery, non-union remains a major unresolved complication. Therefore, several biomaterials and osteobiologics have been used to improve spinal fusion such as the bone morphogenetic protein 2 (BMP). However, the necessary high dose application often leads to sig-

nificant adverse effects.The engineered BMP2 analog L51P could be a possible solution for reducing BMP doses and could even become a possible replacement of BMP2. This pilot study aimed to demonstrate the effect of BMP2 and L51P in the enhancement of spinal fusion in an in vivo rat spinal fusion model.

Methods

26 WISTAR rats (62% male, 419 ± 55 g) underwent a two-step spinal fusion surgery under full anesthesia. Firstly, a specialized designed external ring fixateure was applied and secured with four Kirschner wires in the proximal part of the rats tail (cauda 4-5). Secondly, a discectomy and replacement with a β-TCP (tri-calcium-phosphate) carrier, coated with the bone morphogenetic proteins BMP2 and L51P, was conducted. Rats were assigned double-blinded into four groups according to the coating of the carrier (A: β-TCP with phosphate-buffered-saline (control); B: β-TCP + 1µg BMP2; C: β-TCP + 10µg BMP2; D: β-TCP + 10µg L51P). Read-outs were conducted at three and six weeks postoperatively with digital x-rays and at 12 weeks after euthanasia with additional µCT and histology.

Results

18 rats (A: n = 5, B: n = 4, C: n = 4, D: n = 5) had complete follow-up readouts. All rats in Group C showed complete fusion in µCT data at 12 weeks postoperatively with bridging callus formation, bone in-growth and >50% carrier resorption. Rats of Group B and D exhibited signs of partial fusion, with one-sided docking of bridging callus, bone on-growth and <50% carrier resorption. Within the control Group A, no fusion nor new bone formation nor carrier resorption has occurred after 12 weeks. Bridwell-criteria analysis of conventional x-rays showed significant differences between intervention and the control group ($p < 0.05$) at 12 weeks postoperatively.

Conclusion

In this pilot study, a spinal fusion rat model could be established successfully. With the high dose of 10µg BMP2, complete fusion was achieved. The low dose of 1µg BMP2 and the high dose of 10µg L51P resulted in partial fusion. Without growth factor stimulation, no fusion signs could be seen radiographically. Whether a combination of low dose BMP2 and L51P can further enhance spinal fusion is subject of further investigations.

FM064

The outcome of Wilson Osteotomy using patient-specific planning and instruments (11400)

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Introduction

Arthritis of the basal thumb is a relatively common condition also affecting younger patients. Wilson et al described a 20° to 30° closing wedge osteotomy of the first metacarpal bone to unload the trapeziometacarpal joint. It was the purpose of this study to analyze the clinical and radiographic outcome of patients who underwent proximal extension osteotomy of the first metacarpal bone using patient-specific planning and instruments (PSI).

Methods

All patients who underwent proximal metacarpal osteotomy for basal thumb arthritis at our tertiary referral center were included. The patients underwent preoperative planning using computed tomography and 3D segmentation to build patient-specific guides and instruments for the operative treatment. Stable fixation of the osteotomy was achieved by internal plating. The inclusion criterion was a minimum follow-up of 1 year with clinical examination, including the Michigan Hand Outcomes Questionnaire (MHQ), and computed tomography to validate the correction. Complications and reinterventions were recorded.

Results

A total of 9 Wilson osteotomies in 7 patients could be included at a mean follow-up duration of 33+-15 months (range, 12 to 55 months). The patients were 49 +- 8 years (range, 36 to 56 years) at the surgery and 78% were female. The postoperative MHQ for general hand function was 78 +- 17 (range, 45 to 100) and the MHQ for satisfaction was 76 +- 27 (range, 17 to 100). The working status was unchanged in 8/9 hands (6/7 patients). Radiographic analysis revealed successful correction in all cases with unchanged Eaton-Littler stage in 8/9 hands. One complication with development of a chronic pain syndrome occurred, no reinterventions were recorded.

Conclusion

The combined extending and ulnar adducting osteotomy using patientspecific guides and instrumentation provides a safe and successful treatment for earlystage thumb arthritis with low complication and reintervention rates.

FM065*

Malunion deformity of the forearm: Three-dimensional length variation of interosseous membrane and bone collision (11265)

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Background

Patient-specific corrective osteotomy of the forearm for posttraumatic deformity is a well-established treatment. It may however present limitations because a planning only based on the bone may potentially lead to a tension of the interosseous membrane (IOM) and a residual lack of motion postoperatively.

Method

With three-dimensional simulation, the insertion points of the interosseous membrane were reproduced on one healthy cadaveric forearm. A deformity with an angle of five degrees was simulated on the proximal and distal third of each bone in 4 directions: valgus, varus, flexion and extension, leading to 32 combinations of deformity. The full range of motion from pronation to supination was simulated and the lengthening variation of the IOM and the occurrence of bone collision in pronation were analyzed.

Results

A deficit of pronation may be expected with combined convergent deformities in valgus because of a lengthening of the DOB in maximal pronation (1.4 mm) and a lengthening of the proximal part of IOM (DOAC 2.2 mm and POC 2.4 mm) Convergent varus deformities present an increased bone collision in pronation (45 and 28% loss of pronation when proximal or distal deformity). Convergent extension deformities present an increased bone collision in pronation (100 and 57% when proximal and distal), without relevant ligament lengthening in supination. Divergent combination of radius in valgus and ulna in varus present increased bone collision in early pronation (100 and 7% when proximal and distal) and shows a substantial shortening of the mean IOM length (-0.8mm in neutral position and -1.5mm in 90° supination, statistical intergroup difference $p > 0.001$). A deficit of supination may be expected with combination of radius in varus and ulna in valgus because of the IOM (mean lengthening of 2 mm $p < 0.001$). Combination of radius in flexion and ulna in extension does not show a substantial lengthening of the IOM (0.2 mm in 90° pronation, -0.3 mm in neutral position, 0.0 mm in 90° supination, intergroup difference $p < 0.001$) nor an increased bone collision in pronation (1 and 1% when proximal and distal) and may be therefore more tolerable in terms of supination or pronation with an angulation under five degrees.

Conclusion

By providing a better understanding of the IOM, this study aims to refine the surgical indication for corrective osteotomy and highlights the importance of a soft-tissue based planning.

FM066

Anatomical study of the correlation between collateral ligaments, periarticular exostoses and articular surfaces in osteoarthritic PIP joints (11299)

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Introduction

Osteoarthritis (OA) of the proximal interphalangeal joint (PIPJ) is a common cause of hand pain, and its operative treatment mainly consists of arthroplasty. Depending on the choice of implant, it is of paramount importance to protect the proper collateral ligaments (PCL) as they are primary mediolateral stabilisers of the PIPJ.

Methods

15 cadaveric human fingers were dissected to analyse and compare the correlation of the PCL to the articular surfaces and the periarticular exostoses of PIPJ in a control and an OA group. We further examined the growth pattern of periarticular exostoses in osteoarthritic PIPJ

Results

The distances separating the articular-nearest fibers of the PCL to the articular surfaces of the proximal (P1) and middle phalanx (P2) were significantly shorter in the OA group than in the control group, as well as the length of the PCL insertion. On P1, large exostoses bulged on each side of the PCL, following the path of the least tissue resistance. We did not find any relevant attachment of the PCL to these exostoses. On P2, the periarticular exostoses were regularly localised at the insertion of the PCL and the central slip, and their growth seemed to be guided by these specific structures.

Conclusions

Our observations support the opinion that different types of periarticular exostoses form around the PIPJ in osteoarthritis. Osteophytes grow predominantly on P1, dorso- and volar-laterally, enthesophytes on P2, laterally and dorsally. The different growth patterns of periarticular exostoses seem to influence considerably their correlation to the PCL in osteoarthritic PIPJ. Our findings suggest, that the periarticular exostoses of P1 can be excised during a surgical procedure without the risk to harm the PCL or the stability of the PIPJ. On the other hand, care should be taken to remove exostoses at the base of P2.

FM067

Overnight and in-hospital 3D–printed patient-specific casts for non-operative treatment of distal radius fractures – a randomized controlled trial (11290)

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Introduction

Throughout the last years, 3D-printing has increasingly gained popularity in orthopaedic surgery. Several case series highlight the feasibility of the method, but there is a lack of of high-quality studies and systematically reported outcomes. We present the first, to our knowledge, prospective randomized controlled trial about point-of-care overnight and in-house 3D–printed patient-specific casts for non-operative treatment of distal radius fractures.

Methods

Between March 2020 and January 2021 forty patients with un- or minimally displaced distal radius fractures were included in the clinical trial. After randomization, twenty patients were treated with conventional plaster casts and twenty with 3D-printed patient-specific casts for six weeks. The 3D-printed casts were based on free-hand 3D-surface scans of the forearm and printed in-hospital by the investigators using fast digital-light-processing additive manufacturing. Patient satisfaction (cast comfort) and clinical effectiveness of both immobilization devices were assessed with questionnaires one and six weeks after trauma. Furthermore, clinical (VAS, ROM, grip strength) and radiological outcome measurements were recorded at six, twelve, 26 und 52 weeks after trauma; functional outcome questionnaires (DASH/PRWE) were recorded at 12 and 52 weeks.

Results

The average patient satisfaction was slightly higher in the intervention group (3D-printed cast) at one and six weeks after trauma. Clinical effectiveness was similar at one and six weeks. VAS, ROM, grip strength and radiological outcome measurements were comparable at all follow-up appointments.

Conclusion

With this RCT we aim to highlight the clinical relevance, effectiveness and safety of point-of-care in-hospital 3D-printed patient-specific immobilization devices in non-operative treatment of distal radius fractures. Furthermore, we demonstrate the feasibility of routine clinical implementation of the method by demonstrating our multidisciplinary workflow.

FM068*

Volar Locking Plate VS Cast Immobilization for Distal Radius Fractures: A Systematic Review and Meta-analysis (11318)

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Purpose

To evaluate whether volar locking plate (VLP) fixation leads to different clinical and radiological outcomes than those of closed reduction and cast immobilization for the treatment of distal radius fractures (DRFs).

Methods

A comprehensive literature search was performed in the PubMed, Web of Science, and Cochrane databases up to January 14th, 2022. Inclusion criteria: RCT studies comparing the outcomes of VLP fixation with cast immobilization for the treatment of DRFs. Assessment of risk of bias and quality of evidence was performed with Downs and Black's "Checklist for Measuring Quality".

Results

A total of 12 RCTs (1368 patients) were included. No difference was found for Range of Motion (ROM), grip strength, quality of life, and reoperation, while the Disabilities of the Harm, Shoulder and Hand score (DASH) and the Patient Rated Wrist Evaluation (PRWE) at three months were statistically better in the VLP group. From a radiological perspective, only palmar tilt and radial tilt reached statistical significance in favour of the VLP group. Fewer complications were found in the VLP group (12.4% vs 24.1% of the non-operative group), but they did not result in different reintervention rates.

Conclusion

The main finding of this systematic review and meta-analysis is that no clinical difference was found between operative treatment with volar plate and conservative treatment with the cast, apart from a better DASH score at three months, better fracture alignment, and fewer complications at one year after surgery. Thus, the choice of proper fracture management should be carefully evaluated, balancing for each patient pros and cons of the two approaches.

FREE COMMUNICATIONS: SHOULDER / ELBOW PART 2

FM069

New technique – Percutaneous elevation of radial head fractures without fixation (11284)

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Introduction

The radial head is crucial for the elbow joint stability and its range of motion. In Mason type II or higher surgical treatment is recommended which varies from plate to screw fixation. A new and less invasive technique is percutaneous elevation for depressed articular surface fractures. This study aimed to investigate the radiographic outcome, complication and revision rate following percutaneous radial head reduction without fixation.

Methods

A retrospective study was performed between 2018 and 2021. Data on demographics, fracture morphology applying the Mason classification, dislocation in mm based on pre-, one week and 6 weeks postoperative x-rays as well as complications including revision surgery were noted.

In all patients a 2.0mm K-wire is used as metal bone tamps and reduction is performed under imaging intensifier until no radiographic step is identifiable. If no anatomical reduction is obtained the surgery is converted into an open reduction and internal fixation. Postoperatively the elbow is immobilized using a case for one week and a radiography in anteroposterior, lateral and Coyle's view are obtained. If no secondary dislocation is identified an early functional postoperative treatment is initiated with active mobilization without resistance for 5 weeks.

Results

In 23 patients a percutaneous elevation was planned however, in 3 patients no satisfactory radiographic results (2 Mason type II and 1 Mason type III fractures) were obtained why an open reduction was performed, leaving 20 patients for inclusion. The mean age was 38.6±12.9 years, males were affected in 60% (n = 12/20) of cases and especially the left side was injured in 55% (n = 11/20). In all patients a Mason type II fracture was observed with a mean step of 2.2±1.1mm on anteroposterior and 1.6±1.0mm on lateral view. The mean surgical time was 15.5minutes (range 2-37minutes) and not intra- or postoperative complications were observed. At initial follow up 7±3 days postoperatively, the step was 0.1±0.2mm on anteroposterior (p = 0.005) and 0.4±0.4mm on Coyle view (p = 0.005). No secondary fracture dislocation was observed. At final follow up 71±200days after surgery no significant difference was observed with a step of 0.1±0.2mm on anteroposterior (p = 0.896) and 0.1±0.2mm on Coyle view (p = 0.075).

Conclusion

This study shows that percutaneous closed reduction without fixation in Mason type II fractures is a very effective technique with little to no complications

FM070*

Superior versus anterior plate fixation for midshaft clavicular fractures – a multicentre analysis (11205)

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Introduction

To date it remains whether a superior or anterior plate is better for treating midshaft clavicular fractures. The aim of this study was to compare both techniques with regard to implant removal due to irritation, healing and complications.

Methods

This was a retrospective study of all midshaft clavicular fractures treated operatively between 2017 and 2019 in two hospitals with polarized treatment preferences in Switzerland. The primary outcome was the number of implant removal due to hardware irritation. Secondary outcomes were complications, re-interventions, range- of-motion and time to union of patients with at least 6-mont follow-up.

Results

In total 171 patients were included in the study of which 89 (52%) received anterior plating and 82 (48%) superior plating. The overall mean age was 45 years (SD 16). There was no significant difference between anterior and superior plating with regard to implant removal (39.3% versus 45.1%), infection rate (1.1% versus 1.2%), implant failure (1.1% versus 0%), nonunion (1.1% and 0%) and time to union (mean 40 weeks versus 51 weeks).

Ninety-four patients had a documented range of motion after a follow-up from 6 up to 12 months with no significant difference in abduction (mean 166 degree anterior versus 176 degree superior) and anteflexion (mean 170 degree anterior versus 178 degree superior).

Conclusion

There is no significant difference between anterior and superior plating for midshaft clavicular fractures with regard to implant removal, healing, complications and shoulder function. The decision may depend on surgeons experience, as both treatment opinions are viable.

FM071*

A MUSCULAR CONTROLLED, EX-VIVO GLENOHUMERAL SIMULATOR (11321)

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Introduction

Shoulder joint and muscle forces cannot be easily and accurately measured directly in-vivo. An ex-vivo approach is often chosen to conduct biomechanical studies of the shoulder, especially when investigating the active and passive contribution of individual muscles. Various glenohumeral simulators have been therefore developed. However, currently only few simulators can simulate dynamic glenohumeral motion induced by active muscle forces, and a standard for such an experimental set-up and its control system is lacking. In this work, we present a control system for a shoulder simulator with the goal of mimicking physiological glenohumeral motion while tackling the challenge of over actuation.

Methods

The current simulator is an enhancement of an existing unconstrained glenohumeral simulator designed for ex-vivo experiments with different rotator cuff injuries and hand-held weight conditions (0kg, 2kg, 4kg). The simulator consists of eight active muscle segments (8 DOF), three deltoid, an infraspinatus, a teres minor, two subscapularis, a supraspinatus, a pectoralis major and a latissimus dorsi muscle segment and a free hanging arm with appropriate weight (6 DOF). The infraspinatus and the teres minor, as well as the two segments of the subscapularis are then merged to one motor each. A cascade feedback control system was developed to activate the eight muscle units to control six degrees of freedom in the glenohumeral joint. The outer cascade controls the position of the humerus and yields the net torques which is used as input to an optimization scheme. The optimizer provides the muscle forces to actuate the glenohumeral joint.

Results

The optimized shoulder simulator can perform repetitive cycles of 35° (+/- 3.6°), where each muscle and joint forces are measured dynamically.

Conclusion

The experimental setup reproduces a given motion well while the optimizer actuates the humerus in a physiological manner. A maximum abduction angle of 90° has been achieved. The limitations of this experimental setup include the approximation of the line of action of the muscles. The activation level of the in-vivo situation of the muscle groups can only be estimated, and hence does not necessarily reproduce it exactly. These limitations are inherent to all glenohumeral simulators. They are addressed with adjustable insertion of the muscles and the optimization scheme presented here.

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FM072

Health-related quality of life in the out-patient shoulder department: correlation with patient-reported outcome measures and identification of influential patient- and disease-related factors (11393)

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Introduction

Shoulder-related disability and pain have been shown to pose a major financial burden to modern health care systems. Patient-reported outcome measures (PROMS) as well as health-related quality of life (HRQoL) are increasingly required to prove success and analyse cost-effectiveness of specific treatments. This study assessed sociodemographic data, shoulder-specific PROMS and HRQoL scores to evaluate overall physical and mental well-being, shoulder-related disability and pain in the most frequently encountered shoulder pathologies. Secondly, the study's purpose was to identifiy patient- and disease-related factors, which influence functional outcomes.

Methods

In the out-patient shoulder department a pre-defined, web-based survey was conducted from October 2020 to December 2020 using tablets distributed upon registration at the department's front desk. It included: sociodemographic parameters, the Subjective Shoulder value (SSV), the patient-reported American Shoulder and Elbow Surgeon Score (ASES-p), the Short Form 12 Health Survey (SF-12), the Eq5d (EuroQoL 5 Dimensions questionnaire) and the Oxford Shoulder Score (OSS).

Results

The survey was completed by a total of 512 consecutive patients, of which 395 data sets were eligible for final analyses.

The most prevalent shoulder pathology was rotator cuff tear (27.6%). Regarding ability to work, rotator cuff re-ruptures and frozen shoulder were the pathologies with the highest ratios of unemployment due to the shoulder condition (62% and 31% of affected patients, respectively). Smoking was identified as a strong risk factor to be unemployed due to the shoulder condition (40% in the smoker's group vs. 19% in the non-smoker's group were unemployed, $p = 0.000$). Patients unable to work had significantly higher pain levels than those able to work, while subjective function assessed with the SSV and ASES-p was signficantly lower ($p = 0.000$, each). Higher sports activity levels and higher levels of education were correlated significantly with higher overall quality of life ($r = 0.273$, $p = 0.000$ and $r = 0.306$, $p = 0.000$, respectively) and less pain associated with the shoulder condition ($r = -0.165$, $p = 0.002$ and $r = -0.296$, $p = 0.000$, respectively).

Conclusion

We analyzed and interpreted sociodemographic data, PROMS and HRQoL scores for the majority of common shoulder conditions in the out-patient shoulder department. Various lifestyle parameters, such as sport activity and smoking influence functional outcome.

FM073

The Digitation Sign Facilitates Diagnosis of Shoulder Subscapularis Lesions on Preoperative Magnetic Resonance Imaging (11405)

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Background

Reliable preoperative evaluation of subscapularis (SSC) tears remains challenging because of limited imaging sensitivity. SSC pathology is normally analyzed in the axial and coronal planes of magnetic resonance imaging (MRI).

Purpose

To investigate a sign observed in the coronal oblique plane of MRI in SSC pathology by reporting interobserver reliability, sensitivity and specificity, and to correlate its use in the preoperative assessment of SSC pathology with intraoperative findings.

Hypothesis: In case of SSC pathology, the normal distinct tendinous slips defining clear digitations on MRI would be disrupted.

Methods

It was a retrospective case series of consecutive patients operated on an arthroscopic rotator cuff repair (ARCR) by a single surgeon between January and December 2020. All patients ≥18 years old who received primary ARCR and had an MRI with T2-weighted sequences in all 3 planes within 18 months of surgery were eligible. 3 trained shoulder fellows blinded from intraoperative findings interpreted independently all MRI. The SSC was analyzed in all 3 planes on T2-weighted sequences according to Adams et al criteria (Accuracy of preoperative MRI in predicting a SSC tendon tear based on arthroscopy; Arthroscopy 2010;26:1427-1433). The digitation sign was assessed in the coronal oblique plane on T2-weighted images. It was positive if ≥1 tendinous slip was not visible at the level of the lesser tuberosity. Positive diagnosis of a SSC tear was then confirmed at arthroscopy. We used the Fleiss's k coefficient to measure the interobserver agreement. Comparisons for sensitivity and specificity were performed with a McNemar test. The level of significance set at $p < .05$.

Results

197 patients were eligible. 65 were excluded. Of the 132 included patients, 56% had SSC tears confirmed during arthroscopy. Interobserver agreement for the digitation sign was substantial ($k = .640$). Sensitivity and specificity were 74.3% and 84.5% for the digitation sign, 83.8% and 77.6% for Adams et al criteria and 89.2% and 67.2 for the combination of these 2 methods. Sensitivity ($p = .046$) was better when the digitation sign was added to the Adams et al criteria.

Conclusion

The digitation sign can be helpful in the initial MRI assessment as it allows the diagnosis of SSC tears in the coronal oblique plane on T2-weighted sequences. In addition, the use of this easy-to-apply sign increases sensitivity when combined with a systematic approach such as Adams et al criteria.

FM074

The Influence of Acromial Slope on the Location of Acromial Fractures (11153)

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Introduction

The purpose of this study was to evaluate the relationship between acromial morphology and the location of acromial fractures following reverse shoulder arthroplasty (RSA), and to determine whether fracture location and displacement impact clinical outcomes. The hypotheses were that (1) increased acromial slope would correlate with Levy type I fractures whereas a lower slope would correlate with Levy type II fractures, and (2) improvement in clinical outcomes would be impacted by fracture displacement but not fracture location.

Methods

A multicenter retrospective review was performed on RSAs complicated by acromial fractures. Radiographic measurements were compared to determine the differences in acromial slope parameters and fracture patterns between patients with Levy type I (n = 17) and Levy type II (n = 25) fractures. Patients with a minimum of 2-year follow-up were selected to examine the association between clinical outcomes and fracture features, including location and displacement. Twenty-two patients were stratified based on whether they achieved the American Shoulder and Elbow Surgeons (ASES) minimal clinically important difference (MCID; i.e. ≥ 20 points). The two groups were then compared radiographically for fracture location as well as displacement using the acromion-humeral distance (AHD), acromion-cup distance (ACD), and acromion-glenosphere distance (AGD).

Results

The Levy type I group had a higher mean acromial slope (127° vs. 117°; p <0.001) and posterior acromial slope (136° vs. 130°; p = 0.016) than the Levy type II group. At final follow-up, 12/22 patients (55%) achieved the MCID. Those who did not achieve the MCID had a significantly lower AHD (9 vs. 20 mm, p = 0.002), ACD (6 vs.13 mm, p = 0.003) and AGD (4 vs. 11 mm. p = 0.001). The mean ΔASES was significantly lower in the group that did not achieve the MCID compared to the one that did (-6 vs. 39, p <0.001). There was no difference in distribution of Levy type I and type II between groups (p = 0.093).

Conclusion

Increased acromial slope is associated with coronal plane fractures in the Levy type I region, whereas a lower acromial slope is associated with sagittal plane fractures in the Levy type II region. Overall, 55% of patients with postoperative acromial fractures achieved the MCID at mid-term follow-up and those who did not have worse outcomes than their preoperative scores.

FM075

Effect of abduction brace wearing compliance on the result of rotator cuff repair (11213)

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Background

The benefit of protective bracing after rotator cuff reconstruction has been debated for many years, although to date, compliance with an abduction brace and its effect on clinical and radiographic outcome have never been assessed. In a previous study, abduction brace wearing compliance was measured for the first-time using temperature sensitive sensorsThe purpose of this follow up study was to assess the effect of immobilization compliance on tendon healing after RCR.METHODS:

The clinical and radiological outcome of 46 consecutive patients with objectively assessed abduction-brace wearing-compliance after arthroscopic rotator cuff repair of a superior rotator cuff tear were prospectively analyzed. Rotator cuff integrity was examined with Ultrasound. Clinical outcome was assessed with the relative Constant Murley Score (RCS), the subjective shoulder value (SSV), pain and patient satisfaction ratings. Receiver operating characteristic (ROC) curves were performed to determine the cutoff value of abduction brace compliance and its association with rotator cuff repair (RCR) failure.

Results

After a mean follow up of 20±9 months the Odds Ratio for having a RCR failure with a compliance rate of less than 60% (n = 11) was 13-fold increased (p = 0.037). The retear rate in the high compliance cohort (≥60% compliance rate) was 3% (1 out of 35 patients) and 27% (3 out of 11) in the low compliance cohort (<60% compliance) (p = 0.037). No differences in RCS, SSV, pain and postoperative patient satisfaction was observed between patients with ≥60% compliance vs. <60% compliance rate.

Conclusions

Patients with an abduction brace immobilization compliance rate <60% have a 13-fold increased rotator cuff retear risk. The two patients with the lowest compliance rate (11% and 22%) showed both retears.

Due to the small sample size, no final conclusions can be drawn regarding the influence of immobilization compliance on tendon healing after rotator cuff repair.

The findings justify a prospective trial with a larger cohort to confirm or disprove the value of a reliable abduction bracing.

FM076*

Symmetrical gait and high subjective satisfaction of Patients with severe and moderate SCFE at 10 year followup after modified Dunn procedure (11149)

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Introduction

Patients with slipped-capital-femoral-epiphyses(SCFE) are at risk for outtoeing gait and avascular necrosis of the femoral head. The modified Dunn procedure can correct slip deformities but there is a lack of longterm studies and only few studies evaluated gait.

Therefore, we report on patient reported outcome, subjective satisfaction and gait analysis at longterm followup after the modified Dunn procedure.

Methods

We performed a retrospective analysis involving 24 patients(24 hips, 2008-2015). Inclusion criteria were SCFE patients that underwent modified Dunn procedure and minimal 5-year followup. Two patients with AVN were excluded. Eight patients had moderate slip deformity and 16 patients had severe SCFE.

We evaluated patient reported outcome (iHOT, HOOS and HSS) and subjective satisfaction at mean followup of 10±3 years. 3D gait analysis was performed in the gait laboratory (Vicon system) using 16 infrared cameras. Three hip and three knee gait parameters and foot progression angle in stance phase were compared to contralateral side. Contralateral hips were used as control group.

Results

Mean mHHS was 95±8 (70-100), mean iHOT was 92±11(66-100), mean HOOS was 94±6(78-100) at followup.

Subjective hip value was 94±9 (70-100) of SCFE patients at followup and 96±8(70-100) of the contralateral side.

Mean Hip flexion was 19±8°(7-32), mean hip abduction was 0±5°(-11-8) and mean hip internal rotation was 1±10(-22-14) for SCFE patients.

Hip flexion, hip abduction and hip internal rotation and knee flexion, knee abduction and knee internal rotation showed side-to-side difference of <2°.

Foot progression angle was 4.8±12°(-11-33) on the SCFE side and 3.3±16°(-34-28) on the contralateral side. Six patients had side-to-side difference of >20°. Two SCFE patients and four controls had Out-Toeing at followup. Six SCFE patients and six controls had In-Toeing at followup.

Foot progression angle was 3±10°(-11-18) of patients with severe SCFE patients and 8±14°(-10-33) of moderate SCFE patients.

Conclusion

High hip scores and mostly symmetrical gait was found for SCFE patients at longterm followup after treatment with the modified Dunn procedure.

Foot progression angle showed a side-to-side difference of 1.5° at followup. No increased rate of Out Toeing for SCFE patients was observed. This is different compared to previous studies evaluating gait analysis after in situ pinning that reported a high rate of Out Toeing at followup.

FM077

No relevant mechanical leg axis deviation in the frontal and sagittal planes is to be expected after subtrochanteric or supracondylar femoral rotational or derotational osteotomy (11374)

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Purpose

The purpose of this study was to investigate if one level of corrective femoral osteotomy (subtrochanteric or supracondylar) bears an increased risk of unintentional implications on frontal and sagittal plane alignment in a simulated clinical setting.

