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Outcomes of elderly hip fracture patients in the Swiss healthcare system

A survey prior to the implementation of DRGs and prior to the implementation of a Geriatric Fracture Centre

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Summary

Problem and questions: The consequences for elderly patients with hip fractures are well known. In Switzerland, the introduction of diagnosis related groups (DRG) will bring additional challenges. New models of care, such as Geriatric Fracture Centres (GFC), may be the key to minimising negative outcomes. This study documents outcomes of hip fracture patients in the Swiss healthcare system, for use as baseline data prior to DRG- and GFC-implementation, and compares them to results reported in the literature, for example by Cooper (1997).

Methods: This was a prospective cohort quality assurance survey with a one-year follow-up. Outcomes were mortality, living situation, required support and mobility. All patients 65 years of age or older with a proximal femoral fracture were included. Data were analysed by descriptive and interferential statistics.

Results: From 272 patients, 70% were community dwelling pre-fracture. Overall, one-year mortality was 22%. Pre-fracture community dwelling patients had better outcomes than nursing home patients with a one-year mortality rate of 12%. A total of 83% of pre-fracture community dwelling patients still lived in the community after one year but more needed help with activities of daily living (ADL) or mobility. Patients with dementia, ADL- and mobility dependency pre-fracture were significantly more at risk for being newly admitted to a nursing home.

Conclusions: Our results reflect the clinical reality of the hip fracture population in Switzerland. Results one year after fracture were comparable to study findings in different health care systems. Our findings provide important baseline data prior to the implementation of DRG and GFC.

Key words: *Hip fracture; mortality; frailty, physical and cognitive functioning; mobility, activities of daily living, dependency*

Introduction

Fragility fractures in older adults describe two major problems: 1) osteoporotic fractures as result of a low energy trauma and 2) age-related higher prevalence of co-morbidity and disability, so called frailty, as an index for deficit accumulation, which puts patients at risk for postoperative complications and further fractures [1–3]. The ability of frail elderly fracture patients to perform activities of daily living (ADL) is already limited, even in the absence of a fracture, which creates a sensitive balance that is easily disturbed [4]. The capability to withstand a major fracture without further loss of function is therefore reduced. Such a fracture often results in increased mortality compared to an age-matched population, and further reduction of functional status with reduced ADLs and mobility. As a result, geriatric fracture patients are at risk of experiencing an inability to return to their baseline pre-fracture community

residential status without additional support; they may even require admission to a nursing home [5–7].

Thus, fragility fractures create a significant and increasing burden of illness for the affected patient as well as for the community and the healthcare system. In Switzerland, the introduction of Diagnostic Related Groups (DRG) will present us with additional challenges. For instance, DRG may change hospital lengths of stay, especially for vulnerable patient groups such as frail elderly people. In the future, the implementation of new models of care such as Geriatric Fracture Centres (GFC) with a co-managed approach (discussed later) will be necessary and may be an answer to providing appropriate support to the growing number of geriatric fracture patients.

As a result, baseline data about the outcomes of hip fracture patients are urgently needed before the implementation of DRG and GFC. Current outcome data of hip fracture patients are also necessary because the historic review of Cooper (1997) is still one of the most frequently cited references. This review, however, refers to patient outcomes following hip fractures in 1997 in the US healthcare system and more recent data from within our own healthcare system are needed.

The aim of the current study was to describe hip fracture patients and their one-year follow-up results following treatment in the Swiss healthcare setting, prior to DRG introduction and prior to implementation of a GFC with a co-managed approach. The following research questions guided the investigation: What were patient characteristics and functional status before fracture? One year post-fracture, what was the mortality rate, living circumstances, required help and mobility status of patients? Since most studies only refer to community dwelling patients, we also wanted to know how this subgroup differed from nursing home patients and the total cohort. The results are discussed in context of Cooper's (1997) frequently cited review article and other literature from different healthcare systems.

Methods

Design, sample and setting

The present survey was a prospective cohort study with a one-year follow-up. One-year mortality, place of residence, required help and mobility 12 months after the initial fracture were studied with a special focus on pre-fracture community dwelling patients. All patients aged 65 years or older who were treated for a femoral neck or intertrochanteric hip fracture at the University Hospital Basel, during the 16 month period between June 2007 and September 2008, were consecutively included in the survey. Patients with pathologic fracture for metastasized diseases, other femur fracture location than hip or fractures due to a high energy trauma were excluded (fig. 1 illustrates the flow of inclusion).