Methods

Out of 100 cadaveric femora, 23 three-dimensional (3-D) surface models with femoral antetorsion (femAT) deformities (>22 ° or <2 °) were investigated, and femAT normalized to 12 ° with single plane rotational osteotomies, perpendicular to the mechanical axis of the femur. Change of the frontal and sagittal plane alignment was expressed by the mechanical lateral distal femoral angle (mLDFA) and the posterior distal femoral angle (FA), respectively. The influence of morphologic factors of the femur [centrum–collum–diaphyseal (CCD) angle and antecurvatum radius (ACR)] were assessed. Furthermore, position changes of the lesser (LT) and greater trochanters (GT) in the frontal and sagittal plane compared to the hip centre were investigated.

Results

Mean femoral derotation of the high-antetorsion group (n = 6) was 12.3 ° (range 10–17 °). In the frontal plane, mLDFA changed a mean of 0.1 ° (-0.06 to 0.3 °) (n.s.) and −0.3 ° (−0.5 to −0.1 °) (p = 0.03) after subtrochanteric and supracondylar osteotomy, respectively. In the sagittal plane, FA changed a mean of 1 ° (0.7 to 1.1 °) (p = 0.03) and 0.3 ° (0.1 to 0.7 °) (p = 0.03), respectively. The low-antetorsion group (n = 17) was rotated by a mean of 13.8 ° (10 °–23 °). mLDFA changed a mean of −0.2 ° (−0.5 to 0.2 °) (p <0.006) and 0.2 ° (0 – 0.5 °) (p <0.001) after subtrochanteric and supracondylar osteotomy, respectively. FA changed a mean of 1 ° (−2.3 to 1.3 °) (p <0.01) and 0.5 ° (−1.9 to 0.3 °) (p <0.01), respectively. The amount of femAT correction was associated with increased postoperative deviation of the mechanical leg axis (p <0.01). Using multiple regression analysis, no other morphological factors were found to influence mLDFA or FA. Internal rotational osteotomies decreased the ischial-lesser trochanteric space by <5 mm in both the frontal and sagittal plane (p <0.001).

Conclusions

In case of femAT correction of ≤ 20 °, neither subtrochanteric nor supracondylar femoral derotational or rotational osteotomies have a clinically relevant impact on frontal or sagittal leg alignment. A relevant deviation in the sagittal (but not frontal plane) might occur in case of a >25 ° subtrochanteric femAT correction.

FM078

Mosaicplasty of the femoral head: 9 to 25 years follow-up. (11384)

Caroline Passaplan; Matthieu Hanauer; Vera Stetzelberger; Moritz Tannast; Emanuel Gautier

Introduction

Mosaicplasty is the only technique reconstructing an osteochondral defect of the femoral head with hyaline cartilage. It is frequently used in knee and ankle joint with acceptable mid- to long-term results. For the hip, however, there is lack of information about the long-term outcome of this technique in the literature. We present our experience of a single institutional serie of patients undergoing this procedure.

We evaluated the long term survivorship of the hip, the radiographic progression of osteoarthritis, the clinical results of the patients not undergoing THA, and potential risk factors for failure.

Methods

We identified 11 consecutive patients who underwent osteochondral autograft transfer. Indications were 5 patients with AVN, 2 with FAI, 1 with Perthes disease and 3 with traumatic chondral lesions. No patient was excluded. We extracted donor osteochondral plugs from the non-weight bearing portion of the antero-inferior portion of the head in 6 patients, and in 5 from the non-articulating parts of the ipsilateral femoral trochlea using an antero-lateral surgical approach with medial knee arthrotomy. In all but 3 patients (anterior arthrotomy) mosaicplasty was performed through a surgical hip dislocation. No patient was lost to follow-up. Kaplan-Meier survivorship analysis was performed with total hip arthroplasty as endpoint. Radiographic progression was analyzed using the Tönnis osteoarthritis score, clinical evaluation with hip scoring systems and the potential risk factor for failure with Cox-regression analysis.

Results

Conversion to total hip arthroplasty was necessary in six patients at 10.4 (range 1-17) years after the index procedure due to development of severe osteoarthritis. The cumulative 5/10/20 year survivorship of the hip was 90%/62%/37%. Of the 5 surviving hips 2 showed signs of osteoarthritis Tönnis >1. The mean HHS was 71.7, the HOOS 72.3, the UCLA 5.2 and the mean WOMAC 68.6. Older age (p = 0.05) and a larger overall surface area of the defect size (p = 0.04) were associated with an unfavorable outcome.

Conclusion

This is the first study analyzing the encouraging long-term follow-up of osteochondral autografts of the femoral head. Although the majority of hips needed a conversion to THA in the long term run, over half of the patients survived more than 10 years. Mosaicplasty appears to be a time-saving procedure for young patients with devastating hip conditions who have no other surgical options.

FM079*

Accuracy and reliability of the sine wave stereoradiogrammetric method for measurement of femoral anteversion (11413)

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Introduction

Femoral anteversion is crucial for assessment of many hip pathologies, and CT scan is regarded as the gold standard. However, due to costs and irradiation doses, it is not suitable for larger scale daily practice. An alternative stereoradiogrammetric method enables calculation of femoral anteversion by applying trigonometric calculation (thus sine wave method–SW) on two X-rays angled at 45° to each other. The aim of this study was to proof the accuracy and reliability of the sw method compared with CT scans and direct photogrammetric measurement (DIRM).

Methods

In 50 cadaveric human femoral specimens (25 right, 25 left), the anteversion was assessed by: (A) CT scans, (B) standardized direct photogrammetric measurement and (C) SW method. (A) Standard CT protocol and published measurement method were applied on the specimen being positioned horizontally in the CT and fixed in a custom-made holder. (B) To measure the anteversion directly on the bones, long diaphyseal axis and neck axis were marked with k-wires using two laser liners. The specimens were then photographed in the holder, and the angles measured from the photographs. (C) A true ap and a 45 degrees oblique X-ray were taken in a standardized manner with specimen positioned in the holder. The measurements were carried out on the X-rays and the anteversion calculated using the already published trigonometric formula. Finally, the values of the three methods were compared for accuracy and interobserver reliability.

Results

We found high correlation of measured femoral anteversion between the three methods CT vs. DIRM r = 0.85 (p <0.001), CT vs. SW r = 0.87 (p

<0.001) and DIRM vs. SW r = 93 (p <0.001). The CT measurements systematically resulted in about 5° less anteversion than DIRM and SW. The interobserver reliability of DIRM and SW methods were good with high ICC3 = 0.86 (p <0.001).

Discussion

In this study we cross-validated three methods for assessment of the femoral anteversion. X-rays in two standardized positions at 45 degrees to each other enables the use of the SW method in everyday practice, with low radiation dose and low costs. CT measurements result systematically in 5° less anteversion than the other two methods, which is due to the different tomographic planes in CT measurement methods, as already analyzed in previous studies. The SW method is an accurate and reliable method for assessment of femoral anteversion and should be introduced in standard clinical protocols

FREE COMMUNICATIONS: HIP

FM080

The use of dual mobility cup in revision total hip arthroplasty for failed large head metal-on-metal bearings (11370)

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Introduction

Revision of failed large head metal-on-metal (MoM) total hip arthroplasty (THA) is a challenging procedure particularly to reconstruct acetabular bone defect due to osteolysis and to achieve hip stability after revision due to soft tissue damages, both potentially caused by adverse reaction to metal debris (ARMD). This study aimed to evaluate the outcome of dual mobility cup constructs in revision THA for failed large head MoM bearings with an attention to the occurrence of dislocation or reoperation after revision.

Methods

Between 2015 to 2019, 57 patients (64 hips, 16 women, 41 men, mean age = 65 ± 10 years) who underwent revision of a large head MoM THA with the use of a dual mobility construct were prospectively included in our total joint registry and retrospectively analyzed at latest follow-up. Clinical evaluation was performed with the Harris Hip Score (HHS). Radiographic evaluation was performed on standard antero-posterior and lateral views of the pelvis and the operated hip. The post-operative complications and reoperations were recorded and analyzed.

Results

The mean follow-up was 3.5 ± 1.5 years. The mean time to revision was 11 ± 2.5 years. The most common cause for revision was ARMD in 49 THA (76%), painful hip with elevated blood cobalt/chrome (Co/Cr) ions in 7 THA (11%) and aseptic loosening of the cup in 8 THA (13%). Bipolar revision was performed in 22 THA (34%) and acetabular-only revision in 42 THA (66%). The pre- to post-operative HHS improved at latest follow-up from 74 ± 19 to 92 ± 4 (p = 0.004). Post-operative complications were reported after 11 revisions THA (17%), being dislocation after 5 revisions THA (8%), periprosthetic infection after 3 revisions THA (5%), and aseptic loosening of the acetabular construct after 2 revisions THA (3%). Re-revision was performed after 6 revision THA (9%). Two (3%) of them were for instability and required dual mobility cup reorientation without recurrence at latest follow-up. The others re-revisions were for infection with a two-stage procedure (2 revision THA, 3%) and for aseptic loosening of the acetabular construct (2 revision THA, 3%).

Conclusion

Revision THA for failed MoM bearing is a challenging procedure, particularly in case of ARMD. The use of dual mobility cup for acetabular reconstruction is a reliable option to prevent instability. However, the risk of dislocation after revision remains a concern particularly in case of severe soft tissue damages due to ARMD

FM081*

Joint Arthroplasty After Intra-Articular Steroid Injections: The Risk of Post-Operative Infection Increases in Total Hip Arthroplasty and Within 3 Months. A systematic Review and Meta-Analysis (11319)

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Introduction

Osteoarthritis affects around 32.5 million adults in the US alone, with a lifetime 10% risk of undergoing total hip arthroplasty (THA) or total knee arthroplasty (TKA). Among them, approximately 22-39% of the patients had at least one intra-articular corticosteroid (CS) injection before surgery, which is a highly debated aspect for the potential risk of complications. Aim of this study was to evaluate the risk of periprosthetic joint infection (PJI) or other complications after total joint arthroplasty in patients who received intra-articular CS injections.

Methods

A literature search was performed on three medical databases (PubMed, Web of Science, and Cochrane Library) up to January 4th, 2022. Studies describing patients receiving intra-articular injections before total joint replacement were included in the systematic review. A meta-analysis was performed on studies focusing on CS injections and PJI. Assessment of risk of bias and quality of evidence was based on Downs and Black's "Checklist for Measuring Quality". The statistical analysis was carried out according to Neyeloff et al. 2012, and results were considered significant at p <0.05.

Results

Out of 3,898 studies assessed for eligibility, 30 studies on 480,532 patients were selected for qualitative and quantitative analysis. A significant association (p = 0.001, C.I. 1.357-1.772) between PJI and CS injections was found in the total hip arthroplasty (THA) group with a 63.6% risk increase when compared to non-CS group. No association was found between CS injections and other joint replacement procedures. Additionally, the analysis conducted on the CS injection timing revealed that the risk of PJI is statistically higher (p = 0.045, C.I.: 1.058-1.347) if the injections are performed within 3 months before the surgery.

Conclusions

Patients undergoing THA who previously received intra-articular CS may expect a higher likelihood of developing PJI. Particular attention should be paid when CS injections are administered within 3 months before the joint replacement. No evidence of CS related infections was found for other joint replacement procedures.

FM082*

Treatment of acetabular fractures in elderly patients – a retrospective comparative study in 207 patients (11203)

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Introduction

Acetabular fractures in the elderly are challenging injuries, especially given the heterogeneity of the patient population. In active patients with high functional expectations joint preservation with open reduction and internal fixation (ORIF) is the treatment of choice. In patients with functional limitations or signs of frailty, ORIF combined with primary total hip arthroplasty (THA) is performed, facilitating early full weight-bearing mobilization to avoid immobility-associated morbidity and preserve independence. The aim of this analysis was to systematically evaluate a treatment algorithm that separates patients into three categories: a) those with stable fracture patterns treated conservatively, or unstable fracture patterns treated surgically performing b) either ORIF or c) ORIF+ THA. The indication for the type of surgery is based on patient rather than fracture characteristics.

Methods

Information on patients ≥50 years treated between 2009 to 2019 for an acetabular fracture were retrospectively analyzed. The adequacy of the algorithm was evaluated based on the similarity of outcomes after ORIF with vs. without THA, and after high- vs. low-energy trauma. The primary outcome was loss of independence. Group differences were assessed using hazard ratios and odds ratios adjusted for age and gender.

Results

Of 207 treated patients, 135 were male, and 67% suffered a low-energy trauma. ORIF was performed in 89 patients, 33 received ORIF+THA, 85 were treated conservatively. After adjustment for age and gender, loss of independence occurred at similar rates after high- or low-energy trauma and independent of the surgical approach. The initial morbidity after ORIF+THA (e.g., complications, length of stay) was higher, than after ORIF alone, but the long-term outcome was favorable with less pain or secondary interventions after ORIF+THA.

Conclusions

The results suggest a successful segmentation of the patient population allowing the assignment of the most promising tailored treatment approach independent of the fracture pattern. The long-term benefit of ORIF with primary THA in frail patients comes at the price of an initially higher risk of adverse outcomes.

FM083*

A reliable predictor of secondary lateral wall fracture following trochanteric fractures – an uate (11277)

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Introduction

The lateral wall thickness (LWT) in trochanteric femoral fractures is a known predictive factor for postoperative fracture stability. Currently, the AO/OTA classification uses a patient non-specific measure to assess the absolute LWT (aLWT) and distinguish stable A1.3 from unstable A2.1 fractures based on a threshold of 20.5 mm. This approach potentially results in interpatient deviations due to different bone morphologies and consequently variations in fracture stability. Therefore, the aim of this study was to explore whether a patient-specific measure for assessment of the relative LWT (rLWT) results in a more precise threshold for prediction of unstable fractures.

Materials and Methods

Part 1 of the study evaluated 146 pelvic radiographs to assess left-right symmetry with regard to caput-collum-angle (CCD) and total trochanteric thickness (TTT), and used the results to establish the rLWT measurement technique. Part 2 reevaluated 202 patients from a previous study cohort to analyze their rLWT versus aLWT for optimization purposes.

Results

Findings in Part 1 demonstrated a bilateral symmetry of the femur regarding both CCD and TTT ($p \geq 0.827$) allowing to mirror bone's morphology and geometry from the contralateral intact to the fractured femur. Outcomes in Part 2 resulted in an increased accuracy for the new determined rLWT threshold (50.5%) versus the standard 20.5 mm aLWT threshold, with sensitivity of 83.7% versus 82.7% and specificity 81.3% versus 77.8%, respectively.

Conclusion

The novel patient-specific rLWT measure can be based on the contralateral femur anatomy and is a more accurate predictor of a secondary lateral wall fracture in comparison to the conventional aLWT. This study established the threshold of 50.5% rLWT as a reference value for prediction of fracture stability and selection of an appropriate implant for fixation of trochanteric femoral fractures.

FM084

Quality of Life from Return to Work and Sport Activities to Sexual Dysfunction after Surgical Treatment of Pelvic Ring Fractures (11331)

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Purpose

Pelvic ring fractures are life-threatening injuries causing a severe impact on patients' life. The aim of this clinical study was to evaluate the outcome of surgical treatment in terms of Quality of Life (QoL), return to work, functional results and sport activities, and post-operative sexual dysfunction of patients treated for pelvic ring fractures.

Methods

Patients were retrieved from the database of a Level 1 Trauma Center. Minimum patient follow-up was 12 months: QoL was evaluated with SF-12 questionnaire, return to work with Workplace Activity Limitation Survey (WALS), functional outcomes and sport activities with Harris Hip Score and Tegner activity score, respectively, and sexual function damage with a 0 – 10 NRS.

Results

Seventy-six patients (41 males, 35 females) were enrolled, with a mean age at surgery of 56.4 years (18 – 89 years). Overall, their quality of life remained significantly affected, with male patients reporting worse WALS outcomes ($p = 0.036$), sexual damage ($p = 0.001$), and SF-12 Bodily Pain ($p = 0.046$) than females. In particular, 70.7% of men and 45.7% of women reported sexual limitations, and only 53.7% returned back to their job with 35.2% losing their job as a consequence of the pelvic ring disruption.

Conclusions

An important deterioration in general health state, return to work, and sexual function was documented in patients treated surgically for pelvic trauma, especially in male patients. There are disabling secondary sequels at all levels beyond the mere functional scores, and both patients and clinicians should be aware and have correct expectations. Further understanding the nature and type of patients affected by permanent dysfunctions may help optimizing the complex management of pelvic ring fractures.

FM085

Changes in gait kinematics after hip arthroplasty assessed using wearable sensors are associated with PROMs (11315)

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Introduction

The potential of gait analysis in understanding the osteoarthritis (OA) disease process and its treatment has long been recognized. We aimed to determine if pre- to postoperative gait kinematics assessed using wearable sensors correlate with PROMs in patients with hip OA undergoing total hip arthroplasty (THA).

Methods

Twenty-two patients (13 male, 9 female) with unilateral hip OA scheduled for THA participated in this study. Data for 22 sex-, age- and BMI-matched asymptomatic controls were selected from a larger study. All participants completed the HOOS (patients: preoperatively and 12 months postoperatively) and gait analysis using the inertial sensor system RehaGait® (Hasomed GmbH, Magdeburg, Germany). Hip flexion-extension trajectories and hip range of motion (ROM) during stance for ten steps of a 20m walking trial at self-selected speed were computed and correlations between dynamic hip ROM and HOOS calculated ($P < 0.05$).

Results

Patient demographics were (mean ± SD): age, 63.8±10.6 years; height, 1.73±0.10 m; body mass, 80.8±12.4 kg; BMI, 26.8±3.0 kg/m2. Nine patients had a Kellgren-Lawrence grade 3 and 13 patients grade 4. Demographics of the control group were: age, 65.3±7.9 years; height, 1.74±0.10 m; body mass, 76.8±16.0 kg; BMI, 25.3±4.0 kg/m2. Dynamic hip ROM increased from 28.3±7.5° to 36.6±7.1° in patients from before to 12 months after THA (95% confidence interval of difference [5.0; 12.3]°) and was 40.7±6.3° in controls. HOOS subscores improved after THA but remained below scores in controls. Dynamic hip ROM correlated with HOOS pain ($R = 0.493$; $P < 0.001$), symptoms ($R = 0.530$, $P < 0.001$, activities of daily life ($R = 0.470$, $P < 0.001$), sports/recreation ($R = 0.417$, $P = 0.001$) and quality of life ($R = 0.481$, $P < 0.001$).

Conclusion

The association of hip ROM during the stance phase of walking and HOOS subscores in patients receiving THA support our previous findings in patients with knee or hip OA. While we observed a moderate to large association between these clinical scores and biomechanical parameters in the current study, there was still considerable remaining variance. Future work is needed to elucidate whether clinical scores and biomechanical parameters represent different dimensions of outcomes in the context of hip OA and/or THA. The data reported here represent another step towards using gait kinematics as outcome in clinical trials in hip OA.

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FREE COMMUNICATIONS: KNEE

FM086

CT-based Assessment of Native Trochlear Sulcus Orientation in Non-Arthritic Knees. Consequences for TKA Design (11293)

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Introduction

Femoral component design in TKA has evolved as the understanding of human knee anatomy and biomechanics has advanced. The biomimicry evident in femoral condylar design has generally not been reflected in the trochlea. The relationship between the trochlea and the distal femoral joint line has not been studied in-depth, although it has implications concerning kinematic alignment and prosthetic design. The aim of this study was to describe the native trochlear orientation of non-arthritic knees in 3 planes and to quantify the relationship between trochlear and distal condylar anatomy across race and sex.

Methods

Computed tomography scans of 1,578 femora were included in this study. The mediolateral position of the trochlear sulcus, the distal trochlear sulcus angle (DTSA) the medial sulcus angle (MSA) and the lateral sulcus angle (LSA) as well as the mechanical lateral distal femoral angle (mLDFA) were measured relative to a standard reference coordinate system. Multiple linear regression analyses were performed to account for potential confounding variables.

Results

The mediolateral position of the trochlear sulcus had minimal mean deviation from the sagittal femoral plane. The mean DTSA was 86.1° (SD 2.2°). Multilinear regression analysis found mLDFA, sex, and age all influence DTSA ($p < 0.05$), with mLDFA having by far the greatest influence ($r2 = 0.55$).

Conclusion

In non-arthritic knees, due to a strong positive correlation between the DTSA and the mLDFA, the trochlear sulcus is consistently orientated in the sagittal femoral plane regardless of distal condylar anatomy. Minor deviations from the sagittal plane occur in a lateral direction in the middle part and in a medial direction at the proximal and distal part of the trochlea.

These findings have relevance regarding the biomimetic design of total knee implants and kinematic alignment in TKA. Depending on the native mLDFA and DTSA, the DTSA of the implant and the implant positioning technique applied (mechanical or kinematic alignment), large deviations between native and prosthetic sulcus orientations are possible. If the design and placement of femoral TKA components is to continue in a biomimetic direction, changes will need to be made to trochlear design. A single femoral component design and alignment is unlikely to accommodate the range of variations in human distal femoral anatomy. This study provides deep understanding of trochlear anatomy necessary for future TKA design-

FM087

Coronal plane passive knee kinematic curve morphology explained: From a single coronal mechanical tibiofemoral angle to a kinematic curve (11323)

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Introduction

The idea of a single mechanical tibiofemoral angle (MTFA) throughout the range of motion does not reflect the biomechanics of native or arthritic knee joints, or total knee arthroplasties (TKAs). The MTFA varies in different degrees of flexion and hence coronal knee alignment is best described through a graph showing a curve of the MTFA through the range of motion. The aim of this study was to describe and categorize the coronal plane passive knee kinematic curve morphology, as well as to investigate

the associations between the curve morphology and distal femoral and proximal tibial articular anatomy.

Methods

An articulated lower limb bone model consisting of hemipelvis, femur and tibia was used. Registration was completed with a computer navigation system. A medial opening wedge femoral and tibial osteotomy and a rotational femoral osteotomy were used to create 70 different mechanical lateral distal femoral angle (mLDFA), medial proximal tibial angle (MPTA) and femoral torsion combinations. For each combination, a MTFA curve was recorded and categorized into the morphotypes defined by Young et al. Continuous data was tested for normality with the D'Agostino and Pearson test. Statistical comparison of central tendencies was performed using the Kruskall-Wallis test with multiple comparisons using Dunn's multiple comparisons test.

Results

Five different curve morphotypes were identified, namely straight, drift, inverse drift, C-shape and inverse C-shape. The mLDFA and femoral torsional angle differed significantly across curve types ($p < 0.0001$). After adjustment for multiple comparisons there were significant differences in the mLDFA and in the femoral torsional angle between various pairs of curves. MPTA did not vary across curve types ($p = 0.0844$)

Conclusion

Coronal plane kinematic knee curves can be categorized according to their morphology. The curve morphology is determined by the distal femoral coronal and torsional anatomy. The coronal tibial anatomy influences the position of the curve relative to the zero line but not the curve morphology. Restoring the pre-arthritic kinematic curve in total knee arthroplasty requires restoring the pre-arthritic mLDFA and femoral torsion, while producing a neutral straight curve requires adjusting the femoral rotation individually once the pre-arthritic kinematic curve and mLDFA are known. Consistently producing a neutral straight curve is not possible without the use of computer navigation.

FM088

Elongation patterns of the superficial medial collateral ligament and the posterior oblique ligament – a three-dimensional weight-bearing computed tomography simulation (11170)

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Balgrist

Background

Length change patterns of the medial knee structures have been reported before. However, previous studies either have not considered the weight-bearing state or have not reported quantitative radiographic landmarks that allow the clear identification of the insertion sites that demonstrate the smallest length changes.

Purpose/Hypothesis: The primary aim of this study was to analyze the length changes of the superficial medial collateral ligament (sMCL) and posterior oblique ligament (POL) under weight-bearing conditions. The secondary aim was to identify the femoral sMCL insertion that demonstrates the smallest length changes during knee flexion and to report quantitative radiographic landmarks .

Study design: Descriptive laboratory study

Methods

A three-dimensional (3D) analysis of weight-bearing computer-tomographies (CT) of ten healthy knees from 0-120° of knee flexion was perfor Ligament length changes of the sMCL and POL during knee flexion were analyzed using an automatic string generation algorithm. The most isometric femoral insertion of the sMCL that demonstrated the smallest length changes throughout the full range of motion (ROM) was identified. Radiographic landmarks were reported in an isometric grid defined by a true lateral view of the 3D CT model and transferred to a digitally reconstructed radiograph.

Results

The sMCL demonstrated ligament lengthening compared to shortening of the POL during knee flexion ($p = 0.005$). Shortening of the POL started from 30° of knee flexion.

The most isometric femoral sMCL insertion was located 0.6 ±1.7 mm posterior and 0.8 ± 1.2 mm inferior to the center of the sMCL insertion and prevented ligament length changes >5% during knee flexion in all subjects. The insertion was located at 47.8 ± 2.7% from the anterior femoral cortex and at 46.3 ± 1.9% from the joint line in a true lateral view.

Conclusion

The sMCL demonstrates small length changes during knee flexion. The POL demonstrated substantial shortening during knee flexion, starting from 30° of knee flexion, and requires tightening near full extension to avoid overconstraint.

Femoral sMCL graft placement directly posteroinferior to the center of the anatomical insertion of the sMCL (0.6 ± 1.7 mm posterior and 0.8 ± 1.2 mm inferior) demonstrated the most isometric behavior during knee flexion and can be identified at 47.8 ± 2.7% from the anterior femoral cortex and at 46.3 ± 1.9% from the joint line in a true lateral view.

FM089

Increased femoral curvature and trochlea flexion in high-grade patellofemoral dysplastic knees: a three-dimensional analysis (11172)

Sandro Hodel; Carlos Torrez; Armando Hoch; Philipp Fürnstahl; Lazaros Vlachopoulos ; Sandro F. Fucentese

Balgrist

Background

High-grade patellofemoral dysplasia is often associated with concomitant axial and frontal leg malalignment. However, the curvature of the femur and the sagittal flexion of the trochlea have not been studied yet in patellofemoral dysplastic knees.

Purpose

To quantify the femoral curvature and sagittal flexion of the trochlea in high-grade patellofemoral dysplastic and healthy knees.

Method: A retrospective case-control study matched 19 high-grade patellofemoral dysplastic knees (Dejour type C and D) to 19 healthy knees according to sex and body-mass index (BMI). The three-dimensional (3D) femoral curvature and the sagittal trochlea flexion were analyzed. To analyze femoral curvature, the specific 3D radius of curvature (ROC) was calculated. Trochlear flexion was quantified through the development of the trochlea flexion angle (TFA). The TFA is a novel 3D measurement in relation to the anatomical and mechanical femur axis and is referred to as 3D TFAanatomic and 3D TFAmech. The influence of age, gender, height, weight, frontal and axial alignment on ROC and TFA was analyzed in a multiple regression model.

Results

Overall ROC was significantly smaller in dysplastic knees with a mean /std of 898 ± 217 mm (range 453 to 1275 mm) compared to 1308 ± 391 mm (range 878 to 2316 mm) for the control group ($p < 0.001$). TFA was significantly higher in dysplastic knees compared to the control group for 3D TFAmech and 3D TFAanatomic: 14 ± 7 ° (range 4 to 33 °) vs. 7 ± 2° (range 1 to 10 °) ($p < 0.001$) and 13 ± 7 ° (range 3 to 32 °) vs. 6 ± 2 °(range 2 to 9 °) ($p = 0.001$) respectively. A smaller ROC was associated with smaller height, female gender and a higher femoral antetorsion. An increased TFA was associated with valgus malalignment.

Conclusion

High-grade patellofemoral dysplastic knees demonstrated an increased femoral curvature and sagittal flexion of the trochlea compared to healthy knees. The ROC and newly described TFA allow the quantification of the sagittal femoral deformity. This provides the base for potential implications in concomitant realignment procedures.

FM090*

Identification of patient specific location of isometric MPFL femoral footprint on sagittal view using CLASS – MRI sequence. (11396)

Marc Barrera

Objectives: Femoral tunnel malposition during medial patellofemoral ligament (MPFL) reconstruction may lead to length changes and increase in medial peak pressure of the patellofemoral joint. The method according to Schöttle et al. for radiological identification of the femoral MPFL footprint haas been widely accepted. Still, tunnel malposition accounts for up to 36% of revision causes in cases of reconstruction failures. This exceptionally high value of missing the isometric femoral point raises the question of individual variability.

It was hypothesized that the femoral MPFL footprint identified in magnetic resonance imaging (MRI) and processed to a sagittal view using the Compressed Lateral and anteroposterior Anatomical Systematic Sequences (CLASS) would show a variation of anatomical location if compared to Schöttle's standard description. The second hypotheses was that this anatomical location is reproducible among 2 independent orthopaedic surgeons.

Methods

80 MRI of uninjured knee were analysed. Two senior orthopaedic knee surgeons performed the identifcation of the femoral MPFL footprint according to Dirim et al. An ad-hoc software allowed a volumetric 3D image projection on a 2D anteroposterior (AP) and sagittal views. The femoral footprint was precisely identifed on sagittal view and its location was also analyzed using Schöttle's identification method. The location of the MPFL femoral footprints were compared using both methods. Also, the reproducibility of the location of the MPFL have been analysed.

Results

The location of the femoral MPFL footprint according to the CLASS sequence showed an individual variability. Effectively about 80.2% of the knee located the femoral isometric point in the saddle sulcus as described by Chen et al. Both orthopaedic surgeons who located the isometric point confirmed this variability, as their results were concordant, speaking in favour of a reproducibility of the method

Conclusion

Identifying the femoral MPFL isometric footprint is of great importance for reconstruction procedures. The standard method is proposed by Schöttle et al. on a true-lateral knee X-Ray view. Nevertheless, this study suggest that individual variations exist. The "CLASS" MRI sequence with identified MPFL footprint could help the surgeon to identify these outliers and thus prevent femoral tunnel malposition.

FM091*

Increased Incidence of Accessory Iliotibial Band-Meniscal Ligament (AIML) in patients with Runner's Knee – a Novel Anatomical Risk Factor (11228)

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Introduction

The etiology of painful irritation of the iliotibial band (ITB), known as "Runner's Knee" or "Iliotibial band Syndrome", is poorly understood. Presence of an accessory iliotibial band-meniscal ligament (AIML), an anatomical variant where a ligamentous connection reaches from the iliotibial band to the anterolateral aspect of the lateral meniscus, imaginably increases mechanical stress and irritation of the ITB, potentially representing an underlying anatomical risk factor for runner's knee.

The aim of the study was to analyze presence of the AIML in patients with symptoms of a runner's knee. We hypothesized, that patients with runner's knee would more often have an AIML compared to a control group.

Methods

A retrospective review of 1'078 knees from 2014 to 2021 was perfor Presence of an AIML was assessed on magnetic-resonance imaging (MRI) by a blinded musculoskeletal radiologist. After review of the patient's charts, the cohort was grouped into patients diagnosed with a runner's knee and a control group. Runner's knee was defined as lateral sided knee pain with painful palpation of the ITB and/or the presence of MRI signs of irritation or edema of the ITB. Cases with concomitant radiological findings, which could otherwise elicit lateral knee pain (i.e. lateral meniscus lesions), were excluded. Presence of an AIML was evaluated for both groups.

Results

Sixty-seven patients with a runner's knee were identified (67/1078). Mean age in the runner's knee group was 30 ± 12 years, in the control group 39 ± 16.2 years (p = 0.008). There were no significant gender differences between the runner's knee and the control group (p = 1.000). An AIML was present in 23.9% of patients with runner's knee (n = 16/67) versus 13.5% in the control group (n = 136/1'011, p = 0.018). Presence of an AIML was associated with the diagnosis of a runner's knee (odds ratio: 2.02 (95% CI: 1.12-3.64)).

Conclusion

An AIML was found twice as often in patients suffering from symptoms of a runner's knee compared to a control group. Based on these findings, the AIML appears to contribute to the development of painful runner's knee, potentially by leading to increased ITB stress. Further biomechanical analysis is necessary to confirm this hypothesis, and research is warranted to further determine the clinical relevance of these findings.

FM092*

Finite Element Analysis of Medial Closing Wedge and Lateral Opening Wedge Osteotomies of the Distal Femur in Relation to Hinge Fractures (11347)

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Introduction

A hinge fracture in distal femur osteotomy (DFO) frequently occurs during surgery and represents a risk factor for loss of alignment as well as nonunion. The goal of this study was to determine the effect of hinge location, gap size and different cortical thicknesses on cortical strain and stress in medial closed wedge (MCW) and lateral open wedge (LOW) DFO using finite element analysis (FEA).

Methods

A statistical shape model was used for FEA, with a cortical thickness of 3 (norm value) and 1.5 (decreased/osteoporotic) mm. According to the literature, the optimal hinge position was located at the upper border of the lateral femoral condyle for biplanar MCW DFO, and at the proximal margin of adductor tubercle for biplanar LOW DFO. Different hinge widths (5, 7.5 and 10 mm) were created and the osteotomy gap was opened/closed stepwise by 5, 7.5 and 10 mm. Mean maximum and minimum principal strain of cortical bone in the hinge region was determined in each scenario.

Results

Mean cortical bone strain was higher in case of larger hinge width (10 mm versus 5 mm): 157% in LOW and 47% in MCW DFO. Moreover, mean cortical bone strain in the hinge region was increased in case of a larger correction (10 mm versus 5 mm): 100% in LOW and 92% in MCW DFO. Increased cortical thickness (3 versus 1.5 mm) resulted in higher mean cortical bone strain in the hinge region of only 3% in LOW and 10% in MCW DFO, respectively.

Conclusion

A larger hinge width and a larger correction increase the risk of hinge fractures. The residual width of the intact hinge is the greatest risk factor for hinge fractures in LOW DFO, whereas the extent of correction has a

greater influence in MCW DFO due to morphological features of the medial femoral condyle.

FM093

A prospective matched-pair analysis of two different inlay trochlear designs for patellofemoral arthroplasty (11403)

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Background

Patellofemoral inlay arthroplasty (PFIA) using a 2nd generation trochlear component such as the HemiCAP® Wave (Arthrosurface, USA) has become a valid treatment option for isolated Patellofemoral osteoarthritis (PFOA). However, this implant offers only limited possibilities to correct PF maltracking by itself. To address this malfunction, a trochlear component with a larger lateralized flange, the HemiCAP® Kahuna (Arthrosurface USA), has recently been developed.

Purpose

To compare 2-year functional and radiological outcomes of these two implants. Hypothesis: Changes in the design features of the HemiCAP® Kahuna would result in a greater improvement in functional outcome.

Methods

All primary PFIA performed between 2009 and 2020 at a single institution were eligible. Exclusion criteria included no patella resurfacing or concomitant procedures addressing PF instability or malalignment. 2 groups were established according to the type of implant (Wave or Kahuna) and matched for follow-up (±3 months), age (±5 years), gender, and BMI (±5 kg/m2). An independent observer assessed all patients before surgery and at follow-up. Prospectively collected data included visual analogue scale (VAS) for pain, Western Ontario and McMaster Universities OA Index (WOMAC), Tegner scale, progression of tibiofemoral (TF) OA (Kellgren-lawrence grade), and patellar height (Caton-Deschamps index).

Results

157 PFIAs were eligible. 103 were excluded. A total of 44 were included, 22 allocated to each group. The mean age at surgery was 51.3±11.5 years for the Kahuna group and 51.6±12.1 years for the Wave group. Pain VAS (Wave 5±2, Kahuna 6±2), WOMAC overall (Wave 60.6±18.8, Kahuna 60.8±16.5) and subscales and Tegner scale (Wave 3±2, Kahuna 3±1) were all similar between groups preoperatively. At 2-year follow-up, both groups had a decrease in pain VAS (Wave 3±2, Kahuna 2±2, $p < 0.001$). Only the Kahuna group had an increase in WOMAC overall (83.5±11.5, $p < 0.001$) and all its subscales ($p < 0.001$). The final WOMAC overall (Wave: 67.7±26.0, $p = 0.028$) and subscales function (Wave 67.0±31.0, Kahuna 82.8±12.2, $p = 0.032$) and pain (Wave 71.5±24.9, Kahuna 86.8±10.4, $p = 0.026$) were higher than the Wave group. The Tegner scale remained unchanged with no difference between groups. No progression of or changes in patellar height were observed.

Conclusion

HemiCAP® Kahuna showed a greater improvement in functional outcome than HemiCAP® Wave at 2-year follow-up.

FM094

Unexpected high rates of complication and early failure of a custom total knee arthroplasty system (11248)

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CHUV

Introduction

Almost 20% of the patients undergoing primary total knee arthroplasty (TKA) remain unsatisfied after surgery. Custom implants promise a personalized surgical approach in attempt to improve reconstruction of individual knee morphology and patient satisfaction.

This study aimed to report the early results of a new custom made TKA system within two years after surgery.

Methods

Between April 2019 and August 2020, 94 cemented posterior-stabilized custom-made ORIGIN® TKA (Symbios, Yverdon-les-Bains, Switzerland) were implanted in 89 patients (50 women, 39 men, mean age = 68±10 years) for primary knee osteoarthritis and prospectively included in our institutional total joint registry. The clinical outcome was evaluated using the Knee Society Score (KSS). The radiological outcome included pre- and post-operative lower limb axis (HKA angle), radiolucent lines, implant sizing and patellar tracking using standardized antero-posterior, lateral, Merchant and weight-bearing long leg views. Complications, early mechanical failure and revisions were reported at latest follow-up.

Results

The mean follow-up was 14±6 months. Pre- to post-operative mean KSS significantly increased. However, 18 patients (19%) presented with a KSS ≤ 60 corresponding to a fair or poor clinical outcome. In addition, 3 patients demonstrated worse postoperative than preoperative KSS. Patellar maltracking was reported in 50 knees (53%) and unwanted change in varus/valgus axis (>±3° from 180°) in 7 knees (7.5%). 22 TKA (23%) demonstrated implant oversizing with femoral and/or tibial component overhanging over the osseous limits. 7 mobilization under narcosis for stiffness (7.4 %) were reported. At latest follow-up, 9 knees (10%) were revised: 1 for acute hematogenous infection (1.1%), 5 for pain and instability with oversizing of at least one component (5.3%), 1 for instability and pain due to migration of the femoral implant (1.1%) and 2 for patellar complication with instability or fracture (2.1%).

Conclusion

This prospective series demonstrated an unexpected high rate of complication and early failure of a custom TKA within 2 years after surgery. Importantly, the early revision rate for mechanical failure was 10% in our practice. We therefore recommend caution about this custom TKA especially regarding the lack of large prospective and unbiased series in literature and the difficulty for the surgeons to make accurate pre-operative planification due to the software design.

FM095

Preliminary clinical outcome, isokinetic muscle strength and hop performance after ACL repair and InternalBraceTM augmentation compared to ACL reconstruction and healthy controls (11282)

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Introduction

The aim of this study was to provide preliminary clinical and functional outcomes 2 years after ACL repair and InternalBrace augmentation (IB) compared with patients after ACL reconstruction using autologous hamstring tendons (Reco) and healthy controls.

Methods

To date, 25 patients 2 years after ACL repair and InternalBraceTM augmentation, 25 age- and sex-matched patients 2 years after ACL reconstruction and 25 matched healthy controls (CTR) have been included in our ongoing study [1] (female:male, all: 14:11; mean age IB/Reco/CTR: 37.2/37.3/37.3 years; Body Mass Index: 24.4/25.4/23.3 kg/m2). Clinical outcome was assessed using the IKDC and the KOOS scores. Hop performance was assessed as single leg hops (SLH) for distance and side hops over 40cm in 30s (SH) of stable single leg landing trials. Isokinetic muscle strength was measured using a Biodex dynamometer (peak knee flexor and extensor torque at 60°/s). For functional parameters, the limb symmetry index (LSI) (operated/contralateral*100; non-dominant/dominant*100, respectively) was calculated. Differences between groups were detected using ANOVA and Bonferroni posthoc tests ($p < .05$).

Results

The IKDC was (mean ±standard deviation) IB: 86.4±9.7, Reco: 80.1±10.4 and CTR: 98.1±3.0 (IB vs. Reco: $p = .033$). All KOOS subscores were comparable after IB compared to Reco (e.g., KOOS pain score, IB: 91.9 ±9.5;

Reco: 89.6 ±7.3; CTR: 99.1±2.1). IKDC and KOOS for both patient groups remained below levels of controls (all p <.05). Similar results were observed for LSI for SLH (IB: 93.4±11%; Reco: 90.0±12.8%; CTR: 97.6±7.1%) and SH (IB: 86.1±19.9%; Reko: 81.6±12.8%; CTR: 100.1±23.4%) with significant differences found only for Reco vs. CTR (both p = .042). LSI for knee extensors strength were IB: 91.4±17.2%, Reco: 85.2±21.2% and CTR: 103.5±9.7% with a significant difference for IB vs. CTR (p = .038) and Reco vs. CTR (p <.001). LSI for knee flexors strength was IB: 97.7%, Reco: 94.9±13.1% and CTR: 98.2±12.9% (p >.05).

Conclusion

Two years after IB, patients showed good to excellent clinical and functional outcomes with better (IKDC) or comparable (with a trend towards superior) results compared to ACL reconstruction. Hence, IB may be a promising alternative treatment option for proximal ACL injuries, which has to be further confirmed by our ongoing study and data of future clinical trials.

Funding

Swiss Orthopaedics, Deutsche Arthrose-Hilfe eV

[1] Müller S. et al. BMJ Open. 2022 Feb 1;12(2):e054709.

FM096

Tibial tunnel enlargement is affected by the tunnel diameter-screw ratio in tibial hybrid fixation for hamstring ACL reconstruction (11136)

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Introduction

There is no evidence on screw diameter with regards to tunnel size in anterior cruciate ligament reconstruction (ACLR) using hybrid fixation devices. The hypothesis was that an undersized tunnel coverage by the tibial screw leads to subsequent tunnel enlargement in ACLR in hybrid fixation technique.

Methods

In a retrospective case series, radiographs and clinical scores of 103 patients who underwent primary hamstring tendon ACLR with a hybrid fixation technique at the tibial site (interference screw and suspensory fixation) were obtained. Tunnel diameters in the frontal and sagittal planes were measured on radiographs 6 weeks and 12 months postoperatively. Tunnel enlargement of more than 10 % between the two periods was defined as tunnel widening. Tunnel coverage ratio was calculated as the tunnel diameter covered by the screw in percentage.

Results

Overall, tunnel widening 12 months postoperatively was 23.1 ± 17.1 % and 24.2 ± 18.2 % in the frontal and sagittal plane, respectively. Linear regression analysis revealed the tunnel coverage ratio to be a negative predicting risk factor for tunnel widening (p = 0.001). The ROC curve analysis provided an ideal cut-off for tunnel enlargement of >10 % at a tunnel coverage ratio of 70 % (sensitivity 60 %, specificity 81 %, AUC 75 %, p <0.001). Patients (n = 53 / 103) with a tunnel coverage ratio of <70 % showed significantly higher tibial tunnel enlargement of 15 % in the frontal and sagittal planes. The binary logistic regression showed a significant OR of 6.9 (p = 0.02) for tunnel widening >10 % in the frontal plane if the tunnel coverage ratio was <70 % (sagittal plane: OR 14.7, p = 0.001). Clinical scores did not correlate to tunnel widening.

Conclusion

Tibial tunnel widening was affected by the tunnel diameter coverage ratio. In order to minimize the likelihood of disadvantageous tunnel expansion – which is of importance in case of revision surgery – an interference screw should not undercut the tunnel diameter by more than 1mm.

FM097

The winking sign is a reliable indicator for increased femorotibial rotation through the knee joint in patients with recurrent patellar instability (11137)

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Purpose

Rotation of the tibia relative to the femur was recently identified as another contributing risk factor for patellar instability, and correlated with its severity. The hypothesis was that in patellofemoral dysplastic knees, an increase in femorotibial rotation can be reliably detected on anteroposterior (AP) radiographs by an overlap of the lateral femoral condyle over the lateral tibial eminence.

Methods

59 patients (77 knees) received low-dose computed tomography (CT) of the lower extremity for assessment of torsional malalignment due to recurrent patellofemoral instability. Three-dimensional surface models were created to assess femorotibial rotation and its relationship to hip-knee-ankle angle (HKA), femoral and tibial torsion, tibial tuberosity-trochlear groove (TTTG) distance, patellar tilt, and trochlear dysplasia. On weight-bearing AP knee radiographs, a femoral condyle/lateral tibial eminence superimposition was defined as a positive winking sign. Diagnostic performance to detect an increased femorotibial rotation (>15 °) was analyzed. The impact of vertical/horizontal image malrotation on femoral condyle/tibial eminence superimposition was assessed.

Results

A positive winking sign was present in 30 patients (39.0 %) and indicated a 6.3 ± 1.4 ° increase in femorotibial rotation (p <0.001). Femoral condyle/tibial eminence superimposition of 1.9mm detected an increased femorotibial rotation (>15 °) with 43 % sensitivity and 90 % specificity (AUC = 0.72; p = 0.002). Mean absolute overlap error was 0.9 ± 0.5mm and 1.5 ± 4mm per 5 ° of X-ray rotation and tilt, respectively. In absence of a winking sign, no superimposition resulted within 20° of vertical/horizontal image malrotation. Femorotibial rotation was positively correlated to TTTG (R2 = 0.40, p = 0.001) and patellar tilt (R2 = 0.30, p = 0.001).

Conclusions

A positive winking sign reliably indicates an increased femorotibial rotation on a weight-bearing AP knee radiograph. Due to the relationship to other morphological risk factors of patellar instability such as TTTG and patellar tilt, femorotibial rotation may become not only a prognostic factor but a potential surgical target in patients with patellofemoral disorders.

FREE COMMUNICATIONS: SPINE

FM098

Low-energy fractures of the pelvis in the elderly and mortality (11193)

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Introduction

While the prognostic impact of hip fractures in the elderly is widely accepted, the risk and excess mortality associated with pelvic fragility fractures is still underestimated and receives considerably less attention. Morbidity and mortality might thereby be related to fracture morphology and/or patient characteristics. The aim of this project is to investigate the prognostic value of specific fracture characteristics with respect to overall survival and to compare it with an established classification system.

Methods

Retrospective analysis of patients ≥60 years, treated conservatively for a CT-scan verified, low-energy pelvic ring fracture diagnosed between August 2006 and December 2018. Survival data was available from patients' charts and cantonal or national registries.

The prognostic value of fracture characteristic describing the anterior and posterior involvement of the pelvic ring was investigated. This analysis was repeated after patients were stratified into a high-risk vs a low-risk group according to patient characteristic (age, gender, comorbidities, mobility, living situation). This allowed to assess the impact of the different fracture morphologies on mortality in fit vs. frail senior patients separately

Results

Overall, 428 patients (83.4% female) with a mean age of 83.7 years were included. Two thirds of patients were still living in their home and mobile without walking aid at baseline. In-hospital mortality was 0.7%, overall, one-year mortality 16.9%. An independent and significant association of age, gender and comorbidities to overall survival was found. Further, the occurrence of a horizontal sacral fracture as well as a ventral comminution or dislocation was associated with an increased mortality. The effect of a horizontal sacral fracture was more accentuated in low-risk patients while the ventral fracture components showed a larger effect on survival in high-risk patients. No association of the FFP classification with survival was observed.

Conclusion

Specific fracture characteristics such as horizontal sacral fracture, comminuted and dislocated ventral fractures may indicate a higher mortality risk of patients with a pelvic fragility fracture. Hence, they should be taken into account in future treatment algorithms and decisions on patient management.

FM099*

EFFICACY OF THORACOLUMBAR ORTHOSIS FOR OSTEOPOROTIC VERTEBRAL FRACTURES TO PREVENT KYPHOTIC PROGRESSION – A PROSPECTIVE BLINDED SENSOR-CONTROLLED STUDY (11242)

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Introduction

Hyperextension orthosis (HO) for osteoporotic vertebral fractures (OVF) are widely prescribed. However, the compliance of wearing a HO and its effect to prevent spinal kyphotic progression is unknown. The aim of the study was to assess the wearing time of HO in OVF in a prospective blinded sensor-controlled manner and to find potential correlation of wearing time to radiographic kyphotic progression.

Methods

We prospectively included 18 patients who were treated non-operatively with a HO for OVF between 2018 and 2021. The true wearing time was measured by using a hidden, temperature based sensor. Full compliance was defined with 15 hours wear time as 100%. Patients were called for regular follow-up every two weeks, with clinical evaluation and radiographs of the fracture. After completion of the therapy, the patients were informed about the sensor and consented or declined study participation.

Results

HO wearing time was 5.5±3.3 hours (37%±22% compliance). Female patients used the HO significantly longer compared to male patients (6.5±3.2 vs. 2.9±2.0 hours, p = 0.039). Age and BMI had no influence on wearing behavior. No significant radiologic correlation of kyphotic progression and wearing time of the HO was documentable.

Conclusion

Compliance of the HO is poor with great variability, significant difference between women and men, and not depending on BMI or age. The wearing time has no influence on kyphotic progression of the osteoporotic fractured segment.

FM100*

Pelvic fixation in neuromuscular scoliosis: A retrospective outcome comparison (11155)

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Introduction

Surgical correction of neuromuscular scoliosis can be associated with high complication rates, including such associated with pelvic fixation. Up to now it is debated whether and when to include the pelvis into the fusion construct. Therefore, we aimed to illuminate when pelvic fixation is beneficial in surgical correction of neuromuscular scoliosis.

Patients & Methods

A prospective cohort of 49 patients (mean age 13 ± 3 y, 63% females, follow up 56 months, range 24 − 215) who underwent correction of neuromuscular scoliosis with (n = 18) or without (n = 31) pelvic fixation were included in the final analysis of radiological parameters, clinical improvement and complication/revision rates.

Subgroup analysis was performed to find if non-ambulatory patients with Gross motor functions classification system (GMFCS) levels >III, with larger scoliotic curves (>60°) and moderate pelvic obliquities up to 35° benefit from pelvic fixation.

Results

There was no significant difference in complications when comparing patients with (9 out of 18 patients, 50%) or without (9 out of 31 patients, 29%) fixation to the pelvis (p = .219). Also, subgroup analysis of the wheelchair bound GMFCS >III Patients and cobb angles greater than 60° with pelvic obliquity less than 35° (n = 20) revealed no differences in amount of clinical improvement of ambulation with (n = 9) or without (n = 11) pelvic fixation, respectively (p: n.s.) nor regarding complication or revision rates.

Conclusion

Pelvic fixation does not seem obligatory in wheelchair bound patients per definition. Even with pelvic obliquities up to 35° and large scoliotic curves >60°, avoiding pelvic fixation does not result in higher revision rate or worse clinical outcomes.

FM101

Factors Associated with an Increased Risk of Developing Postoperative Symptomatic Lumbar Spondylolisthesis after Decompression Surgery: An Explorative Two-centre International Cohort Study (11297)

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Purpose

A recent review reported that, after decompression surgery, 1.6-32.0% patients develop postoperative symptomatic spondylolisthesis. It remains unclear why some patients develop a postoperative symptomatic spondylolisthesis. This study explores the association between key demographic, biological and radiological factors and postoperative symptomatic spondylolisthesis after lumbar decompression surgery.

Methods

This retrospective study included patients who had undergone lumbar decompression surgery between 2014-2016 at the Spine Centre in the Netherlands or Switzerland and had a follow-up of at least two years. Patient characteristics, surgical procedures and recurrent neurological complaints were retrieved from patient files. Preoperative MRI-scans and X-rays were evaluated for morphological characteristics. Postoperative spondylolisthesis was evaluated on postoperative MRI-scans. For patient-basis outcomes, patients with and without postoperative symptomatic spondylolisthesis were compared. For surgical level-basis outcomes, surgical levels that did or did not develop postoperative spondylolisthesis, were compared. Univariable and multivariable regression analyses were used to identify statistical predictors.

Results

716 patients with 1094 surgical levels were included. ICCs for intra-, and interobserver reliability of X-ray and MRI variables ranged between 0.67-0.99.

91 of 716 included patients developed postoperative symptomatic spondylolisthesis (12.7%). Multivariable regression analyses of patient-basis outcomes showed a higher risk of postoperative symptomatic spondylolisthesis for females (OR 1.78, 95%CI 1.13-2.81) and RA (OR 2.03, 95%CI 0.99-4.16). A lower risk was associated with smoking (OR 0.54, 95%CI 0.28-1.06) and higher BMI (OR 0.94, 95%CI 0.89-0.99). Multivariable regression analyses of surgical level-basis outcomes showed a higher risk for levels with preoperative spondylolisthesis (OR 17.30, 95%CI 10.27-29.07) and increased CSA of M. psoas (OR 5.67, 95%CI 1.41-22.79).

Conclusion

Being female and having RA was associated with a higher risk of postoperative symptomatic spondylolisthesis, while having a higher BMI and smoking resulted in a lower risk. When looking at factors at the surgical level, preoperative spondylolisthesis and increased CSA of M. psoas showed an association. Future research will focus on a prediction model for a clearer overview of the influence of risk factor on postoperative symptomatic spondylolisthesis.

FM102

Pre- and postoperative kinetics and kinematics in patients with first-time single-level lumbar fusion (11309)

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Introduction

Adjacent segment degeneration and material failure are two common and momentous complications after spinal fusion surgery. A correlation with spinal imbalance and unphysiological movement in some segments is suspected. However, there is a lack of studies investigating the dynamic movement in patients with lumbar pathologies and its change after fusion. Hence, we aimed to investigate the dynamic spinal and lower limbs' alignment prior and after spinal fusion.

Methods

Fourteen patients undergoing first time single-level fusion (L4/5 or L5/S1) of lumbar spine for segmental degeneration and spinal stenosis were prospectively included. Prior and six months after surgery, patients' movement kinematics during functional tasks of daily living were analyzed in detail with VICON motion capture system in a movement analysis infrastructure. Additionally, pre- and postoperative full body models were created in OpenSim to investigate patients' in-vivo kinetics and kinematics acting in the spine, pelvis, and the lower limbs.

Results

During barefoot gait, patients showed an overall improvement of pelvis (+13%) and hip rotation (+14%). Further, resolving the pain sources resulted in an improved range of motion (ROM) of all movements of the lumbar (+21% for flexion/extension, +22% for lateral bending, +9% for rotation) and also the thoracic spine (+17% for flexion/extension, +5% for lateral bending) despite single level lumbar fusion surgery. Physiological angles of knees and hip extension were reached postoperatively with standing up from the sitting position if compared to flexed knees and hips as a compensatory mechanism to spinal imbalance prior to surgery.

Conclusion

Single level spinal fusion as treatment for spinal stenosis and segmental degeneration resulted in a significantly different postural control (e.g. spinal alignment) and ROMs of pelvis, hip and knees. Movement kinematics and patient specific modelling allow creation of algorithms for patient-specific preoperative planning of lumbar spinal fusion and for postoperative rehabilitation protocols.

FM103

Loads at adjacent segment after adult spinal deformity surgery – a combined clinical and simulation study of 205 patients (11287)

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Introduction

Sagittal malalignment is a risk factor for mechanical complications after spinal surgery for adult spinal deformity (ASD). Postoperative mechanical failure in ASD can be attributed to excessive loading conditions of the proximal segment caused by biomechanical effects of spinal realignment and fusion. Therefore, the aim of this study was to investigate the relationships between: (1) postoperative change in loads at the proximal segment and realignment, and (2) absolute postoperative loads and postoperative alignment measures.

Methods

A previously validated musculoskeletal (AnyBody) model of the thoracolumbar spine, with and without fusion, was used to simulate pre- and postoperative spinal biomechanics, respectively. The model was modified to represent patient-specific sagittal alignments, based on measured pelvic incidence, sacral slope, global tilt, L1-S1 and L4-S1 lordoses, T10-L2, T5-T12 and T2-T12 kyphoses angles. Compression and shear forces at the proximal adjacent segment (or corresponding level for preop condition) were predicted for upright standing for individual patients. In total, 205 patients were analysed (156 female, 49 male; age 52.1±19.2 years; upper and lower instrumented vertebra: UIV = T2-L3, LIV = T12-Sacrum/Ilia).

Results

Weak-to-moderate associations were found between preop-to-postop changes in lumbar lordosis, LL ($r = -0.23$, $r = -0.43$; $p < 0.001$), global tilt, GT ($r = 0.26$, $r = -0.38$; $p < 0.001$) and the Global Alignment and Proportion score, GAP ($r = 0.26$, $r = 0.37$; $p < 0.001$), and changes in compressive and

shear forces at the proximal segment, respectively. GAP score components, thoracic angles and the slope of upper instrumented vertebra were associated with changes in shear. In patients with T10-pelvis fusion, moderate-to-strong associations were found between several postoperative sagittal alignment measures and compressive and shear loads (strongest correlations for GT, r = 0.75, r = 0.73, p <0.001).

Conclusion

Spinal loads were estimated for patient-specific thoracolumbar-spino-pelvic alignment profiles in a large cohort of patients with ASD pre- and postoperatively. Changes in sagittal alignment after surgery correlated with changes in loads at the proximal segment. In patients with T10-pelvis fusion, sagittal imbalance was related to greater loads. Future work should explore whether loads provide a causative mechanism explaining the association between sagittal imbalance and risk of proximal junction complications.