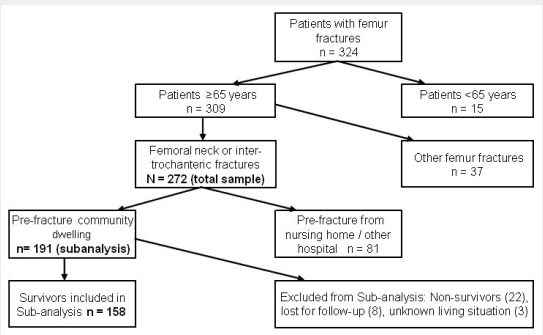

Figure 1

Flow diagram: Included patients.

Data collection and analysis

All information in the survey was collected prospectively. Demographic data, fracture type, and pre-existing co-morbidities were retrieved from the medical records. The index of co-morbidities was calculated based on the physician's diagnoses at admission, using the Charlson Co-morbidity Index (CCI), not including age [8]. Pre-existing dementia was defined as a documented diagnosis (or suspicion) of dementia or cognitive impairment in the patient's chart at admission. The rating was not based on a systematic screening (e.g. Mini Mental Status Examination MMSE) in the emergency situation but on patients' known history or on patients' status at admission as assessed by the emergency physician. Length of stay was defined as the number of days from admission to the hospital, to the day of discharge from the acute clinic and transfer to the rehabilitation clinic, to the nursing home, or direct discharge back home. Data on living circumstances, required help in ADL and mobility before fracture were obtained from the patient or family members during the hospital stay. Patients were categorised by well trained, advanced practice nurses as dependent in ADL, if there was a reported need for help in any ADL such as washing or dressing. Mobility was estimated based on the need for different walking aids. Patients were categorised in 'good mobility' status when they reported being able to walk without help or only needing minor help such as a walking cane. There was no systematic use of validated assessment tools like the Barthel- or Parker- Mobility Index, however the adequacy of the assessment was supported by the expertise of the assessors. All data from the initial hospital stay were collected by the first and the fourth authors.

Follow-up data were obtained by telephone interviews with the patient, relatives and primary care provider, 12 months after fracture (plus/minus 2 weeks). To determine patients who died within the first year after the fracture, searches were conducted in the local medical information system (IS-MED) or information was obtained from the primary care provider. Follow-up data were collected by the first, third and fourth authors.

All data were analysed by descriptive statistics. Differences in baseline data of the two sample-subgroups with different residential status were calculated by using Student's *t*-test, Chi-square or Mann-Whitney-U-Tests for the not normally distributed data of CCI and length of stay. Univariate comparisons were carried out to describe relative risk estimation of one-year mortality and – for the subgroup of pre-fracture community-living patients - living in a nursing home one year after the fracture. Baseline characteristics, which were known as predictors from the literature, were included for these calculations. Multivari-

ate interference-statistics for analysing mortality predictors were not conducted in this survey but will be done with a larger sample in the future. All tests were conducted at the 5% level of significance. All analyses were done in SPSS version 17.0 (SPSS Inc., Chicago, IL, USA).

Ethical considerations

Data were collected in the clinical setting in order to prepare for future quality improvement. The survey was therefore considered as a quality assurance survey without the requirement of written informed consent by participants. Patient data were maintained confidentially, analysed anonymously, and an accordant commitment for confidentiality was signed by the main authors. The survey was approved in the context of continuous quality improvement by the responsible Ethics Committee.

Results

Study population, physical and mental status before fracture

Included in the survey were 272 patients with a mean age of 84 years (SD = 7.5) (see fig. 1). A total of 191 patients (70%) were community dwelling, while 81 patients were living in a nursing home prior to fracture (23%) or were admitted from another hospital. In one case, the original living place was missing. Baseline characteristics for all patients and for the subgroup of "community dwelling patients" and others (patients from nursing homes or other hospitals), and the differences between these two subgroups are shown in table 1.