FM104

Lower Effectiveness of Facet Joint Infiltration in Patients with Concurrent Facet Joint Degeneration and Active Endplate Changes (11266)

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Introduction

Facet joint degeneration (FJD) and degenerative disc disease (DDD) with associated endplate (EP) changes, specifically Modic 1 changes, might occur concurrently and therefore pose a challenge in the treatment of lower back pain (LBP). The aim of the present study was to investigate if the presence of active EP changes (Modic 1) would alter the effect of facet joint infiltrations (FJI) for the treatment of concurrent FJD.

Methods

42 patients (Male:20, Female:22) with an average of 58 ± 14 years with FJD on conventional MRI receiving a FJI were included. All the patients underwent a (18F)-NaF PET/MR and FJI for symptomatic FJD. Active EP changes on conventional MRI and increased EP metabolic activity on PET/MR were analyzed for conformity. The pain score at baseline, 15 min, 1 day, 1 week and 1 month following FJI as well as the reduction of pain were analyzed and compared between patients with and without increased EP metabolic activity in PET/MR.

Results

The LBP reduction was significantly different between patients with (n = 20) and without (n = 22) active EP changes at 15 minutes (1.3 ± 2.4 vs. 2.9± 2.4, p = 0.03) and 1 month (0.9± 2.3 vs. 2.8± 2.9, p <0.001) following FJI. The minimal clinically important difference for LBP reduction was reached significantly more often in the absence of active EP changes (73%) compared with patients with active EP changes (35%) one month following FJI (p = 0.03).

Conclusions

FJI is less efficient in LBP reduction of patients with FJD and concurrent active EP changes (e.g. Modic 1).

FM105*

Retrospective evaluation of retrograde ejaculation event rate after primary ALIF – Quality control in the patient collective of a high volume spine center – (11303)

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Introduction

Anterior lumbar interbody fusion (ALIF) is an established procedure for spondylosis, spondylolisthesis and degenerative disc disease. Approach-related, this procedure may result in altered sexual function (VS) and retrograde ejaculation (RE) due to damage to the hypogastric plexus.

In a retrospective quality control we investigated the event rate of VS and RE as well as the general satisfaction with the surgical outcome in our own patient collective.

Methods

Patients undergoing primary ALIF L5/S1, L4/L5, or L5/S1 + L4/L5, either stand-alone or combined, during 2015-2020, were studied. 170 male patients received a questionnaire by mail. Patients with altered sexual function were additionally interviewed by telephone regarding symptoms.

Results

We received 98 responses and conducted 8 telephone interviews. Patients ranged in age from 20 to 60 years, with a median age of 44 years. In 74 patients an ALIF L5/S1, in 6 patients an ALIF L4/L5 and in 11 patients an ALIF L4/L5 + L5/S1 was perfor In 5 pat, no assignment to surgical level was possible.

Primary outcome: 11% of patients reported decreased amount or absence of ejaculation as an indication of the presence of retrograde ejaculation. 21% of patients reported noticing a general change in their sexual function. Age at the time of surgery did not appear to play a role in the event rate. The occurrence of changes in sexual function did have an impact on whether patients reported decreased or absent ejaculation.

Secondary outcome: 83.6% (n = 82) of patients were very satisfied with the outcome of surgery. 84.6% of patients would have the surgery again (83 yes, 10 no, 5 undecided).

Conclusion

The 11% event rate seen in our own patient population exceeds the frequency rates of retrograde ejaculation reported in the literature and is probably underestimated.

Patients with a potential desire to have a child must be advised to donate sperm before the procedure is performed and the preoperative education must be adapted.

The ALIF procedure is a successful treatment option with high postoperative patient satisfaction.

FM106

Comparison of short versus long fusion in the treatment of adult lumbar spinal deformity: surgical, radiographic and patient-reported outcomes. (11362)

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Introduction

Lumbar adult spinal deformity (ASD) is a challenge to the physician, with no established decision-making pathway to determine the optimal surgical treatment. The ideal procedure limits the extensiveness of surgery without compromising the outcome, though in practice many uncertainties exist. This study aimed to compare the surgical, radiographic and patient-rated outcomes in patients with ASD of the lumbar spine undergoing either short fusion (SF; max 2 levels) or long fusion (LF; 3 or more levels), while controlling for potential confounders.

Methods

An international, multicentre database (7 European sites, 4 countries) containing the prospectively collected data from patients with adult deformity was searched for patients with deformity of either a degenerative or idiopathic origin, undergoing fusion surgery that included the lumbar spine, at least 1yr ago. We identified 57 SF and 137 LF patients. Propensity score (PS) adjustment was used to evaluate the difference in outcome between the treatment groups, controlling for relevant baseline variables. Surgical outcomes (blood-loss, duration of surgery, length of stay) as well as 1-yr patient-rated outcomes (SRS-22) and coronal and sagittal curves were evaluated.

Results

Compared with long fusion, short fusion was associated with less blood-loss during surgery (by 725ml, 95%CI 613-838; p <0.001), a shorter duration of surgery (by 86 min, 95%CI 66-107; p = 0.001), and a shorter length of stay (by 3.5 days, 95%CI 2.5-4.5, p = 0.001). However, at 1-yr follow-up, it was associated with a higher TL/L coronal curve (by 12.1 deg, 95% CI 9.5-14.6; p <0.001), a higher LS/S coronal curve (by 4.3 deg, 95% CI 2.9-5.8; p <0.001) and a lower relative lumbar lordosis (by 6.4 deg, 95% CI 3.5-9.4; p <0.001). SRS-subtotal scores at 1yr were slightly, but not significantly better in the short fusion group (by 0.11 points, 95%CI, -0.03-0.25; p = 0.13); sagittal balance showed no significant difference between the groups (difference, 0.37, 95%CI, -8.5-9.3; p = 0.93).

Discussion

Short fusion was less complex/invasive than long fusion, with no detrimental effect on patient rated outcomes. This likely reflects appropriate and careful patient selection in this cohort. Further analyses of the selection procedure are warranted to refine indications for longer fusion and determine whether there exists, for example, a maximum level of deformity that can still be treated successful with short fusion.

FM107*

Radiographic and clinical consequences of posterior cervical laminectomy with or without fusion (11380)

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Introduction

Fusion is believed to be necessary to avoid clinically relevant post-laminectomy kyphosis after posterior cervical decompression. While radiographically, a kyphosis might occur, its clinical relevance is largely unknown.

Methods

A retrospective, comparative two-center cohort study was performed including patients with at least 1 year follow up after a cervical dorsal decompression +/- fusion for degenerative cervical myelopathy (2002-2019) (n = 137). Primary outcome was change of C2-7 Cobb angle and secondary outcomes were the number of revisions, change of T1 slope and C2-7 sagittal vertical axis (SVA) as well Neck Disability Index (NDI). Regression analysis was adjusted for confounders (age, operated levels, and follow-up) to compare the two groups.

Results

46 (34%) patients underwent posterior cervical laminectomy without fusion versus 91 (66%) with fusion. The decrease in C2-7 Cobb angle from pre- to postoperative (at final follow-up at a median of 59 (interquartile range 80) and 59 (38) months) was higher in the decompression group (median -6° (20)) if compared to the fusion group (-1° (7), p = 0.002)). After adjusting for confounders, the decrease in C2-7 Cobb angle was higher in the decompression group (regression coefficient -12 (95% confidence interval (CI) -18 to -5), p = 0.001). We did not observe differences for revision rates (OR 1.3 (95% CI 0.1-12.1), p = 0.79), T1 slope (regression coefficient -3 (95% CI -10 to 4), p = 0.42), C2-7 SVA (regression coefficient 2 (-7 to 11), p = 0.63) and NDI (regression coefficient -11 (-23 to 2), p = 0.10).

Conclusions

Cervical laminectomy without fusion is associated with a mild loss of cervical lordosis of around 6° in the mid-term after around five years, however without any clinical consequences measured with regard to the NDI and revisions in well-selected patients.

POSTERS: SHOULDER / ELBOW

P01

All-suture technique for fixation of unstable displaced distal clavicle fractures (11188)

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Background

Displaced Neer type II and V clavicle fractures are usually treated surgically in active patients. However, distal fragment fixation remains a challenge, and no consensus has been established regarding the optimal surgical treatment. Osteosuture techniques have been popularized over the last decade, and multiple different techniques have been described.

The aim of this study was to describe an all-suture technique in patients with displaced type II and V clavicle fractures and report its outcome in a prospective case series.

Methods

Between 2017 and 2020, 15 patients with displaced acute distal clavicle fractures were treated with an all-suture open technique performed by one shoulder specialized surgeon, with a minimum follow-up of 12 months. Osteosuture repair consisted in a coraco-clavicular cerclage with 4 n°6 Ethibonds and a figure-of-0 and figure-of-8 fracture cerclage with 2 n°2 Suturetapes. Single assessment numerical evaluation (SANE) and adjusted Constant score were recorded at 6 and 12 months. Radiologic union was assessed on plain radiographs.

Results

At 12 months, all patients reported excellent clinical results, with a mean SANE of 98.2 [± 5.2, range 80 to 100] and a mean adjusted Constant score of 99.0 [± 1.9, range 94 to 100]. One patient developed shoulder stiffness that resolved before final follow-up. Fractures consolidated in 93% of the cases, with union happening between 3 and 6 months [range 3 to 12 months]. One patient developed an asymptomatic malunion. No degenerative changes were noted in the acromioclavicular joint at 12 months. Correlation analysis between radiologic union and functional scores showed moderate negative correlation between time to union with 6 months SANE score (r = -0.7, p = 0.003) but none with 1 year SANE or adjusted Constant scores (r = -0.13, p = 0.6 and r = 0.35, p = 0.2, respectively).

Conclusion

Excellent clinical and radiological outcomes can be achieved with this minimally invasive all-suture fixation technique for displaced distal clavicle fractures, which allows for an anatomic reduction and stable fixation. This study showed low complications and a high level of union after a minimum follow up of 12 months. Among the numerous advantages are a smaller exposure than for plate fixation, avoidance of hardware-related complications (screw/plate failure, coracoid fracture from drilling, or rotator cuff damage caused by hook-plates) and avoids a reoperation to remove symptomatic hardware.

P02

Massive Rotator Cuff Tears With Short Tendon Length Can Be Successfully Repaired Using Synthetic Patch Augmentation (11244)

Adrian Chlasta; Lukas Dommer; Tomás Rojas; Annabel Hayoz; Michael Schär; Matthias A. Zumstein

Introduction

Choosing the optimal treatment for massive rotator cuff tears (MRCT) still poses a surgical problem. In MRCT with good muscle quality, but short tendon length, non-augmented repairs lead to high failure rates of up to 90%.

The aim of the study was to evaluate clinical and radiological outcomes of MRCT without clinical pseudoparalysis and good muscle quality, but short tendon length, which were repaired at the medial footprint with synthetic patch augmentation with a minimum follow-up of two years.

Methods

Arthroscopic or open rotator cuff repairs, with patch augmentation, were performed on fourteen patients between 2016 and 2019, who presented MRCT confirmed by an MR arthrogram showing good muscle quality (Goutallier ≤ 2) and short tendon length (length <15 mm).

Constant-Murley score (CS), subjective shoulder value (SSV) and range of motion were compared pre-operatively and at least two years post-operatively. Clinical failures were defined by re-operation, forward flexion <120 or a relative CS <70. Structural integrity of the repair was assessed by MRI. Comparison between different variables and outcomes was performed using Wilcoxon-Mann-Whitney and Chi square tests.

Results

Fourteen patients (mean age 57 years, 12 (86%) male, 8 (57%) right shoulders) were reevaluated with a mean follow up of 46 months (28-59 months). There was a significant improvement in the absolute CS (from 35 to 84 points, p = 0.003), the relative CS (from 39% to 94%, p = 0,001), the SSV (from 34% to 90%, p = 0.003) and forward flexion (from 115° to 168°, p = 0.003) but not in external rotation (from 34° to 39°, p = 0.34).

There were three clinical failures with a re-operation, two conversions to a reverse total shoulder arthroplasty, one underwent a patch augmented re-repair. Structurally, there were six failures (two partial; four full-thickness re-tears) of which only one re-tear size exceeded 10 mm.

The presence of a full-thickness or partial re-tear was not associated with inferior clinical outcomes compared to intact cuff repairs. There were no correlations between the grade of retraction, muscle quality or rotator cuff tear configuration and re-rupture or functional outcomes.

Conclusion

Patch augmented cuff repair for MRCT with good muscle quality, but short tendon length and high retraction grades leads to a significant improvement in functional outcomes with low full-thickness re-tear rates and re-operations.

P03

"Normal" shoulder function with genetic hypermobility syndromes. (11234)

Patrick Vavken

Introduction

It is estimated that between 15 and 50 people per 100,000 suffer from a collagen disease or connective tissue disorder. Very frequently, the inherent hypermobility disturbs shoulder, ankle, and patellofemoral mechanics. In the shoulder, multidirectional instability (MDI) is the typical result.

The treatment recommendations for symptomatic MDI in patients with a systemic collagen disorder are fairly controversial. A better understanding of the "normal" shoulder function in this population would help in developing effective and evidence-based treatment protocols.

Methods

250 patients with genetic hypermobility or Ehlers-Danlos Syndrom were surveyed for their day-to-day shoulder function. Endpoints were subjective shoulder function (SSV), the ROWE and WOSI scores, demographic details and a free text question.

Results

The return rate for the questionnaire was 93%. Most patients (56%) were between 22 and 40 years of age, female (86%), suffering from EDS (70%). 84% are suffering from constant joint pain, with a median Tegner activity score of 8. Shoulder pain is bilateral in 64%, 74% have experienced more than 6 full dislocations.

72% do sports on a regular basis. The mean SSV was 73 ± 23%. The mean Rowe score was 46 ± 22 pts, the mean WOSI score 59 ± 21 pts.

Three issues stood out in the free text response: pain and instability are independent problems; scapular problems often more troublesome than the glenohumeral instability; neurological issues even after successful stabilization.

Conclusion

In this population with genetic hypermobility, there was an interesting discrepancy between low clinical scores, but high levels of sports participation and SSV, suggesting well functioning compensation mechanisms. Many patients perceive their scapular problems equally or even more troublesome than the acutal glenohumeral instability.

P04

Arthroscopic Rotator Cuff Repair and Effects on Return to Work: Level of Employment, Change of Tasks, and Work Loss (11313)

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Purpose

The purpose of this study is to determine the return to previous work after an arthroscopic rotator cuff repair (ARCR), with a minimum of 12 months follow-up.

Methods

Three hundred and eighty-three patients underwent ARCR and were retrospectively reviewed. The patients were stratified based on the physical demand of their work according to the Canadian Classification and Dictionary of Occupations. The primary outcomes were time to return to work, level of employment, change of tasks, and work loss. Secondary outcomes including the return to sports activities, EQ-VAS, EQ-5D-5L, DASH, and Oxford score were also recorded.

Results

Overall, 86.4% of patients (n = 331) returned to work at a mean time of 5.3 ± 4.5 months; of them, 6.4% had to lower their level of employment, and 5.5% changed their tasks. 13.6% of the patients lost their work, with a percentage of 34.4% in the heavy-work category. 75.3% returned to their previous level of sport activity. The mean EQ-VAS was 77.3 ± 18 points, the mean Oxford Shoulder score was 43.4 ± 7.2 points, and the DASH Score was 9.9 ± 14.5 points.

Conclusion

Patients undergoing ARCR may expect a high likelihood of return to work, but this could be jeopardized by the necessity of reducing their level of employment or changing their tasks. However, this is not true for patients with very physically demanding work, who have a percentage of job loss superior to 30%, and even if returning to work, they often have to reduce their level of employment or change their tasks.

P06

2 years follow-up after arthroscopic repair for posterolateral rotational elbow instability (11233)

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Introduction

Posterolateral rotational instability of the elbow causes pain and instability and is often misdiagnosed as epicondylitis lateralis. The gold standard is ligament reconstruction with a tendon graft, which requires an open approach and may cause additional harvest morbidities due to autograft. This study is a follow-up of 10 patients two years after arthroscopic elbow stabilisation with suture anchors instead of a tendon graft.

Methods

2-year results after performing elbow arthroscopy with reinsertion of the lateral ulnar collateral ligament and extensor tendons with suture anchors in patients with clinical, mri and intraoperative confirmed PLRI II°-III°. Endpoints were VAS pain (0-10), ROM, the Mayo Elbow Performance Score (MEPS) and the Andrews Carson Score (ACS).

Results

The mean age was 44 years (95%CI 35-53), 60% male. 4 patients had a history of trauma, all others had been treated for lateral epicondylitis with an average of 2.2 (95%CI 1-4) corticosteroid injections and physiotherapy.

There were statistically significant and clinically relevant improvements in all endpoints with a reduction in pain by 5.4 pts (95%CI 4.6-6.3) and improvement in MEPS by 37.2 pts (95%CI 28-47) and ACS by 59 pts (95%CI 50-68). There was no significant reduction in extension (-1°, 95%CI -2.9-3.8) or flexion (-1.7°, 95%CI -0.6-4.0). There were no complications, one patient did report occasional tenderness to touch over the knots.

Conclusion

Arthroscopic stabilization provided a statistically significant and clinically relevant improvement in this prospective cohort of patients with °II − °III PLRI.

P07

Surgical treatment of Neer type V lateral clavicle fractures – a comparative study in human cadavers (11298)

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Background

Treatment of distal clavicle fractures with bony avulsion of the coracoclavicular (CC) ligaments is challenging and a single gold-standard surgical technique has not yet been defined. The purpose of this study was to investigate the biomechanical fixation strength of the CC stand-alone Cow-Hitch suture repair technique in comparison with the clavicle hook plate and the lateral locking plate with CC suture repair fixation techniques.

Material: 3D guided Neer Type V fractures of the clavicle were created in 18 cadaveric shoulders, which were matched by age and gender in 3 groups: (1) clavicle hook plate (Group HP), (2) lateral locking plate fixation with CC suture repair (Group LPCC) and (3) stand-alone suture repair using the Cow-Hitch technique (Group CH). After preconditioning with 25 N for 10 cycles the specimens were cycled for 500 cycles from 10N to 70N. Displacement and ultimate load to failure were documented and analyzed with the data acquisition system.

Results

There was a significant difference in the fracture displacement during cyclic loading between the LPCC group and the HP group (0.6 vs. 1.7 mm; p = 0.02), as well as between CH and HP group (0.5 vs. 1.7 mm; p = 0.004). There was no significant difference between the LPCC group and the CH group (p = 0.544). The CH group and the LPCC group showed a significant higher stiffness compared to the HP group (p <0.001 and p = 0.003 respectively). The CH group showed a significant higher ultimate load to failure compared with the HP group (429 vs. 172 N; p = 0.005), but not compared with the LPCC group (428.7 vs. 258.2 N; p = 0.071).

Conclusion

The CC-Stand-Alone Cow-Hitch technique and the locking plate fixation technique with suture repair showed superior biomechanical results than the hook plate in fixation of Neer type V fractures of the distal clavicle. Both techniques showed comparable biomechanical fixation strength, however, the CH technique has potential advantages such as less soft tissue stripping, low costs, and simple technique.

P08

Does “Wave”- and “Liquid”-sign in MRI help decision making in the diagnosis of AC dislocation: a retrospective correlation study. (11402)

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Background

The diagnosis of AC joint dislocation is made by X-rays using the Rockwood classification. However, it gives only indirect information about the ligamentous injury. The treatment decision making is challenging for type II and III dislocations.

The purpose of this study is to evaluate the role of MRI in treatment decision making.

Methods

Examinations of all patients suffering from AC joint trauma were randomised and retrospectively rated by two residents and two consultants blinded to the chosen treatment. This retrospective study includes all who suffered a trauma to the AC joint and were investigated with conventional X-rays (anteroposterior and Zanca) and MRI at our institution between 2015 and 2019. AC dislocation was defined using Rockwood classification on X-ray and ligaments were assessed on MRI.

The reproducibility and reliability were assessed using weighted kappa. The correlation of surgical treatment using MRI and the operative treated patients was calculated using phi and maximum difference.

Results

50 patients (mean 39yo) were included. 9 were graded Rockwood Type I, 10 Type II, 19 Type III, and 12 Type V. Due to clinical evaluation, no Type I, 4 Type II, 17 Type III and 12 Type V had surgery.

The reproducibility of the Rockwood classification was almost perfect, but the reliability was moderate. The reproducibility of the lesions of the AC joint was slight to almost perfect and the reliability slight to moderate. The reproducibility of both “Wave”- and “Liquid”-sign was almost perfect, and the reliability was almost perfect and substantial, respectively.

The calculated correlation phi of positive “Wave”- and “Liquid”-sign and performed surgical treatment was phi = 0.626. The maximum difference was 63,2%. The positive correlation of the two positive signs (“Wave” and “Liquid”) indicating surgical treatment and the patients who had surgery was strong and high significant (p = 0.000), meaning a positive association. In cases of RW Type V or Type I phi resulted in an absolute constant.

Conclusion

MRI gives us more reliable information about the status of CC ligaments and concomitant injuries. Both the “Wave”-sign and the “Liquid”-sign were present in patients who showed instability and underwent surgical treatment.

The benefit of MR-diagnosis in decision-making seems of great value, particularly for Rockwood Type II and III, and would allow more accurate decision-making to avoid a delay in surgical treatment when necessary.

P09

Platelet concentrates for the treatment of rotator cuff tears (11260)

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Background

Despite improving surgical techniques for rotator cuff repair, the retear rate is still high at 26%. That is the reason why nowadays we try to improve healing with biological augmentation, i.e., with platelet concentrates. Beside the easy production of those autologous concentrates, the regulator barriers are quite low. The timely use of those products immediately after the blood collection is a further advantage of platelet concentrates. The term platelet concentrates represents a large inhomogeneous group of different concentrates with various properties. Due to different manufacturing processes, not every platelet concentrate product has the same properties.

Objectives

Can the use of platelet concen-trates in rotator cuff tears improve outcome? How different is the outcome between the different products?

Materials and Methods

Through PubMed we assessed 26 studies from 2007–2020.

Results and Conclusion

The evaluation of the studies which are currently available shows that only P-PRP (leucocyte poor platelet rich plasma) can be suggested for the augmentation of rotator cuff repair. In some studies, significant lower retear rates for the P-PRP group were reported. However, the results are heterogeneous. This puts the benefit of P-PRP into perspective. Platelet concentrates did not improve healing or the clinical outcome after conservative therapies of partial ruptures and tendinopathies.

P10

Lateral clavicular fractures associated with acromioclavicular luxation: A surgical technique (11417)

Nermine Habib; Timothée Helmstetter; Paolo Fornaciari; Grégoire Thürig; Moritz Tannast; Philippe Vial

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Background

Unstable distal clavicle fractures associated with lesions of the coracoclavicular (CC) ligaments demonstrate a high symptomatic nonunion rate if treated conservatively. A wide variety of surgical techniques have been described. Many of these techniques were associated with high failure rates and hardware-related complications. Therefore, we have adopted a surgical technique that aims at stabilization of the CC ligaments in combination with osteosynthesis of the clavicle.

We questioned: (i) Loss of reduction or loosening of the CC ligaments, (ii) The clinical function in terms of the Oxford Shoulder Score (OSS); American Shoulder and Elbow Surgeons Shoulder Score (ASES); Visual Analogue Scale (VAS), (iii) Return to work, (iv) Return to sports.

Methods

A retrospective single-center case series. Between 2015 and 2019, patients who had a lateral clavicular fracture associated with a CC ligament lesion and underwent stabilization of the CC ligaments by FiberWire® and osteosynthesis by low-profile plating (thickness 1.3mm). Only acute lesions were included.

Thirteen patients, with an average age of 48 years, had a clinical and/or radiological average follow-up of 3 years.

Results

Only one of the patients showed loosening of more than 5 mm of the CC ligaments, without horizontal instability and was completely asymptomatic. No loss of reduction was determined.

The clinical function at an average of 38 months showed a complete recovery in 10 of the patients. The average OSS was 47 out of 48, the average ASES 99, and the VAS 0.

All the patients, except two pensioners, went back to work within two months and back to sports within five months of the operation.

Four of the patients were reoperated with the removal of the implants due to discomfort. No other complications were encountered.

Conclusion

Stabilization of the CC ligaments in combination with osteosynthesis of the lateral clavicle using low profile plating provides a surgical treatment option with complication rates consistent with the current literature, a very satisfactory clinical outcome, as well as early return to work and sports.

KEYWORDS: Coracoclavicular ligaments; Fracture; Stabilization; Osteosynthesis

P11

Anatomical Analysis Of Different Helical Plate Designs For Proximal Humeral Shaft Fracture Fixation (11271)

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Background

Helical plates are preferably used for proximal humeral shaft fracture fixation with metaphyseal extension into the humeral head and potentially avoid radial nerve irritation as compared to straight plates.

Aims

(1) to investigate the safety of applying different long plate designs (straight, 45°-, 90°-helical and ALPS) in MIPO-technique to the humerus and (2) to assess and compare their distances to adjacent anatomical structures at risk.

Methods

MIPO was performed in 16 human cadaveric humeri using either a straight plate (group 1), a 45°-helical (group 2), a 90°-helical (group 3) or an ALPS (group 4). Using CT-angiography, distances between brachial arteries and plates were evaluated. Following, all specimens were dissected, and distances to the axillary, radial and musculocutaneous nerve were evaluated.

Results

None of the specimens demonstrated injuries of the anatomical structures at risk after MIPO with all investigated plate designs. Closest overall distance (mm(range)) between each plate and the radial nerve was 1 (1-3) in group 1, 7 (2-11) in group 2, 14 (7-25) in group 3 and 6 (3-8) in group 4. It was significantly longer in group 3 and significantly shorter in group 1 as compared to all other groups, $p < 0.001$. Closest overall distance (mm (range)) between each plate and the musculocutaneous nerve was 16 (8-28) in group 1, 11 (7-18) in group 2, 3 (2-4) in group 3 and 6 (3-8) in group 4. It was significantly longer in group 1 and significantly shorter in group 3 as compared to all other groups, $p < 0.001$. Closest overall distance (mm (range)) between each plate and the brachial artery was 21 (18-23) in group 1, 7(6-7) in group 2, 4 (3-5) in group 3 and 7 (6-7) in group 4. It was significantly longer in group 1 and significantly shorter in group 3 as compared to all other groups, $p < 0.021$.

Conclusions

MIPO with 45°- and 90°-helical plates as well as ALPS is safely feasible and showed a significant greater distance to the radial nerve compared to straight plates. However, distances remain low, and attention must be paid to the musculocutaneous nerve and the brachial artery when MIPO is used with ALPS, 45°- and 90°-helical implants. Moreover, the anterior part of the deltoid insertion will be detached when using 90°-helical and ALPS implants in MIPO-technique.

POSTERS: HAND

P12

Synovial chondromatosis of the pisotriquetral joint (11311)

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Introduction

Synovial chondromatosis (SC), also referred to as Reichel's syndrome, is a very rare condition, especially when the wrist is affected. As a benign metaplasia of the synovium that leads to the formation of mostly intraarticularly located, cartilaginous nodules, this condition can result in pain, swelling or limited range of motion of the affected joint. SC predominantly occurs in large joints such as the knee or the hip, but manifestations have been reported in various other joints. Typically, men between 30-60 years of age are affected. In respect to diagnostics, first indications can be found in radiographs, whereas the imaging of choice is Magnet-resonance imaging (MRI). Treatment usually consists of open or arthroscopic surgical excision, aiming for pain relieve and prevention of secondary lesions of the affected joint.

Methods

A retrospective case report of a 34-year old male patient who presented-with recurring pain in his right wrist after a hyperextension trauma two years prior to presentation was conducted. Plain radiographs showed round radiopaque bodies proximal to the pisotriquetral joint. Patient's history also revealed a Gitelman Syndrome (autosomal-recessive kidney tubule disorder) and HIV-Infection, which was sufficiently treated with antiretroviral therapy. Therefore, differential diagnosis included chondrocalcinosis due to the genetic renal condition. For further exploration, an MRI was perfor

Results

The MRI scan supported SC being the underlying pathology, additionally providing information about the exact position of the cartilaginous bodies. The patient was treated with open surgical excision of synovial tissue and five loose cartilaginous bodies from the pisotriquetral joint. The histopathological examination was consistent with SC. No perioperative complications occurred.

Conclusion

As symptoms and patient history of SC can be highly variable, awareness of this rare condition as a differential diagnosis needs to be established. Even though X-ray delivers almost pathognomonic hints towards this rare disease, it takes on average around five years until the correct diagnosis is given.

P13

Using the pronator quadratus sign to differentiate distal forearm fractures from simple wrist contusions in children. (11235)

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The pronator quadratus sign is a radiologic sign found on lateral wrist x-rays suggesting forearm fracture. While it has been described in the adult population, this sign has never been validated for the pediatric population. However, it is often used in children due to the biomechanical properties of growing bone that can make some fractures difficult to detect.

For our retrospective case-control study we measured different parameters of the pronator quadratus complex in 200 children that we normalized to their growth. Results confirm that there is a modification of the pronator quadratus complex following distal radius fractures compared to simple forearm contusions. We also found that the most significant and discriminating measure to differentiate fractures from contusions is the combination of the pronator muscle thickness and fat pad thickness.

P14

Necessity is the mother of invention: Case study of osteosynthesis of a distal ulna fracture using a posterolateral fibula plate (11246)

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Introduction

Isolated ulnar shaft fractures are among the rarer fractures, and clear guidelines for treatment are lacking. According to the current literature, a fracture dislocation greater than 25-50% or more than 10-15° angulation of the fragments is considered an indication for surgery. Nevertheless, the individual decision seems to remain in the foreground. A high complication rate is known, non-union and mal-union are the most common problems. This case study describes the decision making and therapy of such a fracture with an unusual plate osteosynthesis.

Case Report

A 36-year-old male patient presented to our emergency department with right distal forearm pain after a fall downstairs. Radiologically, an isolated distal ulnar fracture was diagnosed. This multifragmentary metaphyseal fracture was displaced approximately 1/3 of the shaft width. Furthermore, it was angulated five degrees and had significant malrotation. The patient, who worked in the foodservice industry, required a rapid return to work with a return to full functionality as soon as possible. Due to the dislocation and malrotation, as well as the patient's demands, we jointly decided on surgical treatment using osteosynthesis.

The near-joint fracture with a small distal fragment and the long length of the multifragmentary fracture zone proved to be a technical challenge. All known ulnar plates from various suppliers lacked the necessary size and stability or did not have enough angle locking holes in the distal plate area. Because of the anatomical similarity of the ulna and fibula, we also considered using a distal fibula plate. The Synthes® posterolateral distal fibula plate had the appropriate minimum length and the appropriate orientation of the angular stable holes. It was therefore chosen for the osteosynthesis. The operation went smoothly. After three months, the patient had hardly any complaints in everyday life, and the x-ray showed a healed fracture.

Conclusion

Even with a large selection of osteosynthesis materials, there may be limitations. It is worthwhile to plan every osteosyntheses well and to compare available materials thoroughly. But sometimes, it is also necessary to be creative and think outside the box.

POSTERS: SPINE

P15

Passive resistance of dorsal muscle and connective tissues against flexion of the spine (11354)

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Purpose

The passive resistance against flexion of the spine (e.g. during slumped sitting) arises by ligaments, fascia, and myoelectrically silent paraspinal muscles. The aim of this cadaveric study was to quantify contributions of the thoracolumbar fascia, paraspinal muscles and inter- & supraspinous ligaments (ISL/SSL) to the passive resistance to spinal flexion.

Materials and Methods

The pelvis of five freshly frozen human torsos was rigidly fixed and the model was passively flexed. The thoracolumbar fascia and paraspinal muscles were longitudinally separated from the bony structures, first from Th12-S1 and then from Th4-S1 in a stepwise manner. The inter- & supraspinous ligaments (ISL/SSL) were then incised horizontally and in plane in the same sequence. The angulation of S1 (control), Th12 and Th4 were measured with fluoroscopy.

Results

Dissection of the lumbar fascia led to an increase of 0.9 ± 0.3° of spinal angulation (Th4 to S1) and 1.8 ± 0.5° for the total thoracolumbar fascia. Dissection of the lumbar musculature increased this angulation by 3.1 ± 2.3 ° and 4.2 ± 1.8° in the whole thoracolumbar area. ISL/SSL incision led to a spinal angulation increase of 3.3 ± 1.8° for the lumbar area and 4.9 ± 2.5° for the total thoracolumbar incisions. Lumbar spinal angulation (Th12 to S1) increased by 1.9 ± 1.2° for lumbar fascial incision, by 2.7 ± 0.9° for muscular dissection and 4.8 ± 2.1° for ISL/SSL dissection.

Conclusion

The thoracolumbar fascia, the paraspinous muscles, and the ISL/SSL resist passively against spinal flexion with ISL/SSL contributing mostly. This biomechanical observation could be useful in choosing the best surgical technique for e.g. spinal decompression.

P16

Worse postoperative outcomes for "drop-outs", as predicted by machine-learning based model. (11361)

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Introduction

Lack of compliance with follow-up can threaten the validity of outcomes reported in registries and clinical studies. We used a published outcome-predictor model to predict (based on baseline characteristics) the outcomes of patients failing to return a questionnaire 12 months after surgery (dropouts) and compare them with the outcomes of those that did return a questionnaire (remainers).

Methods

The data of all patients with degenerative spinal disorders of the thoracic or lumbar spine included in our in-house spine outcomes registry from 1.1.2006 to 31.12.2017 were analysed. Using the data of remainers (8374/9189 (91%) cases), a model was developed to predict multidimensional outcome 12 months after surgery (COMI, and its domain scores) based on 20 key baseline variables (Müller et al 2021). This was used to predict the outcome of both dropouts and remainers. The groups were compared using unpaired t-tests.

Results

The predicted outcome scores of the remainers did not differ significantly ($p>0.05$) from their actual outcome scores, suggesting the model was sufficiently accurate. The mean baseline scores of dropouts were significantly ($p <0.05$) worse than those of remainers for most domains. The predicted outcome of dropouts at 12mo FU was significantly ($p<0.05$) worse than that of the remainers for all domains.

Discussion

Dropouts at follow-up introduced a significant and consistent bias in reported outcomes. Although the size of the effect was small in this particularly compliant cohort (with 91% follow-up at 12mo), when evaluating healthcare providers with poorer follow-up rates such a bias may be sufficient to threaten valid comparisons. The bias would overestimate the performance of hospitals with lower follow-up rates (perhaps also failing to detect poorly performing hospitals) and underestimate that of hospitals with high follow-up rates. If using spine surgery registries to perform benchmarking activities, the difference in follow-up rates between hospitals must be considered and adjusted for.

P17

Complementary Value of CT Scout View in the Recognition of Thoracolumbar Spine Injuries (11269)

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Introduction

Fractures of the thoracolumbar spine (TLS) are common in polytrauma. Prompt detection of spinal injuries is essential in the early resuscitation phase. Whole-body CT (WBCT) is used as standard diagnostic tool for spinal screening. Each WBCT starts with a CT scout view (SV) to prescribe and display locations of CT slices. Apart from its original purpose, SV may supply complementary information and be of value to operate as a diagnostic tool. There is dearth of literature investigating on the importance of SV in screening the spine. We aimed to investigate the reliability of SV to detect clinically relevant injuries of the TLS.

Methods

In this retrospective single-center study of prospectively collected data, we reviewed 200 patients undergoing WBCT in early resuscitation phase after trauma, admitted to our tertiary emergency center in 2019. Lateral and AP SV were independently analyzed by two senior spine surgeons and one senior radiologist including Th10-L5. Findings of the raters were compared to CT reconstructions. Fractures were ranked according to AOSpine Classification system. All data analyses were done in the R Language for Statistical Computing. Calculations of diagnostic performance (accuracy, sensitivity, specificity) was carried out using the pROC package. Rater agreement was calculated using Fleiss Kappa as implemented in the irr-package. Univariate and multivariate logistic regressions were estimated using the glm function.

Results

Overall, 39 patients had a fracture within the included region. Of these, N = 17 had multiple fractures (range 2-4). In sum, there were 39 mild fractures (type A), 16 were moderate (type B) and 1 severe (type C). The pooled accuracy was 78%. Pooled sensitivity and specificity were 88% and 76%, respectively. For experts' ability to detect moderate or severe injuries only (type AO B and C), sensitivity was 94%. All raters correctly identified the single type C injury. In cases of the right decision, the average confidence level was 74% for lateral and 65% for AP view.

Conclusion

SV review may serve as a valuable tool for early detection of spinal injuries in the TLS before CT constructions are available. Particularly in fractures of type B and C according to AOSpine, our data revealed a high sensitivity in detection and appraisal. SV may accelerate spinal screening in the management of polytrauma patients.

P18

Computational model predicts risk of spinal screw loosening in patients (11333)

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Introduction

Pedicle screw loosening after spondylodesis surgery is a common complication and it has been reported to occur in more than 50% of cases among patients with osteoporotic bone. Pre-operative knowledge about the risk of insufficient screw fixation might lead to more personalized and therefore successful treatment. In this case-control study, the use of computational biomechanical models for quantifying screw loosening risk was evaluated.

Methods

Based on pre-operative and post-operative imaging data, individual biomechanical models were retrospectively generated for 16 patients who underwent spondylodesis surgery. Screws that successfully integrated into the vertebral bone (control group) were compared to loose screws (case group). For this purpose, finite element models rendering the entire instrumented region of each patient's lumbar spine were generated. Joint loads obtained from patient-specific musculoskeletal simulations were applied to render physiological loading during standing. The mean Hounsfield unit values, von Mises Stress, and a parameter quantifying the relationship between the predicted stress and bone strength ("loading factor") around the screw were evaluated. Additionally, models consisting of only a single vertebra and a screw were prepared for 26 vertebrae and the screws were loaded along the longitudinal axis to simulate pull-out.

Results

The mean Hounsfield unit and the stress values in the vicinity of the screws differed significantly between the case and the control group ($p = 0.017$ and $p = 0.029$ for the Hounsfield unit and stress read-out, respectively). However, discrimination and predictability were best when considering the loading factor ($p = 0.001$, R2Pseudo = 0.34, AUC = 0.87). Specifically, a loading factor higher than 35% suggests a high risk of loosening, while a factor lower than 10% indicates an almost 0 risk of loosening to occur. Finite element analysis of screw pull-out models suggests that no association exists between pull-out strength and implant loosening ($p = 0.7953$).

Conclusion

The results of this study indicate that the risk of implant fixation failure could be reliably quantified with a biomechanics-based score describing the relationship between local bone mechanical properties and the simulated stress. With the outlined approach, a cost-efficient improvement of patient care might be possible. Next, a prospective study is required to further assess the clinical feasibility of the method.

P19

SPHEROIDS DERIVED FROM HUMAN NASAL CHONDROCYTES AS PROMISING CELL SOURCE FOR NUCLEUS PULPOSUS REPAIR (11146)

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Introduction

Cell-based therapy for degenerative disc disease (DDD) still faces limitations associated with cell engraftment in a harsh microenvironment. Recent studies show that spheroids (multi-cellular aggregates with self-produced matrix) may enhance cell adhesion, resistance, and function. Nasal chondrocyte (NC) spheroids (NCS) could be an excellent source for nucleus pulposus (NP) repair, as NC survive in harsh microenvironments better than traditionally used MSCs. We aim this study at analysing the therapeutic potential of NCS for NP repair, namely their capacity for injectability, matrix accumulation, and tissue integration.

Methods

Human NCS were fabricated for 1-7 days with or without standard chondrogenic supplements. NCS size, shape, injectability, elastic modulus, biochemical content, and gene/protein expression were evaluated. The fusion NP model was generated from human NP spheroids formed for 14 days. NCS-NPS fusion kinetics and viability were determined in DDD-mimicking conditions (inflammation, hypoxia, acidity, low glucose). The effect of NCS injection through a clinically relevant spinal needle into an ex vivo cultured bovine intervertebral disc (IVD) were investigated.

Results

Non-adhesive technology allowed the fabrication of NCS compatible with a spinal needle (22G). Chondrogenic supplements time-dependently increased E of NCS in correlation with gene/protein expression of collagen ($p < 0.05$), when compared to medium without supplements that produced NCS with stable elastic modulus (E, ~5 kPa). Neither NCS-NPS fusion nor viability were impaired by the DDD mimicking conditions. The injection into the bovine IVD did not disrupt the structural integrity of the NCS.

Conclusion

Our data indicate that NCs cultured as spheroids can produce NP-compatible matrix, develop biomechanical properties similar to NP tissue, and possess the capacity to integrate within NP microenvironment. Moreover, specific NCS properties are potentially tunable by culture supplements. These results need to be verified in a whole disc organ culture bioreactor, towards demonstration of the functionality of NC for NP repair.

P20

Gait function in patients with cervical spinal myelopathy before and after decompression surgery: a systematic review and meta-analysis (11408)

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Introduction

Cervical spondylotic myelopathy (CSM) is the most common cause of cervical spinal cord dysfunction in adults and it is the result of chronic degenerative changes of the cervical spine. The compression of the spinal cord leads to ischemia, inflammation, and neuronal apoptosis with a consequent impairment of the neurological function. Gait impairment is one of the most frequent signs of CSM. The aim of this study was to systematically review the literature to investigate the alterations of spatio-temporal parameters of gait in patients affected by CSM.

Methods

Human-based studies assessing and reporting spatial and/or temporal gait parameters in patients with CSM were included. Data sources were

Embase, Medline, and the Core Collection of Web of Science. Spatio-temporal parameters of gait were extracted from the full texts. Meta-analyses were performed to investigate differences in gait parameters between patients with CSM and controls and the influence of surgical decompression on gait parameters.

Results

12 studies reporting on 253 CSM patients and 252 healthy controls met the inclusion criteria. Six studies compared CSM patients with healthy controls, 3 studies compared the same cohorts of CSM patients before and after surgical decompression, and 3 studies performed both comparisons. The mean follow-up time was 11.2 months (ranging from 3 to 32.4 months). Four studies had a level of evidence (LOE) of 2, 8 studies had a LOE of 3. Compared to healthy individuals, CSM patients had slower gait speed (Standardized Mean Difference (SMD) = -1.18 [-1.63, -0.73]), lower cadence (SMD = -0.77 [-0.96, -0.57]), shorter stride length (SMD = -1.27 [-1.57, -1.00]), greater step width (SMD = 0.53 [0.33, 0.74]), and longer stride time (SMD = 0.77 [0.44, 1.09]). No significant differences were found for single and double-limb support time. After surgical decompression, CSM patients showed an improvement in gait speed (postoperative vs. baseline SMD 0.54 [0.27, 0.80]), and no significant differences in other spatio-temporal parameters.

Conclusion

Patients affected by CSM show worse spatio-temporal parameters of gait than healthy people. Gait speed is the only spatio-temporal parameter of gait that improves significantly after surgical decompression, suggesting that changes in gait parameters other than walking speed are not improved by surgical decompression and long-term gait retraining may be warranted.

POSTERS: HIP

P21

Which femoral neck for a dual mobility cup? A biomechanical evaluation. (11158)

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Introduction

The principle of dual mobility cup relies on three prosthetic articulations with the “small articulation” between the polyethylene (PE) mobile component and the femoral head, and the “large articulation” between the PE mobile component outer surface and the metal-shell. A “third articulation” is described between the PE mobile component chamfer and the femoral neck that allows the mobile component to displace at the large articulation upon femoral neck contact with minimal resistance. This study aimed to evaluate PE damage and wear lesions to the chamfer of mobile component under mobile and fixed femoral neck impingement conditions at the third articulation, and to determine which femoral neck characteristics should be considered with a dual mobility cup to limit those lesions.

Methods

Two femoral neck geometries (cylindrical and quadrangular) with 2 surface finishing roughness (rough and polished), and 2 head-to-neck ratios (28- and 22.2-mm diameter femoral heads) were evaluated in a hip simulator testing. For each characteristic, 6 femoral necks were tested with 6 dual mobility cups under fixed and mobile femoral neck impingement simulating in vitro mechanical conditions of either a well-functioning dual mobility cup or dual mobility cup with restricted motion at the large articulation such as observed in case of arthrofibrosis. Chamfer PE damage and volumetric wear were evaluated and compared for each femoral neck characteristic and impingement condition.

Results

Under mobile impingement condition, femoral neck characteristics did not significantly affect PE damage and wear lesions to the chamfer ($p = 0.283$ to 0.810). However, under fixed impingement condition, significantly higher PE damage and wear lesions to the chamfer were produced by the quadrangular geometry compared to the cylindrical geometry ($p = 0.004$ to 0.025). In addition, with the quadrangular geometry, rough surface finishing was demonstrated to increase volumetric wear of the chamfer ($p = 0.009$). No significant influence of head-to-neck ratio was observed on PE damage and wear lesions to the chamfer ($p = 0.244$ to 0.714).

Discussion

This biomechanical study emphasized that femoral neck characteristics are critical in total hip arthroplasty when using a dual mobility cup and tend to favor a cylindrical geometry of femoral neck particularly whether fixed impingement at the third articulation occurs with time in vivo.

P22

Intraoperative Imaging in Hip Arthroplasty − a meta-analysis and systematical review of randomized controlled studies and observational studies (11300)

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Background: Intra-operative fluoroscopy (IFC) is becoming increasingly popular in total hip arthroplasty, with the aim to achieve better component positioning and reduction of revision rates. This meta-analysis investigates the benefit of IFC by comparing it to intra-operative clinical assessment only. Primary outcome is component positioning. Secondary outcomes include complication and revision rates.

Methods

PubMed, Embase and Cochrane Central Register of Controlled Trials were searched for both randomized clinical trials (RCT) and observational studies. Effect estimates were pooled across studies using random effects models and presented as weighted odds ratio (OR) with corresponding 95% confidence interval (95%CI).

Results

A total of 10 observational studies with a total of 1224 patients were included. No randomized trials were found. IFC showed a significant reduction in femoral offset-difference (3.6 vs 4.4mm, p-value 0.01). There is no significant difference in acetabular cup position (inclination and anteversion), leg-length discrepancies, revision (none reported) or overall complication rates.

Conclusion

The current meta-analysis found a reduction in offset-differences to be a potential benefit of intraoperative fluoroscopy in hip arthroplasty. However, no differences in cup positioning, leg length discrepancy, the incidence of complications or revision surgery were detected. Given the lack of prospective data, the significance of intraoperative fluoroscopy in hip arthroplasty remains unclear. Further research is warranted.

P23

Persistent Femoral Neck Non-Union despite Intertrochanteric Valgisation Osteotomy : Relevance for secondary CAM type Impingement (11351)

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Introduction

Valgisation osteotomy has successfully been used for many years as a treatment in delayed union of femoral neck fractures, through conversion of the fracture shear forces into compression forces (1,2). In case of persisting non-union of after valgisation osteotomy, femoral acetabular impingement should be excluded. Contact between fracture callus and the acetabular rim in flexion of the hip may result in micromotion of the fracture zone and limit or prevent consolidation.

Methods

We report a case of persisting non-union of a femoral neck fracture in a 25-year-old patient after a fall from 6m. Initial osteosynthesis was performed with 3 cannulated 7.3 mm screws (Fig. 1A and C). At 9 months follow up the patient presented with a symptomatic non-union with reduced ROM (E/F 0/0/90°, IR/ER 10/0/25°). A bone-scan showed evidence of preserved femoral head perfusion (Fig 2A). Therefore, an intertrochanteric valgisation osteotomy was performed using a 130° blade plate. (Fig. 1 B and D). A concomitant offset correction was not necessary since the femoral head-neck junction was spherical. At 11 months after valgisation, the patient presented with a healed intertrochanteric osteotomy, a persistent femoral neck non-union and secondary cam-type deformity due to excessive callus formation, persistent pain, and a limited ROM.

Results

Surgical hip dislocation with a trochanteric osteotomy and cam reduction was done 1 year after re-osteosynthesis. Femoral head necrosis was excluded by a drill hole, which showed bleeding. The cam deformity was clearly visible at the femoral neck (Fig. 2B). After cam reduction, mobilization under direct view showed an impingement free range of motion of the hip. A re-re-osteosynthesis of the femoral fracture was performed using a Synthes© Pediatric hip plate with an autologous bone graft to treat the pseudoarthrosis. Follow up at 2,5-year after final osteosynthesis and 1,5 years after hardware removal, showed a completely healed femoral neck fracture with minimal joint degeneration. Clinically the patient showed an improved ROM (E/F 0/0/90°, IR/ER 30/0/40°) with only intermittent hip pain most likely due to beginning joint degeneration.

Conclusion

In persistent non-union of femoral neck fractures after valgisation osteotomy, secondary CAM impingement caused by hypertrophic callus formation must be excluded. To obtain complete consolidation and good clinical results a CAM reduction by surgical hip luxation should be considered.

P24

Results of total hip arthroplasty in patients younger than 25 years (11138)

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Background

Total hip arthroplasty (THA) is one of the most performed surgery in orthopedics today.

It shows good functional results and allows a notable reduction in pain.

The majority of THA concern a population with an average age of 69 years with primary hip osteoarthritis as the main etiology.

In younger patients the etiology is mainly due to rare hip conditions during childhood and adolescence. It is thought that pediatric hip disorders account for about 9-10% of all primary THA.

We performed an observational study evaluating the quality of life at medium and long-term follow-up after THA performed before the age of 25 years.

Method

We performed a retrospective monocentric study including all patients that benefits from a THA before the age of 25 years at our tertiary referring orthopedic center between January 2008 and December 2018.

Patients were then invited to a clinical follow-up were they concomitantly completed the Harris hip score as well as the Oxford hip score.

Etiology, previous surgeries, gender and age at the moment of THA were recorded.

We performed a descriptive statistical analysis of the demographic data.

The Spearman correlation test revealed a statistically significant strongly positive correlation between the two scores ($\rho = 0.811$, p-value <0.001).

Results

Of the 19 patients (22hips) with a THA 11 patients with a total of 12 THA were included.

Six patients (60%) were males. Mean age at surgery was 16 years. Mean follow up was 6 years (min 2 years, max 9 years).

Regarding the Harris and Oxford hip scores, the median score was 88 (+/- IQR 17,5), with a mean at 81 (+/- SD 16,4) and 42,5 (+/- IQR 8,75) with a mean of 39,5 (+/- SD 8,1) respectively.

At last follow-up, no patients had signs of implant loosening or had needed revision surgery

Conclusion

THA provides improved hip function and stable implant fixation at short- to midterm followup.

P25

High-energy blunt pelvic ring injury incidence and polytrauma case load in a single level-1 trauma center during CoVid-19 related pseudo-lockdown measures: a registry study. (11257)

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Introduction

Pelvis ring injuries are potentially lethal lesions associated to polytrauma patients (PP) needing a present and efficient trauma team for their management.

The purpose of this study was to evaluate the incidence of blunt pelvic ring injuries type B or C (PRI B/C), according to the OTA/AO classification, in a defined population and the absolute number of PP in a single level-1 trauma center during the CoVid-19 pandemic related pseudo-lockdown period.

Methods

This retrospective cohort study was conducted in a level-1 trauma center (~500000 inhabitants). A nation-wide pseudo-lockdown was established from March 16th to June 19th 2020.

Data on PRI B/C incidence and PP were obtained for each year period (y.p.) from 2014 to 2020 using the institutional Severely Injured Patients' Registry.

PRI B/C inclusion criteria were ≥16 years old and blunt PRI; exclusion criteria were patients pronounced dead before admission, transferred from another institution >24hours after trauma or living outside the defined institution's catchment area and penetrating/blast/burn/electrical injuries.

PP inclusion criteria were ≥16 years old and ISS ≥16; exclusion criteria were patients pronounced dead before admission or transferred from another institution >24hours after trauma.

Descriptive comparisons were made between the pseudo-lockdown period and corresponding periods in 2014-2019, and between the 2020 y.p. and each y.p. from 2014 to 2019.

Results

The pseudo-lockdown period 2020 had 6 PRI B/C: incidence = 5.4 per 100,000 persons per year, which was in range with the corresponding periods in 2014-2019: 4(2014,2015)-10(2019), incidence = 3.8-9.1 per 100,000 persons per year.

The 2020 y.p. had 14 PRI B/C: incidence = 3.3 per 100,000 persons per year, which was in range with each y.p. from 2014 to 2019: 14(2014)-26(2017), incidence = 3.3-6.2 per 100,000 persons per year.

The pseudo-lockdown period 2020 had 34 PP which was in range with the corresponding periods in 2014-2019: 20(2015)-42(2016).

The 2020 y.p. had 129 PP which was in range with each y.p. from 2014 to 2019: 109(2015)-151(2017).

Conclusion

Although pseudo-lockdown was installed among other goals to decrease trauma-related hospital admissions, PRI B/C incidence and the absolute number of PP remained within the range of previous years. This information could help for future health strategy planification.

P26

Reconstruction of severe acetabular bone defects with dual mobility cup cemented into a Ganz reinforcement ring or a porous tantalum shell in revision THA: a comparative study (11386)

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Introduction

Different techniques of acetabular reconstruction during revision total hip arthroplasty (rTHA) were described in literature depending on the severity of acetabular bone defect. To reconstruct severe defects, the most common options include the use of a reinforcement device or a porous tantalum reconstruction shell in association with a cemented dual mobility cup (DMC). However, to our knowledge, no previous study compared acetabular reconstructions performed with these two techniques in rTHA associated with severe bone defects. Therefore, this monocentric study aimed to evaluate their indications and to compare them in terms of complications, survivorship and restoration of the hip center of rotation (CoR).

Methods

From 2012 to 2019, a continuous series of 81 rTHA with acetabular reconstruction performed with a DMC cemented into a Ganz reinforcement ring (41 rTHA) or a Trabecular Metal (TM) reconstruction shell (40 rTHA) was prospectively included in our registry and retrospectively analyzed by two independent surgeons at latest follow-up. The inclusion criteria were Paprosky IIB to III A acetabular bone defects. The Paprosky IIIB defects leading to pelvic discontinuity were excluded. Restoration of the CoR was evaluated using the Pierchon's method.

Results

No difference was observed in terms of indications for rTHA. The severity of acetabular defect was lower in the Ganz group (p-value <0.01 (χ2)).

After a mean follow-up of 5 years, 18 % of the hips sustained new revision(s). No aseptic loosening happened in the TM group, 7 in the Ganz group. No difference was observed in terms of infection and instability.

The CoR's restoration was accurate in both groups apart from the vertical CoR in Paprosky IIIA defects (mean cranialization of 11 mm in the TM group / 11 rTHA concerned vs. 7 mm in the Ganz group / 7 rTHA concerned).

Conclusion

These two techniques are both validated for moderate to severe acetabular bone defect reconstruction during rTHA. However, the risk of aseptic loosening was higher with the Ganz technique while the severity of acetabular bone defect to be reconstructed was lower than that managed with the TM technique. Both techniques ensured an accurate restoration of the hip CoR. However, cranialization of the CoR was more frequent with the TM reconstruction shell technique in acetabular reconstruction for Paprosky IIIA bone defects, mainly explained by the "jumbo cup" effect related to this reconstruction technique.

P27

The different failure modes of the connecting elements of the modular hip arthroplasty revision stem Revitan (11131)

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Introduction

Fracture of the femoral stem is the cause of ~1 % of revisions after total hip arthroplasty. The risk increases intrinsically with modularity, whereby modularity is particularly useful in revision arthroplasty. We present 7 cases of failure of a specific modular, tapered, fluted, titanium alloy Revitan stem and analyse the different failure modes.

Methods

Retrospective review of all Revitan stems revised at our institutions due to implant failure and analysis of clinical presentation, diagnostic workup, and failure mode. The retrieved components were analyzed by optical and scanning electron microscopy.

Results

A total of 7 cases were included. There was a significant time lag between symptom onset and correct diagnosis. Conventional radiographs and low-dose CT scans (CT scout imaging) were decisive for diagnosis. All failures occurred at the level of the connection between the proximal component and the distal part of the stem. Three different failure modes were identified: loosening of the proximal component, fatigue fracture of the connection pin, and distal loosening of the connection pin. No alterations of the microstructure or deviation from manufacturing specifications regarding dimensions were observed. Failure was caused by mechanical overload.

Conclusion

Conventional radiographs are the mainstay in identifying failed modular stems. Repeated radiographs and low-dose CT scans may be helpful additions. No single modification of the connection will address all possible failure modes. Modularity of revision stems offers advantages up until insertion of the definitive stem. Monoblock definitive stems might overcome the potential mechanical weaknesses of modularity and should be considered in relatively young, heavy and active patients.