Considering the co-morbidity status of the patients prior to the fracture, it became evident that many patients suffered from cardiac, renal, pulmonary, mental and other diseases, and had a mean of more than two significant co-morbidities besides the fracture (mean CCI of 2.1; SD = 1.6). The frequency of the most prevalent diagnoses is illustrated in figure 2.

Of the 272 patients, only 49% reported not needing any help in ADL before the fracture. With respect to mobility, 59% could walk without help or needed only minor help such as a walking cane, while 26% needed a walker, a wheelchair or were bedridden before the fracture. For 35% of patients, dementia or the suspicion of dementia was documented in the chart at admission.

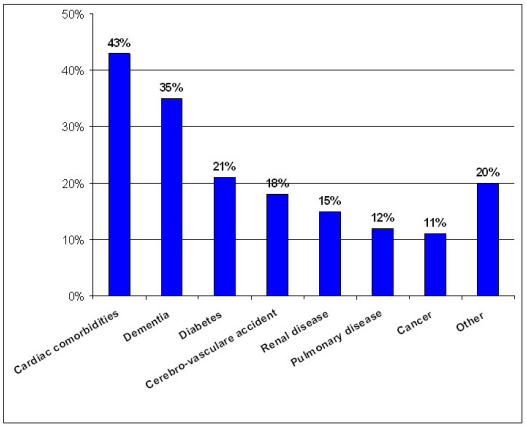

Figure 2

Overall comorbidities (*N* = 272).

Significant differences between community dwelling patients and patients coming from a nursing home or another hospital are presented in table 1. Community dwelling patients had a lower one-year mortality rate, were younger, had fewer co-morbidities, and stayed longer in the hospital than patients who came from a nursing home. For community dwelling patients, further analysis was performed (see below).

Mortality

Mortality for the overall sample during the initial acute hospital stay was 2.6%. Mortality one year after the fracture for the overall sample was 22%. Only nine patients (3%) could not be reached and were lost for the follow-up, probably because they died, lived abroad, or could not be reached for another reason. One year mortality in patients who were community dwelling pre-fracture was significantly lower than for patients who lived in a nursing home pre-fracture (12% vs. 44%, $p < .001$).

Differences between survivors and non-survivors with regard to baseline characteristics, which are known as mortality predictors from the literature, were calculated with univariate comparisons. Patients who did not survive the first year after the fracture were significantly older and had a higher Comorbidity-Index than survivors. In addition, patients with documented dementia pre-fracture, ADL- or mobility dependency, and patients from a nursing home were at a significantly higher risk to die within one year (see table 2).

Subgroup of pre-fracture community dwelling patients: Status before and one year after fracture

For the subgroup of patients who lived in the community before the fracture *(n* = 191), the results for living circumstances, required ADL-help, and mobility before and one year after fracture were analysed in more detail in order to compare them with Cooper (1997) and other literature. Baseline characteristics of the patients are shown in table 1. One-year mortality was 12%. Due to the fact that some patients died, had missing data or were lost for follow-up for other reasons, the living circumstances, required help, and mobility before and one year after fracture could be analysed for 158 patients.

A total of 131 (83%) of the 158 pre-fracture community dwelling surviving patients were still living at home one year after the fracture, while 17% were newly living in a nursing home. Of these 158 patients, 109 (69%) reported not needing any help in ADL before the fracture. One year after the fracture however, only 39% were without need of help; the other 30% required assistance with ADL. Similarly, 126 (80%) of the 158 patients reported good mobility before the fracture (no walking aid or only a walking cane) and 23 (15%) reported restricted mobility with the need of a walking frame or wheelchair. One year after the fracture however, only 90 (57%) of 158 reported good mobility and the number of patients needing a walking frame or wheelchair increased to 67 (42%). Between the patients who were still community dwelling after one year and those

who were newly in a nursing home, the following differences could be seen: For patients with pre-fracture documented dementia, the relative risk (RR) for living in a nursing home was 4.39 (95%-CI 2.27–8.50, p <.001). For patients with pre-fracture ADL-dependency, RR was 3.14 (95%-CI 1.48–6.66, p = .003) and for those with pre-fracture mobility-dependency, RR was 2.36 (95%-CI 1.09–5.09, p = .034).