POSTERS: KNEE

P28

Flouroscopic control of tibial torsion after intramedullary nailing of tibia fractures, a technical trick (11200)

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After intramedullary nailing of tibia shaft fractures, torsional malalignment greater than 10° occur in up to 41% of operated legs. The reason is the difficult clinical assessment of rotation intraoperatively, the large variation in absolute torsion of the tibia and the absence of established reliable methods to fluoroscopically evaluate tibial rotation and compare to the contralateral side. We present here a fast and low-tech intraoperative method on how to achieve identical tibial torsion of the operated and non-injured side. The method can be used for tibia shaft and metaphyseal fractures and only requires a normal C-arm fluoroscope with two monitors. First, a true lateral image of the knee on the non-injured side with the femoral condyles aligned is obtained. Second, with the leg and the C-arm rotation and tilt fixed, the fluoroscope is moved parallel to the patient axis and a lateral ankle image is obtained and saved. The fibula position relative to the tibia at the level of the Volkmann tubercle on the lateral view defines the torsion of the tibia. The sequence described above is repeated on the operated side after implantation of the nail before proximal locking. On the operated side, the fibula position relative to the tibia should be identical to the non-injured side before proximal locking takes place. Otherwise a rotational malalignment is present and must be corrected. The comparison between operated and non-injured side is easy on a fluoroscope with two monitors. The complete examination takes a few minutes and has minor additional radiation exposure. We performed the intra-operative torsion control in 10 patients and performed a post-operative low-dose CT-control of the torsion of both legs and found the rotational deformity to be less than 10° in all patients.

P29

Is the rate of quadricipital tendon rupture lower after total knee arthroplasty using subvastus approach compared to medial para-patellar? (11215)

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Introduction

Medial para-patellar approach (MPA) is the gold standard to perform Total Knee Arthroplasty (TKA). Clinical results after TKA using MPA compared to subvastus approach (SA) are similar but the rate of quadricipital tendon rupture is rarely reported. The objective of this study was to identify if there is a difference concerning quadricipital tendon rupture using these two approaches and risk factors.

Methods

A retrospective comparative study was conducted in our institution. Patients who underwent TKA performed by MPA and SA between 2015 and 2020 were included. Minimum follow-up was one year and patients who presented history of infection, previous surgeries of extensor apparatus were excluded. Thus, 449 TKA performed by MPA were included and compared to 183 TKA performed by SA (Mean age 67 +/- 9.2 years / BMI 30.5 +/- 5.9 Kg/m2 / Sex ratio: 371F/261H). Comorbidities of patients as diabetes, obesity, renal insufficiency and neurological disorders were analyzed to identify risk factor of quadricipital tendon rupture. Mean follow-up was 1.1 years +/- 0.3 years.

Results

Rupture of quadricipital tendon were higher in TKA performed by MPA (2,3%) compared to TKA performed by SA (0%) ($p < 0.05$). In the 9 patients (Mean age 71 +/- 10.8 years / Sex ratio: 4F/5H) with quadricipital tendon rupture 1 have diabetes, 3 have BMI >30, 1 have renal insufficiency and 0 have neurological disorders, but none comorbidities were identified as risk factors.

Conclusion and perspectives

This study suggest that TKA performed by SA have lower rate of quadricipital tendon rupture than a TKA performed by MPA and no risk factors were identified. Prospective study with a larger number of patient are needed to confirm these results, especially regarding risk factors.

P30

Can a simple biomechanical model help improve tibial osteotomy planning? (11338)

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Introduction

For planning of tibial osteotomies (TO) in patients with osteoarthritis, the target mechanical axis (MA) of the leg must be considered. MA is affected by the load distribution at the knee joint, which changes with surgery, making the prediction of the post-op MA during the planning not trivial. While complex computational biomechanical models could predict the change of MA under different loading conditions, they require subject-specific biomechanical data that is not usually collected in standard clinical procedures. Here, we investigate whether a simple model, based on generally available clinical data, could help in predicting post-op MA.

Methods

Data was collected from 18 knees with OA: non-Weight-Bearing (nWB) Computed Tomography, MRI and standing (WB) EOS radiographs (pre- and post-op). Knees were divided in 2 groups according to the type of condylar contact observed in pre-op WB: single (SCC) or double condylar contact (DCC). Bone surfaces were segmented from CT and used to build a simple 2-degrees of freedom model of the knee. Contact was defined between femur and two planes fitted on the medial and lateral tibial plateau, offset by the average thickness of the respective cartilage, based on MRI. We simulated virtual TO based on the post-op tibial geometry, then used three methods to predict the post-op MA: using femur pose relative to tibia from 1) pre-op nWB, 2) pre-op WB and 3) computed from model. The difference (dMA) between the MA obtained from the 3 methods and the ground truth MA from post-op EOS determined the prediction accuracies of the post-op WB MA.

Results

Average dMA for all knees was 0.71°, 1.36° and 0.51° for the nWB, WB and biomechanical methods, respectively. For the SCC group, dMA was 1.17°, 2.18° and 0.62°, while dMA for the DCC group was 0.35°, 0.72° and 0.41°.

Conclusions

For knees with pre-op double condylar contact, the pre-op nWB pose seems to be a good predictor of the post-op WB MA and could be used to support TO planning, without the need of biomechanical models. For patients with condylar lift-off, nWB was less accurate. Possibly, these patients had higher laxity in the knee joint, leading to some residual deformation or incomplete condylar contact, even in the absence of significant external loads. In these cases, even a simple model, seems useful in providing information about the pose of the leg when both condyles are in full contact and thus, provide slightly more accurate prediction of post-op MA.

P31

No difference in patient-reported satisfaction after 12 months between customised individually made and off-the-shelf total knee arthroplasty (11165)

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LEONARDO – Ärzte für Orthopädie und Traumatologie

Purpose

A subset of patients is usually not satisfied after a total knee arthroplasty (TKA). Customised individually made (CIM) TKA are deemed to overcome drawbacks of classical off-the-shelf (OTS) TKA, but evidence is still sparse. To get a better understanding of the patients' perspective, their satisfaction after TKA and potential problems in daily life, an evaluation of patient-reported outcome measures (PROM) is necessary. The aim of this study was to compare satisfaction of patients with CIM and OTS TKA.

Methods

We analysed clinical and patient-reported outcome measures (PROM) between patients with CIM and OTS TKA between January 2017 and September 2020.

The primary outcome was patient satisfaction after 12 months. Secondary outcomes were the Knee Society Score (KSS), the Knee injury and Osteoarthritis Outcome Score (KOOS), the Forgotten Joint Score (FJS-12) and the EQ-5D-3L after 4 and 12 months. Differences between pre- and postoperative data were analysed with paired t-tests for continuous variables and Wilcoxon signed rank test for categorical variables. To support the interpretation of PROM results, we have calculated the proportion of patients whose PROMs improved at least by the minimal important difference (MID).

Results

Data was analysed from 74 CIM TKA and 169 OTS TKA. Patients with CIM TKA were slightly younger (CIM 67.1 years, OTS 69.7 years, p = 0.019), more often male (CIM 55%, OTS 40%, p = 0.035), had a lower body mass index (CIM 26.6 kg/m2, OTS 28.7 kg/m2, p <0.001), a lower KSS (CIM 52.8, OTS 57.1, p = 0.018) and partially higher preoperative PROMs.

Patient satisfaction after 12 months was high and comparable (CIM 87%, OTS 89%). All PROMs improved for both groups (p <0.001) and did not differ after 12 months (p >0.063). The majority of patients improved above the MID (range 65% to 89%) and reported a clear overall improvement (CIM 86%, OTS 87%). The postoperative KSS, notably regarding knee stability, was higher for CIM TKA (p <0.001).

Conclusion

No difference was found in patient satisfaction between CIM and OTS TKA after 12 months. In both groups, patient satisfaction was high and PROMs improved considerably.

(Comment: This abstract was written as part of a paper published before the congress. If it does not result in a Free Averaging, we could imagine writing a poster if that is in your interest.)

P32

Hohe Patientenzufriedenheit ein Jahr nach Rekonstruktion der originären Beinachse und Gelenklinie in der Knietotalendoprothetik (11280)

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Fragestellung

Es existieren verschiedene Strategien, um die Achsdeformität im Rahmen der Implantation einer Knietotalendoprothese zu korrigieren, inklusive des mechanischen, anatomischen und kinematischen Alignments, welche die knöchernen Resektionen bestimmen. Patienten-spezifische Knietotalendoprothesen ermöglichen weitergehende Anpassungen der Gelenkschräge (joint line obliquity, JLO) innerhalb der Implantatkomponenten. Die neu entwickelte patienten-spezifische ORIGIN-Prothese verfolgt das Ziel, die originäre Beinachse, originäre Gelenklinie und individuell anatomische Gelenkflächen zu rekonstruieren.

Material und Methoden

Im Rahmen einer fortlaufenden, multizentrischen, prospektiven Kohortenstudie kommen als klinischer Score der KSS, als PROM der Oxford und Forgotten Joint Score und die Erfassung der Zufriedenheit zur Anwendung. Zusätzlich erfolgt eine radiologische Analyse. Untersuchungen finden präoperativ, nach 3 Monaten und dann in jährlichen Abständen statt.

Ergebnisse

Zwischen CE-Zertifizierung in 8/2018 und Zwischenauswertung in 2021 wurden insgesamt 434 Patienten eingeschlossen. Von 271 Patienten liegen 1-Jahres-Ergebnisse vor. Die Patientenzufriedenheit 1 Jahr postoperativ ergab 96% zufriedene bis sehr zufriedene Patienten, 2% unentschlossene, und 2% unzufriedene. Die Frage, ob sie sich der Operation noch einmal unterziehen würden, beantworteten 98% mit Ja. Der Forgotten-Joint-Score verbesserte sich von 16,5 auf 65. Der Oxford-Score verbesserte sich von 22 auf 41. Der Funktionsscore des KSS verbesserte sich von 54 auf 97. Der Kniescore des KSS verbesserte sich von 30 auf 95. Die durchschnittliche Flexion verbesserte sich von 118 auf 127 Grad. Die Revisionsrate nach 1,8 Jahren betrug 0,9%.

Schlussfolgerung

Die mit der neu entwickelten patienten-spezifischen ORIGIN-Prothese umgesetzten Ziele der Rekonstruktion der originären Beinachse und Schräge der Gelenklinie führen zu guten Frühergebnissen. Mittel- bis langfristige Ergebnisse und randomisierte Studien müssen dies noch bestätigen.

P33

No improved "ligamentization" with preservation of the distal Hamstrings insertions in anterior cruciate ligament reconstruction assessed on 3- and 6-months postoperatively MRI – a prospective randomized controlled study. (11346)

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Objectives

To evaluate if in anterior cruciate ligament (ACL) reconstruction, the preservation of the distal insertion of the hamstrings leads to an improved "ligamentization" process evaluated on sequential postoperative 3 tesla MRI.

Methods

25 active patients with traumatic ACL tears without relevant accessory knee lesions were prospectively enrolled and randomized into 11 patients (Group HP; mean age ± SD: 31.8 years ± 11.4; M : F 5 : 6) who underwent ACL reconstruction with preservation of the distal insertions of the hamstrings and 14 patients (Group HD; mean age ± SD: 27.6 ± 10.6; M : F : 12 : 2) who underwent ACL reconstruction with a classic detachment of distal insertion of the hamstrings. Groups were comparable for age and gender.

In all patients a classical double-tunnel anatomical technique was used. The graft was proximally fixed with an EndoButton in both groups.

Distally, in order to preserve the Hamstrings vascularization in group HP, after the graft tensioning, only the free end of the graft was fixed with a stable just outside the tibial tunnel without damaging the preserved distal Hamstring insertion. In group HD the distal ends of the graft were fixed in a classic technique with an interference screw.

The "ligamentization" process was evaluated on 3- and 6-months postoperative MRIs as follows: ALC signal intensity measured with the Signal/Noise Quotient (SNQ) at the intratibial, intra-articular and intra-femoral portions; graft integration evaluated as presence of hyperintense signal at the bone-graft interface. The graft inclination was assessed in

grades on the sagittal plane. Radiological assessments were performed from two observers and the mean value of each measure was used for statistics. All measures were compared between groups with the Mann-Whitney Test.

Results

The SNQ at 3- and 6-months postoperatively did not differ at the intratibial, intra-articular and intra-femoral ACL portions between groups. Graft integration evaluated as presence of hyperintense signal at the bone-graft interface was present in all patients at 3 and 6 months postoperatively.

The mean ACL inclination did not differ significantly between groups and was 45.7° ± 4.9° in group HD and 48.2° ± 4.7° in group HP.

Conclusions

The preservation of the distal insertion of the hamstrings seems to not influence the "ligamentization" process assessed on 3 and 6-months postoperative MRIs.

P34

Anatomical Analysis Of Different Helical Plate Designs For Distal Femoral Fracture Fixation (11270)

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Background

Helical plates potentially avoid the medial neurovascular structures of the thigh. Recently, two plate designs (90°- and 180°-helix) proved similar biomechanically behavior compared to straight plates.

Aims

(1) feasibility of applying 90°- and 180°-helical plates in MIPO-technique to the femur, (2) Assess the distances to adjacent anatomical structures which are at risk, (3) Compare these distances with medial straight plates, and (4) Correlate measurements performed during anatomical dissection with CT-angiography.

Methods

MIPO was performed in ten cadaveric femoral pairs using either a 90°-helical 14-hole-LCP (group 1) or a 180°-helical 15-hole-LCP-DF (group 2). Using CT-angiography, distances between femoral arteries and plates as well as distances between plates and perforators were evaluated. Following, specimens were dissected, and distances determined again. All plates were removed, and all measurements were repeated with straight medial plates (group 3).

Results

Closest overall distances between plates and femoral arteries were 15mm (11-19mm) in group 1, 22mm (15-24mm) in group 2 and 6mm (1-8mm) in group 3 with a significant difference between group 1 and group 3 ($p < 0.001$). Distances to the nearest perforators were 24mm (15-32mm) in group 1 and 2mm (1-4mm) in group 2. Measurement techniques (visual after surgery and CT-angiography) showed a strong correlation of 0.972 ($p < 0.01$).

Conclusions

MIPO with 90°- and 180°-helical plates is feasible and safe. Attention must be paid to the medial neurovascular structures with 90°-helical implants and to the proximal perforators with 180°-helical implants. Helical implants can avoid medial neurovascular structures compared to straight plates although care must be taken during their distally insertion. Measurements during anatomical dissection correlate with CT-angiography.

P35

Treatment of multiligamentous knee injuries with primary repair and ligament bracing – a viable solution (11379)

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Introduction

Multi-ligamentous knee injuries (MLKI) are rare but severe injuries. Different surgical techniques have been described for treatment. Frequently, conservative approaches and surgical reconstruction using auto- or allograft are combined. The aim of this work was to evaluate the mid-term results of primary surgical repair and ligament bracing.

Methods

Twenty-two patients (5 women, 17 men) with a mean age of 45 ± 15 years with MLKI were followed-up at a mean of 49 ± 16 months after surgical treatment including primary repair and ligament bracing. MRI, stress radiographs and outcome scores were obtained. Clinical examination including hop tests and force measurements for flexion and extension was perfor

Results

The mean difference in Tegner score was 2 ± 1 (pre-injury >post-injury). The outcome scores showed mean values of 84 ± 15 (Lysholm), 73 ± 15 (IKDC) and 65 ± 25 (ACL-RSI). The injured knee showed a mean 21 ± 12° lesser range of motion compared to the uninjured knee. Ten patients felt fit enough to perform hop tests and showed a mean deficit of 7 ± 17% compared to the uninjured leg. The mean force deficit was 19 ± 18% for extension and 8 ± 16% for flexion. Stress radiographs revealed 11 ± 7 mm higher anterior-posterior translation on the injured side. Four patients had secondary ligament reconstructions due to persistent instability and seven underwent arthroscopic arthrolysis due to stiffness. A significant increase of osteoarthritis was found for the medial, lateral and patellofemoral compartment ($p = 0.007$, $p = 0.004$, $p = 0.006$).

Conclusion

Primary repair and ligament bracing of MLKI leads to satisfactory clinical mid-term results. Limited persistent radiological instability and a significant increase in osteoarthritis were observed, which is well-known after those injuries. Twenty percent of the patients required secondary reconstruction of specific ligaments.

P36

Subjective knee apprehension after anterior cruciate ligament reconstruction is not correlated with muscle strength, balance and stability. (11161)

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Introduction

Anterior cruciate ligament (ACL) reconstruction is performed with aim to return to sport (RTS) and lower the risk of further knee injury. RTS is found in 82% athletes, however only 50% still perform at the same level, although rerupture rate is low. Inadequate rehabilitation, muscle weakness, poor movement quality have shown to be risk factors for rerupture. Knee apprehension is important to assess before RTS, which can be evaluated with ACL-RSI score. Sport testing battery is another element to consider, including muscle strength, balance and stability. Purpose of this study was to observe if there was a correlation between knee apprehension with ACL-RSI and sport testing battery after ACL reconstruction.

Methods

All patients treated operatively for ACL injury between 2013 and 2020 were reviewed in this study. Only patients performing 2 sport testing battery were included. Knee apprehension was measured using ACL-RSI score at 6 and 12 months. Sport testing battery was performed at 8 and 12 months. Muscle strength was evaluated by isokinetic test for quadriceps

and hamstring. Balance was assessed with SEBT, side hop test, and triple hop test. Stability was assessed by laximetry with GNRB.

Results

57 patients were included in this study (42 men, 15 women). Mean duration between ACL rupture and surgery was 4 months. The first test was performed at 8 months and the second at 12 months after surgery.

ACL-RSI was 56 ± 25 in the first test, where men showed a slightly higher score (58 ± 26) compared to women (51 ± 26), however not significantly (p = 0.42). The overall score was increased after the second test to 64 ± 31, in women (65 ± 34) more than in men (63 ± 24).

20 patients (35%) showed initially an ACL-RSI <50 and 11 (19%) an ACL-RSI score >75. After second test, only 8 (14%) remained below ACL-RSI of 50, whereas 20 (35%) were above 75. However, this increase in patient reported outcome was not significantly linked to an increase in muscle strength and jumping exercises.

Correlative analysis also revealed no correlation between ACL-RSI and GNRB or muscle strength.

Conclusion

ACL reconstruction showed improvement in knee apprehension measured with ACL-RSI, which increased over time. However, there was no correlation between ACL-RSI and sport testing battery. Hence, evaluation of psychological factors contributing to knee apprehension and physical factors such as muscle strength, balance and stability are important to consider before RTS.

P37

The influence of sagittal cutting planes on the posterior tibial slope in open wedge high tibial osteotomy: high tibial osteotomy on Sawbone model. (11275)

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Introduction

Medial-open-wedge-high-tibial-osteotomy (MOWHTO) is a widely used surgical technique for the treatment of medial compartment osteoarthritis. An unintended increase of the posterior tibial slope (PTS) is a frequently reported consequence. The aim of this study was to investigate the influence of different sagittal cutting orientations on the PTS.

Materials and Methods

Sixty Sawbone-Tibia models were used to produce biplanar MOWHTO. Three different orientations of the main osteotomy in the sagittal plane were produced: parallel to the medial tibial plateau (p-OT), 11° posteriorly ascending (90° to the anterior tibial cortex; a-OT) and 11° posteriorly descending (d-OT). In each group, 20 biplane osteotomies were performed, 10 with distal and 10 with proximal tibial tubercle osteotomy (TT). Medial opening was achieved with 3 D printed wedge-guide and 10 mm metal wedge. The PTS was measured prior and after the MOWHTO using the fast protocol, Brainlab knee 3 navigation system. Pre- and postoperative values were subtracted to calculate the difference in slope, where negative numbers describe an increase in PTS.

Results

There was a significant difference in change of PTS after the osteotomies were performed between p-OT -1.5 ± 0.7° and a-OT groups -0.9 ± 0.7° (p = 0.044). We found statistically significant differences across subgroups in change in PTS between the p-OT ATT distal -1.7 ± 0.6° and the a-OT ATT distal -0.5 ± 0.6° (p = 0.013) and between a-OT ATT distal -0.5 ± 0.6° and the d-OT ATT proximal -1.8 ± 0.8° (p = 0.005).

Conclusion

In current study different sagittal osteotomy orientations in MOWHTO had no or minor significant modification of PTS on Sawbone models with probable very low clinical relevance.

P38

Elongation patterns of posterolateral corner reconstruction techniques in a three-dimensional weight-bearing computed tomography simulation (11169)

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Balgrist

Background

Various surgical techniques to reconstruct the posterolateral corner (PLC) of the knee have been developed, including non-anatomical and anatomical techniques. The isometric characteristics of non-anatomical and anatomical PLC reconstruction techniques under weight-bearing conditions remain unclear.

Purpose

The primary aim of this study was to simulate graft elongation patterns during knee flexion for three different PLC reconstruction techniques (Larson, Arciero, LaPrade). The secondary aim was to compute the most isometric insertion points of the fibular collateral ligament (FCL) graft strands for each technique and to report quantitative radiographic landmarks.

Methods

A three-dimensional simulation of weight-bearing CT scans of ten healthy knees from 0-120 ° of knee flexion was perfor Ligament length changes during knee flexion for the PLC reconstruction techniques of Larson, Arciero, and LaPrade were analyzed. The most isometric femoral insertion points for the FCL graft strands were computed within a 10 mm radius around the lateral epicondyle (LE), using an automatic string generation algorithm (isometric score 0 indicating perfect isometry). Radiographic landmarks for the most isometric points were reported.

Results

Median graft lengthening during knee flexion was similar for the anterior graft stands of Larson's technique 3.6 mm (range 1.7 to 7.2 mm) compared to Arciero's and LaPrade's techniques 2.2 mm (range 0.0 to 5.6 mm) (ns). The posterior graft strands demonstrated shortening of 17.1 mm (-9.3 to − 22.3) for Larson's technique compared to significant lengthening for Arciero's and LaPrade's technique of 9.9 mm (range 6.7 to 15.9 mm) and 10.2 mm (range 4.1 to 19.7 mm) respectively (p <0.001). The most isometric point could be defined for the FCL graft strands of all techniques and was located at a median of 2.2 mm (range − 2.2 to 4.6 mm) posterior and 0.5 mm (range − 1.8 to 3.7 mm) distal to the LE.

Conclusion

Significant lengthening of the posterior graft strands of Arciero's and LaPrade's PLC reconstruction techniques occurred compared to shortening of the posterior graft strand of Larson's technique during knee flexion. The most isometric point could be defined for the FCL graft strands of each PLC reconstruction technique and is located postero-distal to the LE.

P39

How to approach diffuse Tenosynovial Giant-cell Tumors (dTSGCT) of the Knee Joint? (11143)

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Introduction

TSGCT is differentiated into localized and diffuse subtypes. Diffuse TSGCT usually cannot be removed completely, leading to a high risk for recurrence. Reoperation especially in the popliteal region of the knee joint may become difficult because of scarring. A case of ex-tensive anterior and posterior involvement of the knee joint is presented to discuss tactics and technique regarding:

- timing of surgical interventions
- technique (open/arthroscopic/combined)
- indication for adjuvant treatment

Methods

M *1982, at 29 y suspected tumor development posteriorly to the PCL of the right knee, with inconclusive histology of arthroscopic biopsy. At 34 y, CT-guided biopsy approved diagnosis of dTSGCT; with only minimal restrictions initial observation was decided. Two years after biopsy, developing diffuse discomfort and limited ROM, the patient desired treatment. Imaging showed diffuse infiltration of popliteal structures. Open approach of the posterior masses and postponed arthroscopy for the anterior lesions depending upon the further development was decided.

Results

Open tumor resection presented to be difficult due to adherence of the displaced vessels, almost forcing to abort the procedure. Finally subtotal resection of the popliteal lesions was achieved. Anterior arthroscopic approach performed three months later resulted in subtotal resection of the intraarticular tumor masses. At present, 3 y postoperatively, the knee joint is stable in terms of soft tissue mantle and functional parameters.

Conclusion

Because of the variant presentation, treatment of dTSGCT needs to be individualized. We have rejected radiotherapy (90Y synoviorthesis, radiation) because of the lack of hard data. Treatment with tyrosine kinase inhibitors or antibodies is considered promising, yet not generally available.

The optimum timing of surgery has not been analysed so far. Considering the high rate of recurrence with increasing difficulties for re-resections, resection should be postponed as long as possible.

Extended popliteal processes evidently need open approach. Whether anteriorly open or arthroscopic resection be preferred and if it should be combined with the posterior ap-proach in the same session remains discussed. For anterior tumor extension we prefer arthroscopy to reduce scarring making re-resections and arthroplasty more difficult. In se-lected patients with associated degenerative disease synovectomy combined with arthro-plasty may be indicated.

POSTERS: FOOT

P40

Evidence for surgical treatment of osteochondral lesions in the talus. A systematic review (11353)

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Introduction

The therapy of osteochondral lesion is surgically challenging and various techniques are available. The most used methods are : bone marrow stimulation, Cartilage implantation and Bone/Cartilage-Transplantation.

The goal of this systematic review is to investigate and understand the effectiveness and indications of the surgical treatment options.

Methods

This work is a systematic review from studies which were publicated between 2000 and 2020. Inclusion criterias were osteochondral lesions which have been surgically treated, a minimal follow up of 24 months and a minimum of 10 patients which have been at least 16 years of age. The level of evidence was between I and IV.

Results

This study include 45 studies; 20 Bone marrow stimulation (18 BMS & 5 AMIC), 9 Cartilageimplantation (6 ACI & 2 MACI) and 17 transplantations (8 OATS, 5 autograft & 4 allograft).

The study shows an inverse correlation between the initial American Orthopaedic Foot & Ankle Society (AOFAS) Score an the improvement of the value score (R = -0.849, P <.001). However there was a positive correlation from the inital AOFAS Score and the outcome-Score (R = 0.421, P = .008). Furthermore we came to the conclusion that the preoperative size of the cartilage lesion shows no correlation to the AOFAS Score at time after surgery.

Conclusion

The bone marrow stimulation was the most published surgical technique. It was particulary used in small (medium size lesion <90mm2) and most primary lesions. The widest lesion (>200 mm2) in the youngest patient group (medium age: 32 years) have been treated with autologous chondrocyte implantation.

Patient groups with a wide and very symptomatic lesion could benefit the most with an operative therapy of the ostechondral lesion in the talus.

However, due to the heterogenity of the studies, including the different baselines, a comparison of the results between the different surgical techiques was not possible.

P41

Microsurgical Reconstruction of the Lower Extremity in the Elderly (11368)

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Indication

Individuals of advanced age are the fastest growing subpopulation with an increasing incidence of complex lower extremity wounds. Historically, elderly patients were discouraged from microsurgical reconstructions because of medical comorbidities and lack of organ system reserve to withstand the lengthy and physically demanding intervention. The purpose of this article is to discuss strategies for microsurgical reconstruction of the lower extremity in the elderly population and to further reduce perioperative and postoperative risks and complications providing good functional results.

Methods

Based on a single centre experience and illustrated by four comprehensive case examples, indications, contraindications, preoperative evaluation and special considerations (including age vs. frailty, treatment objectives, principles and strategy, decision making, preoperative patient evaluation, perioperative management, preoperative planning and imaging), the surgical procedure itself, postoperative care and management of complications are discussed.

Results

A multidisciplinary team approach makes microsurgery a safe and succesful procedure. Age-related pathologies (atherosclerosis above all) demand thorough preoperative planning. Intraoperative stress can be reduced by regional anaesthesia, a sitting position (beach-chair) and a short operative time through a two-team approach. Reliable workhorse flaps provide easy vascular access with limited incisions, reliable anatomy and long vascular pedicles for speedy and safe soft-tissue reconstruction. Postoperative intensive/intermediate care helps to detect and manage complications early, provide immediate interventions and avoid fast deterioration due to limited physiological reserve. Early flap dangling and mobilization minimize sequelae of prolonged immobilization and support rapid functional and social reintegration.

Conclusion

Microsurgical reconstruction in the lower extremity can be performed safely with high success rates and manageable complications in elderly patients. The prerequisites include (i) a comprehensive preoperative interdisciplinary assessment of the patient and optimization of risk factors,

(ii) meticulous preoperative planning, (iii) intraoperative adaptation of anesthesia and efficient surgical technique, and (iv) specialized postoperative monitoring and early mobilization according to the specific needs of the elderly patient.

P42

Endoscopic-assisted release of exertional leg compartment syndrome: A new surgical technique (11418)

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Chronic exertional compartment syndrome can be a limiting cause of lower leg activity-related pain. The anterior compartment is the most commonly involved. Due to a poor success rate with non-operative management, surgical management with fascial release is the gold standard. Over the years, minimally invasive approaches with smaller incisions have gained popularity over the traditional technique of an open fasciotomy along the entire length of the leg.

Mini-invasive techniques for surgical decompression have been described, however, with the risk of incomplete fascial release or injury to neurovascular structures. This led to the evolution of endoscopically assisted techniques. However, endoscopic compartment release has been described as a time-consuming and technically demanding procedure.

After analysing the literature and the in vivo endoscopic techniques published so far, we propose a technique utilising the EndoBladeTM System by Arthrex®, originally designed for endoscopic Gastrocnemius recession.

In these images, we demonstrate a technique making two 1-cm incisions that allows visualisation of the entire length of the anterior and lateral compartments. The patient is positioned in a supine position and with a tourniquet on the thigh. The first longitudinal incision is performed at the junction between the anterior and lateral compartments. The trocar is then utilised to prepare the subcutaneous path, and the cannula and trocar are inserted in the subcutaneous space lying over the fascia. At the tip of the trocar, we make a longitudinal incision along the same line indicated previously. The 30-degree arthroscope is then introduced into the cannula, and the fascia is observed. From the counter-incision, the hook knife is introduced. Dorsiflexion of the foot will help maintain tension during the procedure. The hook knife is then gradually retracted while gently pressing it against the fascia. Under careful visualisation, the fascia is cut, releasing the muscle belly. After completion, the cannula is introduced from the counter incision, and the remaining part of the fascia is released by the hook knife introduced. The underlying muscle is observed along the entire length to confirm the complete release.

We believe that this method offers a technique that is quick and easy to perform compared to other endoscopic procedures, safe compared to other minimally invasive techniques, and with a rapid recovery compared to the traditional open approach.

P43

Elasticity of the tibialis anterior compartment in healthy subjects, measured with compression sonography and a pressure sensor (11352)

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Introduction

To measure the elasticity of a compartment, the compression sonography is an appropriate non-invasive measure procedure. It's a possible diagnostic tool for acute or chronic compartment syndrom. This method already has been used in earlier studies with human cadaver and animal models. So far there are no standard values for healthy subjects available. Goal of this study is to define the standard compartment elasticity in healthy subjects and to evaluate the reliability of the measurement method.

Methods

The study included 60 healthy subjects in whom the depth of the tibialis anterior compartment was measured while an external pressure of 10mmHg and 80mmHg was applied. A pressor manometer on top of the ultrasound probe was used to observe the external pressure. The ratio of the two values defined the elasticity. Two examiners each carried out two measurements on 10 subjects in order to asses the reliability of the measurements.

Results

The mean elasticity of the tibialis anterior compartment was 15.9% (mean standard deviation: 3.7%; Range 5,0 – 22,2). There was no significant correlation of the circumferene of the lower leg, size, weight, sex, activity hours per week and type of activity (e.g. weightlifting / endurance sports). The intraobserver reliability showed an interclass-correlation (ICC) of 0,89 for the more experienced observer and 0,79 for the less experienced observer. The interobserver reliability shows an ICC of 0,78.

Conclusion

The mean elaysticity in the anterior tibialis compartment in healthy subjects was 15,9%. The elasticity didn't show a dependence of the demographic parameter or the quantity and neither the typ of performed sport. The method of measurement showed a high reliability with a high intra- and interobserver correlation.

P44

Subtalar joint dislocation of a climber: case report (11422)

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Introduction

Acute medial subtalar dislocation is rare. In general, it is the result of a high-energy equine varus trauma, a road accident or a fall from a great height. We report the case of a young 38-year-old climber, victim of a climbing accident and taken care of in our service.

Case description

A 38-year-old patient, in good health, a nonprofessional climber, is seen in our hospital after hitting his left foot against a climbing wall on a 5C graded track with equine varus foot trauma. In the emergency department, he presented with significant pain in his left foot with deformity and functional impotence when walking.

On clinical examination of the left foot, we find a varus deformity of the hindfoot with a hematoma on the lateral face and facing dermabrasions, diffuse pain on palpation of the Chopart joint and no neurovascular disorder. The radiological assessment carried out in the emergency room shows a medial subtalar dislocation of the left foot. The left subtalar dislocation is reduced in the emergency room by an axial traction maneuver and external translation under sedation. A split cast boot is then put in place. A CT scan of the ankle and left foot is performed to complete the assessment and shows an intra-articular fracture of the head of the talus, extending to the neck, to the medial and posterior process of the type I talus according to Marti, a fracture of the anterior process of the calcaneus and a fracture of the base of the 5th metatarsal on the left foot in zone II.

Discussion

Subtalar joint dislocation is a rare condition in rock climbing with no case described in the literature. The mechanism of medial subtalar dislocation is by adduction with forced inversion of the forefoot associated with varus of the hindfoot, leading to ligament rupture in a specific order: it is first the dorsal talonavicular ligament which is injured, then the two bundles of the interosseous ligament in hedge (sinus of the tarsus) and finally the calcaneofibular ligament. The diagnosis is clinical and is confirmed by radiological examinations. A CT scan and an MRI of the foot allow us to exclude associated osteo-ligamentous lesions.

P45

"Morton's" Metatarsalgia treated by DMMO (percutaneous distal metaphyseal metatarsal osteotomies): a case control study (11427)

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Metatarsalgia is a common pathology in foot and ankle patients.

After differentiating the patho-mechanisms and excluding non mechanical issues and installing a conservative treatment the remaining patients benefit from a surgical treatment by adjusting the metatarsal head localisation by the means of percutaneous shortening and lifting osteotomies.

We present our experience in a case series from 2016-2021 including clinical results, complications and reoperation rates and the learning curve of surgeons.

According to our experience DMMO for metatarsalgia are a safe reproducible procedure with a steep learning curve of the treating surgeons

P46

Simultaneous Bilateral Isolated Hallux Valgus Correction Using A New Distal Metatarsal Osteotomy: Clinical, Radiological And Pedobarographic Evaluation With A Minimum Of Two Years Follow Up. (11101)

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Background

Hallux valgus is the most common forefoot deformity whose incidence is bilateral in 84 to 97.3% of cases. This raises the question on whether these cases should be operated sequentially or simultaneously.

Objectives

We wish to examine the pertinence of simultaneous bilateral HV correction in the treatment of moderate to severe isolated bilateral symptomatic hallux valgus deformity.

Study Design & Methods

Between 2015 and 2018, we performed 341 hallux valgus corrections using the ReveL procedure, a new distal biplanar metatarsal osteotomy technique, completed by the Akins osteotomy in necessary cases. Of these, 31 cases with simultaneous correction of an isolated bilateral HV deformity were selected. The AOFAS and the EQ-5D scores were used to evaluate the clinical outcome. HV, IMA and DMAA angles as well as sesamoid deviation were compared in pre- and postoperative standard standing X-rays. Gait analysis was performed at longest follow-up and Max-F, Peak-P, Con-A, Con-T and FTI values were compared the ones of a sex and age matched group of healthy subjects.

Results

At last follow-up, we observed significant rise in AOFAS score by an average of 35 points. We observed average reduction of the following radiological parameters: HV angle by 19.37°, IMA by 8.21°, DMAA by 17.67° and sesamoid deviation by 3.4mm. There was no significant difference between the gait analysis of the control group and the forefoot plantar pressure was restored and similar to healthy subjects.

Conclusions

We concluded that simultaneous osteotomies in bilateral cases of moderate-to-severe HV improves patient's clinical and radiological outcome, with a high level of satisfaction.

P47

Avoiding pitfalls in ankle fracture-dislocations: A case report of a dislocated tibialis posterior tendon causing persistent ankle subluxation (11160)

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Universitätsspital Basel (USB)

Tibialis posterior tendon dislocation, a rare complication in ankle fracture-dislocations, can impede anatomical reduction of the ankle mortise. We report on a 59-year-old healthy male with an open fracture-dislocation of the right ankle. Despite multiple attempts under direct vision of the anterior syndesmosis, anatomical reduction of the ankle mortise was not possible. Soft tissue windows in a computed tomography (CT) scan revealed the dislocated tibialis posterior tendon to be the impeding structure. At the level of the fibula fracture the tendon passed through the interosseous membrane anterior to the distal tibia and was then incarcerated in the medial talocrural joint before returning to the flexor retinaculum and its insertion on the navicular bone. Understanding the trauma mechanism and the course of the dislocated tendon as well as correct interpretation of CT and magnetic resonance images of the ankle enable surgeons to early diagnose and correctly treat this condition.

POSTERS: SPECIAL FIELDS CHILDREN

P48

High rates of lateral patellar redislocation and inconsistent subjective satisfaction in pediatric patients at 7-year follow-up (11261)

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Introduction

The optimal treatment of primary lateral patellar Dislocation (L) remains unclear. Reccurent dislocation is a common problem. Every redislocation leads to further cartilage damage. Different procedures are used in the pediatric population to lower recurrence rates but there is lack of success rates and subjective functional outcome in the long-term.

Methods

A retrospective case series involving 141 patients (98 girls, 43 boys) between 6 and 15 years at initial consultation that were treated at our institution from 01.2007 to 05.2018 due to Ls with a minimum follow-up of 12 Month. A questionnaire focusing on recurrence of dislocation, secondary treatment, PROMs (Kujala AKPS, Pedi-IKDC) were answered with a follow-up rate of 80%. Exclusion criteria were syndromal and neurological disorders, malformations, no contact data and no command of German language.

Results

The mean age at first consultation in our department was 12.3±2.2 (7-15 years). The mean follow-up was 7.0±3.1 years. 64 patients were treated operatively and 77 nonoperatively.

In the conservative cohort, 48 patients reported redislocations (62%) and 17 patients were operated externally after. Mean AKPS was 79±19 (21-100), mean IKDC was 77±19 (25-100).

7 patients were treated by medial temporary hemiepiphysiodesis of which 4 reported redislocations (57%) and one patient had a subsequent reoperation externally. Mean AKPS was 80±27 (27-100), mean IKDC was 73±31 (14-98).

20 patients received MPFL repair of which 8 reported redislocation (40%). 2 patients had subsequent reoperation. Mean AKPS was 88±11 (64-100), mean IKDC was 86±11 (54-96).

30 patients underwent the mod. Slocum procedure. 9 patients were operated on both knees. 3 patients underwent previously MPFL repair. 4 patients had concomitant trochleoplasty. 13 patients reported redislocation (43%). 10 patients had one or more subsequent reoperation. Mean AKPS was 77±16 (30-97), mean IKDC was 73±18 (26-96).

In 7 patients, we performed a MPFL reconstruction. 1 patient had previous MPFL repair externally. 1 patient reported redislocation (14%) and was reoperated. Mean AKPS was 74±17 (39-94), mean IKDC was 76±16 (46-93).

Conclusion

Redislocation rate after primary L was high. The MPFL reconstruction had the lowest recurrence rate. Subjective functional outcome scores are in all cohorts comparable, but with a wide variance in each cohort.

P49

3D Printing of MR-based 3D-models for SCFE patients for patient-specific preoperative planning of modified Dunn procedure (11173)

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Objectives

Slipped capital femoral epiphyses (SCFE) is a common pediatric hip disease with the risk of osteoarthritis and impingement deformities. MRI-based 3D-models would offer radiation-free patient-specific preoperative planning.

Therefore, we investigated (1)bone segmentation (2)feasibility of 3D-printing and of 3D impingement-simulation using MRI 3D-models and (3)short-term clinical followup.

Methods

A retrospective study involving of 10 symptomatic patients (10 hips) with SCFE was perfor Mean age was 13±2 years(50% male patients). Six patients had severe SCFE(four had moderate SCFE). All patients underwent preoperative hip MR(2016-2019) with pelvic coronal high-resolution images(T1 Starvibe). Slice thickness was 1.2mm. Semi-automatic MRI-based 3D segmentation (software AMIRA) and 3D-printing of plastic 3D-models was perfor The virtual 3D models were used for dynamic 3D impingement-simulation. All patients underwent surgical treatment, eight patients underwent modified-Dunn-procedure.

Results

(1)MRI-based 3D segmentation was feasible in all patients(100%, duration of 4.5 hours, mean 277±52 minutes).

(2)3D-printing of the 3D-models was feasible in all patients(100%). 3D-models were considered helpful for preoperative planning by the treating surgeons. Dynamic 3D impingement-simulation was feasible in 6 patients(6 hips) and enabled visualization of femoral and acetabular impingement location.

(3)Hip range of motion was symmetrical and clinical outcome was good at short term followup. Slip angle improved significantly ($p < 0.001$) from preoperative 54±15° (40-70) to postoperative 3±5° (2-4).

Conclusion

MRI-based 3D-models for SCFE patients were feasible for all patients. 3D-models can be used for 3D-printing and for impingement-simulation. This could aid for patient-specific preoperative planning. MRI-based 3D-models are radiation-free and could be used instead of CT-based 3D-models in the future.

P50

Trampoline knee injury resulting in leg length discrepancy and functional lumbar scoliosis – "Did my leg really stop growing?" (11394)

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Introduction

Distal femoral physeal fractures are the third most common growth plate fracture in children after wrist and ankle physeal fractures. Knee injuries can disrupt the distal femoral physis in the growing skeleton. Affected children are unable to bear weight and frequently present with knee swelling. The distal femoral physis is the fastest growing physis contributing to about 70% of femoral length and 40% of overall lower limb length. Fractures involving the distal femoral physis can have a devastating effect on limb length and angular alignment.

We present a case of a 14-year-old girl that presented with leg length discrepancy of 4cm due to a knee hyperextension injury and premature physeal closure 4 years previously. Leg length discrepancy resulted in a functional lumbar scoliosis and was treated by gradual femoral lengthening with an intra-medullary nail.

Case presentation

A 14-year-old girl presented with leg length discrepancy of 4cm with a shortened right leg and functional lumbar scoliosis. A hyperextension injury of the right knee on the trampoline 4 years previously was recalled. At the time of injury she had been unable to bear weight and swelling of the right knee had been noticed. X-ray in another institution had revealed a slightly widened distal femoral physis. Two weeks later knee MRI highlighted massive bone edema adjacent to the distal femoral physis. Weight bearing as tolerated had been recommended without further follow-up.

4 years later leg length discrepancy of 4cm and a closed distal femoral physis on the right side became evident. Because of functional lumbar scoliosis correction of the leg length discrepancy was recommended. The distal femoral and proximal tibial physes on the left side showed little remaining growth and contralateral epiphyseodesis was not advised. Femoral osteotomy and gradual lengthening using a Precise stryde nail were perfor Weight bearing was allowed with crutches. Distraction of 1mm per day was continued until 4cm of lengthening were achieved.

Conclusion

Distal femoral physeal fractures need to be excluded in children with knee injuries unable to bear weight over a prolonged period. Radiographic changes of the distal femoral physis may be subtle. MRI helps to differentiate between ligamentous knee injury and physeal injury. More than 50% of these fracture cause growth disturbance including leg length discrepancy and angular deformity. Follow-up to skeletal maturity is necessary.

P51

Mechanical hip pain in an adolescent patient in a rare combination of a femoroacetabular CAM-type impingement and a localized intra-articular tenosynovial giant cell tumor. (11223)

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Introduction

Intra-articular localized tenosynovial giant cell tumors are occasional synovia proliferations; mostly affecting large joints. The worldwide estimated incidence is 1.8 per million in the general population per year; children seem to be less affected. These benign tumors may lead to cartilage damage resulting in joint destruction and premature osteoarthritis.

Materials and Methods

Case report and review of literature.

Results

A 14-years old girl with increasing left sided hip pain and progressive loss of motion consulted the outpatient clinic. Physical examination was suspicious for a femoroacetabular CAM-type impingement (FAI) with a limited painful internal rotation of 20° (contralateral side 40°) and a positive impingement test. X-rays and arthro-MRI with a decreased offset of the femoral head-neck-junction confirmed a FAI. Additionally, it revealed an intra-articular, sharp limited nodular proliferation of the synovia belonging to the antero-inferior femoral neck. Due to the symptomatic, almost circumferential deformity at the femoral head-neck junction and a concomitant soft-tissue tumor, a surgical hip dislocation according to the original technique of Ganz et al. was favored over of an arthroscopic resection. After performing the capsulotomy and hip dislocation, we identified and resected a well-circumscribed, intra-articular nodular pedunculated lesion probably in association with the capsule or the transverse ligament. Correction of femoral head-neck offset was perfor

Histological exam confirmed a giant cell tumor with the typical microscopic pattern of foamy histiocytes and stroma with admixed mononuclear component including hemosiderin deposits, histiocytes-like cells, epithelioid cells and scattered giant cells .

At 6 weeks postoperative, she regained a pain free hip function with 110° of flexion and 50° internal rotation. Standard x-ray showed a centered femoral head without signs for an avascular necrosis.

Conclusions

Localized intra-articular tenosynovial giant cell tumors are an occasional cause of mechanical hip pain in children. These benign synovial proliferations can rarely be found in the pediatric population. Even in the presence of an obvious cause of mechanical hip pain like femoroacetabular impingement, we recommend further imaging, especially if it has an impact on the choice of the surgical approach or technique. Complete excision is crucial to reduce the risk of premature degenerative changes and recurrence.

P52

Galeazzi-equivalent fracture dislocation in 11-year-old boy – do not miss the ulnar physeal fracture! (11274)

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Introduction

Galeazzi-equivalent fracture dislocations are rare injuries and unique to the pediatric population. The distal radial metaphyseal fracture is associated with disruption of the distal ulnar physis. In contrast to the adult Galeazzi fracture where the distal radioulnar joint (DRUJ) is dislocated and the triangular fibrocartilage complex (TFCC) is injured, the DRUJ and TFCC can remain intact in pediatric cases. Instead, the deforming force dislocates the distal ulnar growth plate. While the distal radial fracture component is immediately evident the disruption of the distal ulnar physis can easily be missed and awareness of this kind of injury is important to prevent malreduction of the ulna.

Case presentation

An 11-year-old male fell on the extended right dominant wrist while playing soccer. Neurovascular status was intact. Radiographs showed a dislocated, apex volar metaphyseal distal radius fracture with disruption of the distal ulnar physis (Salter-Harris type I). Closed reduction of the radius could not be achieved and open reduction of the radius was perfor The pronator quadratus muscle was interposed between the fracture fragments prohibiting reduction. The distal ulnar epiphysis reduced itself once the radius was reduced. Fixation of the radial fracture was achieved by a volar locking plate. To protect the distal ulnar epiphysis from secondary dislocation a long arm cast was applied for 6 weeks. At 6 months follow-up, the patient was pain-free and wrist motion was equal to the other side. No instability of the DRUJ was evident. Grip-strength was 22kg (non dominant left side 22kg). Patient-reported outcome was measured with PROMIS pediatric upper extremity score and was 30/30 points at 6 months. Hard wear removal was performed at 6 months.

Conclusion

Galeazzi-equivalent fracture dislocations can be treated by closed reduction or open reduction if the fractures can not be reduced in a closed fashion. Extensor carpi ulnaris tendon, periosteal flaps or pronator quadratus muscle can inhibit closed reduction.

Premature physeal closure of the distal ulna is a feared complication leading to excessive ulnar minus variance, incongruency of the DRUJ and ulnar translation of the carpus. Ulnar lengthening has been described in cases of premature physeal arrest. To identify growth disturbence of the distal ulna, follow-up is necessary until skeletal maturity and if in doubt wrist x-rays should be compared to the uninjured side.

POSTERS: SPECIAL FIELDS INFECTIONS

P53

The influence of the timing and sequence of revascularization (before or after amputation) on the outcomes of diabetic foot infections – a single-centre, retrospective pilot evaluation (11388)

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Introduction

The management of diabetic foot infections (DFI) is multidisciplinary. Conceptually, the revascularization (if possible) occurs before surgery, but sometimes not. We assess the sequence of both interventions regarding clinical failures of DFI therapy.

Methods

Case-control cohort study with primary outcome "clinical failure" (surgical revision for infection, relapse of infection, ischemia, or wound failures). We target the perioperative time period two weeks before and two weeks after the surgery/amputation.

Results

Among 1,013 DFI episodes in 586 patients (219 females, median age 67 years; 607 smokers with a median of 10 pack-years; 882 cases with osteomyelitis; 85 with renal dialysis; 277 with peripheral arterial disease grade >= 3), 572 DFI episodes (56%) were revascularized (562 angioplasties, 62 vascular surgeries) with a median delay of 7 days prior to surgery. All DFI episodes were debrided or (partially) amputated (median 1 surgical intervention), of which 106 major amputations. The median length of antibiotic therapy was 20 days (initially 5 days parenterally) and the median clinical follow-up 5.5 years.

We revised 245 DFI episodes surgically (245/1,013; 25%). In crude group comparisons, DFIs with the need for revascularization ultimately failed more often that those without (164 failures/572 vascularization (29%) versus 91 failures/441 non-vascularization (21%); p <0 .01), whereas major amputations or a vascularization before surgery (51/169 vs. 8/25; p = 0.30) were indifferent. In the multivariate Cox regression analysis with the outcome "clinical failure", the time delay between surgery and vascularization (HR 1.0, 95%CI 1.0-1.0), or revascularization performed before the surgery (HR 1.0, 95%CI 1.9-0.5-7.7) were not protective of failures. In contrast, a persisting nicotin abuse was clearly associated with failures (HR 2.6, 95% 1.1-6.2). The age, antibiotic therapy, anticoagulation, and past revascularizations were all indifferent.

Conclusions

Retrospectively and within two weeks perioperatively, the exact timing or the sequence, of revascularization, had no influence on failures of DFI treatment. As in many fields of surgery in ischemic areas, surgeons should encourage the patient to stop smoking.

P54

Epidemiology of Lower Extremity Amputations in Switzerland from 2005 to 2015 (11295)

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Balgrist

Introduction

Lower extremity amputations (LEA) are usually performed for complications of diabetes, peripheral arterial disease (PAD), or a combination of both. The current epidemiologic literature on lower extremity amputations mainly derives from the 1990s and therefore mostly does not represent the progress in medical treatment. The aim of this study was to describe the etiologies of lower extremity amputations in Switzerland in the 21st century.

Methods

Swiss nationwide data collected by the Swiss Federal Statistical Office from all hospitalization records in Switzerland from January 1st 2005 to December 31st 2015 were analysed. Out of this dataset, all cases of lower extremity amputations were extracted. The amputation level was classified according to the Swiss operating classification while the indications for amputation were classified according to the ICD-10.

Results

21,315 lower extremity amputations occurred in the observation period. The total yearly number of amputations in Switzerland increased (+14.7%;p = 0.048). Accordingly, the incidence increased from 24.9 to 25.6 per 100 000 people (+2.8%;p = 0.460). While the minor amputation rate increased significantly from 17.9 to 20.8 per 100 000 people (+16.1%;p = 0.041), the incidence of major amputations significantly decreased from 6.5 to 4.8 per 100 000 (-26.9%;p = 0.0007). The majority of low extremity amputation was performed due to vascular diseases (35.9%), diabetes mellitus (23.7%) or infections (21.6%). Only 3.3% of the amputations were performed due to trauma. In patients aged 20-30 years the most frequent reason for LEA was trauma, accounting for 40.3% of the amputations in men and 27.5% in women. In patients aged between 30 and 40 years, trauma was also the main cause of amputation, men 46.9%; women 32.2%. The peak incidence of diabetes related amputations was the sixth decade (male 34.7%, female 26.2%) and the peak incidence of vascular related amputations was the tenth decade (male 55.5%, female 50.5%).

Conclusion

The major finding of this study is a significant decrease in major amputations which might best be explained by improved vascular and orthopedic treatment options in PAD, diabetic foot infections, and trauma. Interestingly, minor amputations increased significantly, what can be explained by the aging population and the increased incidence of Diabetes. Compared to the literature of prior decades, etiologies and their distribution in decades and between both sexes were similar.

P55

Septic arthritis caused by Brucella melitensis – an orthopedic challenge (11194)

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Introduction

The zoonotic infection with Brucella melitensis can be acquired by ingestion of unpasteurized goat's or sheep's milk. The infection is common in Eastern Mediterranean countries (EMC), but rare in western Europe (6 cases in Switzerland, 2021). When evaluating patients with symptoms of septic arthritis, brucellosis is not the foremost differential diagnosis. However, with the increasing population of people from EMC in western Europe, the incidence may be rising. We present a patient who was initially suspected to suffer from Long-COVID-Syndrome (LCS), which underscores the relevance of this case in a pandemic situation.

Methods/Results

A 58-year-old male patient was admitted to the emergency department with a painful right knee effusion after a minor trauma. Additionally, he suffered from fatigue, subfebrile temperatures, back pain and myalgias for more than two months. He was suspected to suffer from LCS after a mild COVID-19 three months earlier. The culture of the arthrocentesis (14.400 cells/µl with 61% polynuclear cells) unexpectedly turned positive for B. melitensis. The patient declared that he had been drinking three liters of unpasteurized goat's milk to cure the presumptive LCS.

To ensure staff safety, arthroscopic lavage was postponed until brucella-active antibiotics had been administered for at least 24 hours. Surgery was performed under strict infection control measures to avoid generating aerosols.

According to Duke, one major (continuous bacteremia over 14 days) and 2 minor criteria (fever, most probably septic embolic gonarthritis) were fulfilled. Therefore, possible endocarditis had to be assumed although transesophageal echocardiography was normal. Antibiotic treatment was escalated to a quadruple regimen (intravenous gentamicin for three weeks; as well as oral doxycycline, trimethoprim/sulfomethoxazole and rifampin for at least 3 months).

The clinical recovery – still under treatment – is protracted with slowly improving knee pain and normalizing signs of inflammation.

Conclusion

Although B. melitensis is a rare pathogen in Switzerland, orthopedic surgeons, rheumatologists and infectious disease specialists need to be aware of diseases with low incidence and non-specific symptoms especially in times of a global pandemia. A high index of suspicion is needed in patients related to EMC. When brucellosis is confirmed, strict infection control measures to protect staff involved in aerosol generating procedures must be adopted.

P56

Are “skin commensals” as virulent as “pathogens” in surgically-debrided diabetic foot infections? (11390)

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Introduction

Multiple factors play a role in the multidisciplinary management of diabetic foot infections (DFI), including osteomyelitis (DFO). We investigated if the clinically presumed virulence of intraoperative pathogens is associated with success of combined medical & surgical treatment.

Methods

In this retrospective, single-center (Geneva University Hospitals), cohort evaluation with a follow-up of one year, we divided the microorganisms isolated intraoperatively from DFIs into 2 groups: only skin commensals (coagulase-negative staphylococci, micrococci, cornynebacteria, cutibacteria); and control (at least one aerobic, pyogenic pathogen).

Results

Among 1018 DFI episodes (73%% males, 392 [39%] with DFO cases; 610 [60%] with peripheral arterial disease), the treating clinicians identified skin commensals as the sole causative pathogens (without accompanying pyogenic pathogens) in 54 cases (5%). Cultures from the control (pyogenic pathogen) group involved Staphylococcus aureus (389 cases [38%]), Pseudomonas aeruginosa (61 cases [6%]) and 30 other bacteria generally considered pathogens (e.g., hemolytic-streptococci, or Klebsiella spp).

After treatment (wound debridement in all, partial amputations in 596 [58%], antibiotic therapy [median of 20 days], hyperbaric oxygen therapy in 98 [10%]), 251 episodes (25%) were clinical failures after a median follow-up of six months.

A crude group comparison between only skin commensals and control (some pyogenic pathogen), found no difference in rates of clinical failure (17% vs 24 %, p = 0.23) or microbiological recurrence (11% vs 17 %, p = 0.23). The number of surgical debridements, proportion of DFO cases, and mean duration of antibiotic therapy (including percent parenteral) were similar.

In multivariate logistic regression analysis with the outcome "clinical failure", culturing only skin commensals from the wound was not a determinant as an independent variable (odds ratio 0.4, 95% confidence interval 0.1-3.8).

Conclusion

DFIs and DFOs from which only skin commensals were isolated were not associated with different clinical or microbiological outcomes from those from which pyogenic pathogens were isolated. Thus, the isolation of only commensals (of presumed low virulence), does not appear to play an important role in the therapeutic outcomes of DFI (including DFO). T

P57

Patients at high risk for PJI – can we reduce the incidence of infections using dual antibiotic-loaded bone cements? (11231)

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Introduction

Despite the widespread clinical practice of preoperative patient optimization a considerable proportion of patients remains at higher risk for prosthetic joint infections (PJI). This has become most evident, if operating on frail and multimorbid patients as well as in revision and hemiarthroplasty procedures. Prior patient stratification according to presumed infection risks, followed by a more potent local antibiotic prophylaxis protocol, may be an interesting strategy to decrease the burden of PJI. Instead of following a “one size fits all” prophylactic approach, it has been hypothesized that such patients may benefit from selective use of dual antibiotic loaded bone cement ((DALBC) consisting of combinations of premixed antibiotics.

Methods

The PubMed & EMBASE databases were screened for publications pertaining to the utilization of DALBC in cement for infection prophylaxis & prosthesis fixation. 6 preclinical & 7 clinical studies were identified which met the inclusion criteria and were stratified by level of clinical evidence (I-IV). The combination of gentamicin & clindamycin in bone cement (product COPAL G+C) was the only referenced dual ALBC in these studies.

Results

(1)DALBC − in particular the DALBC COPAL G+C (loaded with gentamicin & clindamycin) − has been shown to exert a much stronger and longer lasting inhibition of biofilm formation on many PJI relevant bacteria (gram-positive and gram-negative pathogens) than single gentamicin-only containing cements.

(2) COPAL G+C use in the intervention arm of 7 clinical studies has led to a significant reduction of PJI cases in a) cemented hemiarthroplasty procedures (3 studies, evidence level I and III), in b) cemented septic revision surgeries (2 studies, evidence level III), in c) cemented aseptic knee revisions (1 study, evidence level III) and in d) cemented primary arthroplasties in multi-morbid patients (1 study, evidence level III-IV). These benefits were not associated with more systemic side effects or a higher prevalence of broad antimicrobial resistancies.

Conclusion

The idea of a reinforced local AB prophylactic strategy according to higher PJI risks may be an effective option to further mitigate the burden of PJI. The preliminar findings so far may encourage clinicians to consolidate this hypothesis on a wider clinical range.

P58

Multi-staged reconstruction of anterior knee defect after TKA infections with pedicled medial gastrocnemius flap and split thickness skin graft after temporary coverage with Epigard and negative-pressure wound conditioning: a clinical case (11249)

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Background

Soft tissue defects on the knee with TKA underneath are challenging because of the risk of infections. Multiples procedures increase the occurrence of defects, in particular over the knee because of skin tension. Reconstruction of soft tissue defects with pedicled medial gastrocnemius flap and split thickness skin graft has shown excellent results and the technique is reproducible with minimal donor site morbidity. We present a clinical case of multi-staged reconstruction which can be adopted in case of unsure vascularization.

Case Presentation

A 64 years old female with past history of left TKA in 2010 presented to the ED from a rehabilitation unit because of scar opening and implant insufficiency 2.5 weeks after a second osteosynthesis of a left patellar fracture. The third patellar osteosynthesis surgery was complicated by a postoperative acute infection of the knee by s. epidermidis, requiring the patellar implant and TKA removal with placement of an antibiotic-impregnated mobile cement spacer. A VAC system was applied to cover the defect on the anterior aspect of the knee until control of the acute phase of the infection with IV AB-therapy and knee irrigations. The defect was reconstructed with a pedicled medial gastrocnemius flap, but due to uncertain intraoperative vascularization, a multi-staged approach was adopted: immediate coverage with Epigard and multiple changes of negative-pressure dressings before definitive split thickness skin graft. Complete wound healing was observed after 2 weeks, with AB-therapy maintained for 12 weeks. The patient was transferred in a rehabilitation unit, unfortunately she fell and had a proximal femoral IMN on the same side with a subluxation of the mobile spacer, which was changed for a fixed spacer. The knee was approached through elevation of the flap, with excellent wound healing.

Discussion

Iterative procedures in a short-time are a risk of postoperative infections. This case shows how it can tragically progress into a soft-tissue coverage defect, worsening the infection prognosis. Orthoplastics procedures as pedicled medial gastrocnemius flaps and split thickness skin grafts are accepted options to provide a good coverage over sensitive areas, in particular with underlying material such as prosthetics implants. In case of long term AB-treatment before reimplantation, they provide a clean and vascularized protection before the definitive surgery and can be easily approached during the procedure.

P59

Failure of glycaemic normalisation after surgery for diabetic foot infections – associated with potential clinical failures? (11360)

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Introduction

A persistently elevated glycaemia postoperatively might influence the success of the surgical management of diabetic foot infections (DFI).

Methods

In this case-control study using a multivariate Cox regression model, patients undergoing surgical treatment for a DFI with and without clinical failure were compared. The glycaemia, among other factors, were analysed at admission as well as at Day 3 and 7 after postoperatively.

Results

One thousand and thirteen cases of DFI, occurring in 586 adult patients (mean age, 67 years) among which 148 cases (15%) had type I diabetes, 882 (87%) osteomyelitis and 572 (56%) revascularisation procedures, underwent a median of one surgical intervention with a median antibiotic therapy duration of 21 days. Diabetes counselling was implemented in 195 cases (19%) (median of 1 session; range, 0-8 sessions). At the same time, all patients were equally followed by internal medicine physicians. At admission, glycemia derailment was observed in 110 cases (11%) with a median admission glycaemia and serum HbA1c values of 7.9 mmol /l and 7.6%, respectively. On postoperative Day 3, glycemia had normalized in 352 (35%) and on Day 7, in 321 (32%) cases. The glycemia had entirely normalized in only 47 cases (13%) until the end of hospitalisation. Overall, 255 DFI episodes (255/1013; 25%) failed and required revision surgery or reiteration antibiotic treatment. In the multivariate analysis, neither the initial HbA1c value, nor the number of diabetes counselling sessions or the normalisations of daily glycaemic levels at Day 3, Day 7, or both, influenced the incidence of clinical failures.

Conclusions

Among all DFI cases, only 13% showed a normalisation of glycaemia at both time points postoperatively. If glycaemic normalisation occurred, it happened on Day 3, without further improvement thereafter. A rapid postoperative normalisation of glycemia does not influence the failure risk of a surgical treatment for a DFI.

P60

Limb salvage over common amputation for very rare invasive carcinoma arising from chronic osteomyelitis of the femur (11243)

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Introduction

Chronic osteomyelitis (COM) is a difficult to treat and recurring osseous infection caused mostly by contagious inoculation after open fracture injuries. A draining sinus tract is a frequent clinical sign with long-term persistence irritating the soft tissue, especially the skin. A malignant transformation of the sinus tract into a squamous cell carcinoma (SCC) is a very rare severe complication ranging from 0.2-1.6%. In such a case, amputation was commonly the treatment of choice on the limbs due to its potential for local invasion, metastatic spread, and recurrence.

Methods

We present a case of a male patient with a 36-year history of a sinus tract draining the COM of the right femur. A local invasive SCC had developed and the patient underwent a wide soft and bone tissue resection followed by a cement augmented plate osteosynthesis as a bone substitution preserving the function of the limb. Additionally, we reviewed the literature on surgical limb-saving therapy in SCC associated with COM and searched for analogies with our report in the discussion.

Results

Through the complex resection, both the COM and SCC have been cured. Antibiotics were given for 8 weeks after the surgery. The clinical examination showed proper wound healing and a weakened knee extension which improved partially during the years and was balanced with an orthotic brace. There was no evidence of either disease during 17 years. To our knowledge, the longest tumor-free follow-up ever published.

In the literature, 23 cases receiving the wide tumor resection were identified. Out of these cases, 10 had documented follow-up control with a mean time interval of 4.6 years (0.5 − 12.25). Only one local recurrence has been noted and resulted in below-knee amputation.

Conclusion

Based on our experience and recent literature review, the limb salvage treatment of the concomitant SCC in patients with COM should be taken into consideration in selected cases. The factors such as early diagnosis with no local or distant tumor spreading, low histopathological profile, no joint involvement, and functional potential after surgery should be present.

POSTERS: SPECIAL FIELDS TUMORS

P61

Motorized intramedullary bone transport nail – reconstruction of large diaphyseal bone defects after tumor resection (11395)

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Introduction

The technique using bone transport and distraction osteogenesis after tumor resections fell into oblivion, as methods for bone transport used to be very complicated and often needed external fixation techniques. The lack of patient comfort, pin-tract infections and a significantly delayed adjuvant therapy led to little acceptance of this approach. Strictly intramedullary implants can avoid all the mentioned problems. This case report describes the utilization of a Precice Bone Transport Nail for intramedullary distraction osteogenesis after tumor resection at the tibia.

Methods

A 15-year-old female patient was diagnosed with an adamantinoma localized in the tibia diaphysis. After the complete en-bloc resection of the tumor, a bone defect of 9 cm length was present. During the surgery the proximal and distal part of the residual tibia were stabilized with a temporary external fixation in order to keep the correct rotation and length. A Precise Bone Transport Nail was implanted. Distally, another osteotomy was performed to create the transport segment and the nail was then fixed. The transport segment was fixed to the distraction unit of the nail. The distraction process was initiated 8 days after the surgery, at a rate of 0.25 mm twice a day. The patient was provided an external magnet controller for home use along with detailed instructions. Full weight-bearing was allowed. For the first 6 weeks crutches were used for longer distances. Regular follow up examinations were done to monitor transport and callus formation. About 6 months postoperative, the patient underwent the necessary screw exchange of the transport unit because of the large defect and the product design.

Results

At 1-year follow-up, the patient was fully weight-bearing without pain. There was significant healing at the bone distraction site, and no evidence of local recurrence of the tumor. The nail was removed 2 years postoperatively. The hardware removal surgery was more demanding due to the long time the nail stayed implanted and a resulting osseous integration. No further revision surgery was needed. A complete reconstruction of 9 cm bone defect could be achieved.

Conclusion

The use of motorized intramedullary nails for distraction osteogenesis after tumor resection is a safe and reliable technique for the biologic reconstruction of intercalary defects in selected cases. It allows full weight-bearing during the transport phase which is very comfortable.

P62

Hibernoma (11357)

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Objective

Hibernoma or fetal fat cell lipoma is a rare benign adipocytic tumor consisting of brown fat and occurs predominantly in young adults with a mean age of 40 years. It is most commonly located in the subcutis of the thigh, followed by trunk, upper extremity, head and neck. Intra-muscular (up to 20%) and rare cases of intraosseous location have also been described. Because of an abundance of mitochondria and higher vascularity in comparison to a lipoma they have a red-brown gross appearance and may become quite large.

Methods

We present five cases of symptomatic hibernoma in four females and one male with a mean age of 52 years. In three patients, the hibernoma was located intramuscularly: One in the right parascapular region with a maximal tumor dimension of 10cm, one in the left subdeltoid (11cm) and one in the left gluteal region (13cm). In two patients the hibernoma was intraosseous, one in the left sacral ala (1.5cm) and one in the left medial femoral condyle (3cm) respectively. All lesions were histologically proven by imaging guided core needle biopsy, showing typical brown fat cells with mitochondria-rich, eosinophilic, granular cytoplasm.

Results

The intraosseous hibernoma of the left knee could be managed conservatively with follow-up of the lesion due to minor symptoms and no risk of impending fracture. The other 4 hibernomas were surgically treated. For the intraosseous sacral ala lesion a microsurgical decompression was performed, and the other 3 intramuscular located hibernomas were excised in toto. The postoperative course in all patients was uneventful.

Conclusion

Hibernoma has to be considered as a differential diagnosis for adipocytic tumors and due to their growth or sometimes intraosseous location they can become symptomatic. Surgical excision is the treatment of choice and it has no significant potential for local recurrence.

P63

Osteofibrous Dysplasia-like Adamantinoma (OFD-AD) of the Tibia progressing into Adamantinoma (AD) after 36 years (11142)

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Introduction

Osteofibrous dysplasia (OFD) is a rare benign, fibro-osseous lesion predominantly affecting the tibia (Campanacci). Osteofibrous dysplasia-like adamantinoma (OFD-AD) differs from OFD by the inclusion of clusters of epithelial cells spread throughout the lesion, whilst Admantinoma (AD) is a malignant biphasic tumor with nests of sheets of epithelial cells surrounded by spindle cells with an osteofibrous component (WHO).

There is controversy whether OFD can progress to OFD-AD and AD. In a single-institution study [1], no patient with OFD (42 cases) or OFD-AD (10 cases f/u 36 to 316 months, average 97m) progressed to AD. In a large multicenter study [2], OFD-AD showed aggressive behaviour without metastatic potential; only one of the 117 OFD-AD patients developed classic AD over 39 years, remaining disease free at 5 years after treatment. Classic AD (190 cases) in this study showed full malignant potential with local recurrence, metastases (17%) and fatal outcome (13%). One more case [3] with transition from OFD-AD to AD between the age of 12 to 23 years was reported. Our case is presented to draw attention for the need of principally 'open-end' follow-up for patients with OFD-AD.

Methods

F *1975. At 6 years of age (1981) biopsy diagnosed OFD with AD-elements (OFD-AD). At age 20 years (1995) increasing anterior tibial bowing and overlength was treated by shortening and corrective osteotomy. Pathologic examination showed elements of OFD-AD. Imaging (MRI, X-Ray) remained unchanged until MRI 2020 showed osteolytic lesions within the preexisting changes, FDG-avid in PET-CT. Curetted material contained typical AD.

An extralesional resection of the involved diaphyseal tibial segment was performed with replantation after preparation and pasteurization to support the transposed pedicled ipsilateral fibula.

Results

At present 12 months after resection/reconstruction the patient appears disease free with negative bone scan and improving bone remodeling.

Conclusion

Besides the pathologic 'diagnostic etiquette' understanding the biology in the spectrum of OFD to OFD-AD to AD is needed. This case is of special interest because of the long-term follow-up of an OFD-AD over 36 years and late transition into AD. The correct management between careful observation and resection appears mandatory but difficult.

1 Scholfield et al. Bone Joint J 2017; 99-B: 409-16

2 Schutgens et al. J Bone Joint Surg Am 2020; 102: 1703-13

3 Hatori et al. Tohoku J Exp Med 20

P64

FGF-23 transmitted tumor – induced hypophosphatemic osteomalacia: a rare case of a young woman with recurrent fractures (11278)

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Introduction

Tumor-induced osteomalacia (TIO) is a rare form of acquired hypophosphatemia which was first described in 1959. In TIO a mesenchymal tumor produces phosphaturic fibroblast growth factor 23 (FGF 23) and causes hypophosphatemia in adults which has been reported in about 500 cases.

Algorithms for diagnosis and treatment were established, but TIO is often diagnosed with extensive delay leading to unnecessary diagnostic and interventional procedures. Detecting the tumor remains a challenge due to small size and variable location. A genetic etiology must be excluded once TIO is suspected.

Methods/Results

We present a case of tumor-induced osteomalacia (TIO) in a young woman of 22 years. The fibroblast growth factor 23 transmitting tumor in her left foot remained undetected for several years. She suffered multiple fractures including insufficiency fractures of both femoral necks requiring bilateral proximal femoral nailing. After phosphaturia was diagnosed any known genetic etiology was excluded. Even advanced imaging modalities (including FDG-PET) were unable to detect the clinically silent tumor until an 68Ga-DOTA-TOC-PET/CT-scan revealed a mass with paraneoplastic activity in the left foot. Complete resection of the tumor proved to fully cure her condition after 9 years. Serum phosphate levels returned to normal within days and bone densitometry showed normal t-scores within months.

Conclusions

TIO is a rare but increasingly recognized condition, caused by mostly benign and slow-growing phosphaturic mesenchymal tumors secreting FGF-23 (~70-80% of all cases). In 60% of cases (including this one) a FN1-FGFR1 fusion transcript is detectable. This case illustrates the common difficulties in diagnosing and treating these tumors with a delay of nine years between the onset of symptoms and curative tumor surgery.

In a young patient with recurrent fractures and unknown cause of osteomalacia the index of suspicion should be set rather high, and all measures should be taken to establish an early diagnosis. This will spare the patient from long suffering as symptoms are fully reversible after tumor resection.

P65

Osteopenia resistant to therapy: phosphaturic mesenchymal tumor as a rare cause (11316)

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Introduction

Phosphaturic mesenchymal tumor (PMT) is a rare neoplasm of bone and/or soft tissue origins. This often solitary tumor ectopically secretes a bone cell–derived protein, fibroblast growth factor 23 (FGF23) which is responsible for the phosphate homeostasis. The high blood levels of FGF23 causes a renal phosphate wasting, hyperphosphaturia, leading to hypophosphatemia and hypovitaminosis D. The compensatory mobilization of calcium and phosphate from bones manifests clinically as widespread osteomalacia which maximally can lead to pathological fractures. Due to the presentation of a non-specific symptoms, the correct diagnosis is often delayed. The search for the origin of osteopenia can be frustrating. For PMT specifically, a 68-Gallium Dotatate PET CT tracer uptake represents a useful imaging.

Methods

We report a case of a 44-year-old man with more than a year history of progressive immobilizing back pain and acute shoulder and feet pain. Laboratory blood results showed hypophosphatemia (0,33 mmol/l), high bone-specific alkaline phosphatase (43,1 µg/l) and high levels of FGF23 (243 kRU/l). X-Ray and MRI revealed diffuse osteopenia, older sacral fracture and bone edema in femoral neck, no trauma in the past was reported. Before the PMT was diagnosed, attempts to manage osteomalacia with vitamin D and phosphate supplementation were consequently useless. The PET CT showed a 2.5 x 1.3 cm highly Dotatate and contrast binding tumor between left M. adductor magnus and M. adductor brevis. The core needle biopsy confirmed the suspected diagnosis of PMT.

Results

The patient then underwent a surgical resection. Thereafter, we noted a sharply decreased level of FGF23 (28 kRU/l) in the serum, associated with an improved phosphatemia (0,97 mmol/l), normalization of Vitamin D level (69 nmol/l) and a complete relief of systemic pain.

Conclusion

The diagnosis of PMT can be delayed even for years due to rarity, the non-specific symptoms and the failure to test serum phosphorus levels. The possibility of measurement of serum level of FGF23 in case of hypophosphatemic osteomalacia resistant to supplementation is a straightforward diagnostic way. To localize the tumor, a 68Ga-DOTATATE PET/CT scan is enormous helpful. A core needle biopsy confirms the suspicion. Complete surgical removal of the PMT is the treatment of choice and results in the resolution of the osteomalacia, blood abnormalities and pain.

P66

Proximal tibia resection for sarcoma: Reconstruction of the extensor mechanism using a free antero-lateral thigh perforator flap (11434)

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Introduction

Bone sarcomas of the proximal tibia pose difficult challenges considering the resection of the patellar tendon and its restauration of function. There are several techniques used for the reconstruction of the extensor mechanism. Specifically, the goal is that the remainder of the patellar tendon stump is fixed to the prosthesis with the goal that it heals into the periprosthetic membrane to be able to power the leg. Most often, a gastrocnemius flap is used for soft tissue coverage. The disadvantage of using the medial gastrocnemius muscular head is the loss of power for foot flexion. In here, we report the use of a free antero-lateral thigh perforator

flap (ALT) to obtain soft tissue coverage after extensive resections of the extensor musculature of the leg.

Methods

Two male (16 and 19yo) and one female (22yo) patients with two osteosarcomas and one Ewing's sarcoma of the proximal tibia underwent a proximal tibia resection including extensive soft tissue removal of both extensors and flexors because of the local extent of the tumor. A tumor prosthesis was implanted, and the patellar tendon was fixed to the prosthesis in full extension. A free ALT was harvested from the ipsilateral thigh and anastomosed with the stumps of the anterior tibial vessels. In one patient, a large lymph vessel was anastomosed to the popliteal vein.

Results

All patients healed locally uneventfully. At a mean of 8-month follow-up, all three patients walked without crutches and had full active extension of the knee without lag, with normal push up from ground in the ankle.

Conclusion

The use of an ALT for coverage of the proximal tibia after extensive tumor resection has not been described yet. It can be safely used and allows to restore knee function without compromising the push-up power while walking.

POSTERS: BASIC RESEARCH

P67

Culture of 3D Bioprinted Bone Constructs Requires an Increased Fluid Dynamic Stimulation (11236)

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Introduction

Regeneration of bone tissue in critical sized defects is still an open issue and, in this context, biological substitutes based on constructs loaded with osteogenic cells can be a promising therapeutic approach [1]. During in vitro culture, flow-induced mechanical stimulation has been shown to favor mineral deposition in scaffolds seeded with cells directly exposed to the fluid flow [2]. However, the effect of fluid dynamic parameters, such as shear stress (SS), within 3D bioprinted constructs, is still unclear. Thus, the aim of this study was to correlate the levels of fluid flow SS and the mineral deposition in 3D bioprinted constructs, evaluating the possible dampening effect of alginate and gelatin-based hydrogels on the embedded cells.

Methods

Cylindrical porous scaffolds (d = 10 mm, h = 3 mm) were designed with SolidWorks and bioprinted using a hydrogel made of 0.8%(w/v) alginate and 4.1%(w/v) gelatin embedding hMSCs at 5 Mcells/ml. Bioprinted scaffolds were cultured in osteogenic medium comparing 0.7 and 7 ml/min flow rates to static control. Micro-computed tomography was performed weekly to analyze mineral deposition for up to 42 days. Computational fluid dynamic simulations were run on scaffolds using COMSOL Multiphysics to evaluate SS, fluid velocity, and pressure distribution on construct fibers.

Results

Bone volume (BV) significantly increased in perfused groups as compared to static control (Fig. 1). It ranged from 0.35±0.28 mm3, 11.90±8.74 mm3 and 25.81±5.02 mm3 at week 3 to 2.28±0.78 mm3, 22.55±2.45 mm3 and 46.05±5.95 mm3 at week 6 in static, 0.7 and 7 ml/min groups, respectively. SS values on construct fibers in the range 10-100 mPa in 7 ml/min samples (52.81%) were twice those in 0.7 ml/min samples (23.41%), showing the same trend of BV.

Discussion & conclusions

The obtained results suggest that, to increase mineral deposition by hMSCs within in vitro cultured 3D bioprinted constructs, it is necessary to enhance the flow-induced mechanical stimulation within cell-embedded hydrogel structures, as compared to what has been generally reported for the development of bone constructs when employing scaffolds with cells directly exposed to the fluid flow [2].

Acknowledgments

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[1] Pina, S. et al. 2019 Materials (Basel)

[2] Melke, J. et al. 2018 Eur Cell Mater.

P68

Minimally invasive lateral plating for metadiaphyseal fractures of the humerus and its implications for the deltoid muscle: functional analysis and MR-imaging (11348)

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Introduction

Minimally invasive lateral plate osteosynthesis of the humerus (MILPOH) is an alternative to other minimally invasive fixation options of the humeral shaft such as anterior plating, the use of helical plates or intramedullary nailing. The plate is introduced through a deltoid split proximally and advanced through the middle portions of the deltoid insertion and between bone and brachial muscle to the distal aspect of the humerus. It was the aim of this study to evaluate the implications of this manoeuvre on the integrity of the deltoid insertion and muscle function as this have never been studied before.

Methods

Informed consent was obtained from 7 patients (median age 60 years, range 51-73 years, f/m 6/1) who had undergone MILPOH between 08/2017 and 08/2020. Functional testing was performed for the injured and uninjured extremity including strength measurements for 30/60/90° shoulder abduction. CMS, DASH, Oxford Shoulder Score (OSS) and EQ-5D were obtained. MR imaging was performed for both shoulders accordingly to assess the integrity of the distal insertion, muscle mass and fatty degeneration of the deltoid muscle.

Results

Median follow-up was 30 months (range 12-46 months). The difference in median abduction force according to MILPOH compared to the uninjured side was between − 9 % (30°) and 27 % (90°). Age- and gender-adapted CMS was 88 (79-99) compared to 98 (92-110), median OSS was 42, ranging from 37-48. DASH was 26 (15-36). VAS-EQ-5D of the affected extremity ranged from 81-95 with a median of 90. EQ-5D index was 1 (1-1). Deltoid muscle mass showed a heterogeneous pattern with a median difference of 1.4% and a wide range from -21% to 35% compared to the uninjured side. Neither a relevant fatty infiltration of the deltoid muscle nor an inconsistency of the deltoid insertion was observed.

Conclusions

MILPOH is associated with good functional and subjective outcome despite a slight reduction of abduction strength. Neither muscle mass nor

muscle quality correlated with functional outcome. MILPOH does not appear to affect the structural quality of the deltoid muscle and the integrity of its attachment remains intact.

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3D planned surgery of acute fractures performed with 3D guides planned and printed at the point of care – a feasibility study (11383)

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Background

The surgical treatment of long bone fractures leads to complications due to insufficient accuracy in a relevant number of cases. In comminuted diaphyseal femur fractures relevant (>15°) rotation errors occur in up to 40%, which either results in a poor clinical outcome or requires revision surgery. The aim of this study is to evaluate the accuracy of surgery performed with 3D guides planned and printed at the point of care.

Methods

Ten porcine legs were used. CT imaging was performed and 3D models of femur and tibia were built. Reposition guides were constructed and virtually fitted to the proximal and distal metaphysis using Matetrialise Mimics software. Subsequently, these guides were 3D printed using medically approved resin on a Formlabs Form3B 3D printer. Comminuted fractures were created in the shaft region of femur and tibia and subsequently reduced using the 3D guides. Postoperatively, CT scans were acquired and 3D models were built to compare the achieved result to the preoperative planning. Deviations from the plan are given in millimeters (length) and degrees (rotation, axis).

Results

Femoral reposition showed a mean deviation from the plan of 0.8 mm for length, 1.0° for varus/valgus, 1.8° for flexion/extension and 2.7° for rotation. The tibial reposition showed a mean deviation from the plan of 2.5 mm for length, 1.4° for varus/valgus, 1.0° for flexion/extension and 1.6° for rotation.

Conclusion

This study shows a high accuracy of reposition with 3D guides planned and printed at the point of care. Applied to patients this technique has the potential to avoid malreduction and consecutive revision surgery in comminuted long-bone fractures in up to 40%.

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P70

Assessment patient reported outcomes in sarcoma patients undergoing a diagnostic imaging guided biopsy (11428)

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Introduction

The imaging guided biopsy of a musculoskeletal tumor is a critical step to establish the diagnosis before treatment initiation. Because this represents an invasive procedure, patients must be informed thoroughly about the purpose and the potential side effects including pain. Health-related outcome measure are becoming more and more important specifically in the context of determining the quality of therapy and value-based health care. To the best of the authors' knowledge, there is no patient related outcome measure defined for the diagnostic work-up of sarcoma-patients.

Methods

We developed a questionnaire for patients undergoing an imaging guided biopsy for a suspected sarcoma. Ten questions focused on the understanding of the purpose, about their feeling of the biopsy procedure, the pain level, and the organization of the biopsy as well as the act itself, and post procedure control. Each of the 13 questions was scored with 0 to 10 points directly on an iPad.

Results

A total of 64 patients were evaluated with this biopsy related outcome measure by the patients. 98% of all patients understood the purpose for the biopsy, and they felt well infor Pain level experienced during the biopsy varied from 0 to 10, as was expected by them, but the level of pain was judged by 75% of patients as 3 out of 10 and lower. There were no local wound problems in the aftermath of the biopsy.

Conclusion

The assessment of patient reported outcome and experience measures undergoing an imaging guided biopsy for the suspicion of a soft tissue sarcoma is feasible. The initial analysis reveals that overall patient satisfaction level is high. Further analysis focuses on detailed scores with respect to the type of diagnosis, location of the tumor as well as demographic parameters.

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The most important factors for patients' satisfaction during hospitalization for spinal surgery (11387)

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Introduction

Patients' perspectives and expectations around spinal procedures are largely unknown and potentially responsive to non-medical factors. We asked if hospitalization-related expectations overrule objective surgical outcomes regarding the patients' final global satisfaction.

Methods

A questionnaire-based survey was performed during November-December 2021 on patient (mean age of 65 years, 81% were Swiss citizens, 87 females (52%)) 3-6 weeks following spinal surgery (70% lumbar). The survey contained 45 variables ranging from 1 to 5 points on the Likert Scale and the possibilities of free text insertion. Validation was performed by a subgroup of patients with individual interviews (n = 10). Answers situated beyond the 50% percentile were defined as satisfactory. 167 questionnaires were analyzed with an acceptable internal consistency of the formulations (Cronbach's alpha 0.59). A multivariate logistic regression model (ROC value 0.80) was used to find the most influencing factors of patient's satisfaction.

Results

The most determinant variable of global satisfaction was the improvement of mobility (odds ratio 2.2, 95%CI 1.3-3.7), followed by the gentleness of the surgeon (OR 1.8, 95%CI 1.1-2.8) and the professional competence of the nurses (OR 1.8, 95%CI 0.5-6.2). Gender, age, patients' education, waiting delay until surgery, hotel services or improvement in pain (OR 1.0, 95%CI 0.6-1.6) were less influential on global satisfaction.

Conclusion

In adult spinal surgery, the three most striking determinants of global patient satisfaction of the hospitalization period are gain in mobility, gentleness of the surgeon, and professional competence of the nurses.

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