Discussion

The focus of this article was on a hip fracture patient group that, in its totality, reflects the clinical reality in Switzerland before implementation of DRG and GFC. Baseline characteristics, baseline need for help, mobility before the fracture and one-year mortality were considered for all patients. Many other studies that have examined outcomes after hip fractures excluded patients who were not community dwelling and/or patients with pre-fracture dementia. In order to compare our results with the literature, one part of this article therefore focuses on pre-fracture community dwelling patients. For this subgroup, the functional dependency in ADL and mobility before and after the fracture, and the place of residence after one year were investigated in more detail.

Our findings confirm, in major parts, established knowledge from Cooper's review and from other studies. In some parts however, the current findings are different.

Physical and mental status of patients before fracture

Our overall cohort of studied hip fracture patients was old with a mean age of 84 years; 30% of them resided in a nursing home or another hospital prior to the fracture. In their pre-fracture status, patients had a mean of 2.1 serious comorbidities. In 35% of patients, dementia was documented, and in many a dependency in ADL or in mobility occurred. In other words, these patients were frail, elderly people [2].

Baseline frailty, used as an index for deficit accumulation, is an independent risk factor of death, hip fracture, ADL disability, and hospitalisations and frailty, and is a strong predictor for poor hip fracture outcomes [3, 5, 9]. The significantly reduced overall status of pre-fracture nursing home patients compared to community dwelling patients in our study reflects this increased frailty and is, at the same time, the explanation of poorer outcomes in this patient group. The shorter length of stay in hospital for nursing home patients compared to community dwelling patients was an artefact due to the fact that the former group already had a reserved place upon discharge after the

Table 1
Patient characteristics: overall and subgroups.

	Overall sample: Patients ≥65 with Hip Fractures (n = 272 = 100%)	**Subgroup: Community dwelling Patients (n = 191 = 70%)**	**Subgroup: Patients from nursing home/ other hospitals (n = 81 = 30%)**	**p – value**
Age				
Years: Mean (SD)	83.8 (7.5)	82.7 (7.4)	86.8 (6.9)	<.001*
Range (years)	65–101	65–101	66–101	
Length of stay (LoS)				
Days: Mean (SD)	12.3 (4.8)	13.1 (4.8)	10.4 (4.4)	<.001*
Range (days)	3–35	5–35	3–25	
Gender				
Fenale, n (%)	211 (78%)	142 (74%)	68 (85%)	0.14
Type of fracture				
Femoral neck fracture, n (%)	134 (49%)	93 (49%)	41 (51%)	0.57
Trochanteric fracture, n (%)	138 (51%)	98 (51%)	40 (49%)	
Comorbidity				
Charlson Comorbidity Index: Mean (SD)	2.1 (1.6)	1.8 (1.5)	2.8 (1.7)	<.001*
Range	0–7	0–7	0–7	
Dementia documented at admission (%)	94 (35%)	48 (25%)	46 (57%)	<.001*
One-year mortality**	22%	12%	44%	<.001*

* Significant differences (t-test for differences in age, Mann-Whitney-U-Test for LoS and CCI, Chi-square-Test for all nominal data)
** Data in relative percentage, without "lost for follow-up" patients

Table 2
One-year mortality and baseline characteristics.

	Survivors (n = 206)	**Nonsurvivors (n = 57)**	***p*-value**	**RR****	**CI****
Age (mean/SD)	83.2	86.9	.001*		
Comorbidity-Index (CCI) (mean/SD)	1.9	2.9	<.001*		
Gender: Male	40 (19%)	17 (30%)	0.09	1.54	0.95–2.50
Dementia documented at admission	58 (28%)	33 (58%)	<.001*	2.60	1.64–4.12
Type of fracture: Femoral neck	100 (49%)	30 (53%)	0.65	1.14	0.72–1.80
ADL-dependency	44 (22%)	28 (49%)	<.001*	4.49	2.38–8.47
Mobility-dependency	45 (22%)	26 (46%)	<.001*	2.97	1.76–5.00
From nursing home / other hospital	44 (21%)	35 (61%)	<.001*	3.64	2.29–5.79

* Significant on level .05%; n = 263, excluding "lost for follow-up" patients; Chi-square-, Mann-Whitney-U- or T-test
** Relative Risk (RR) and 95%-Confidence Interval (CI) for dying within 1 year (nominal baseline characteristics, missing data exluded)

acute hospitalisation; the latter group had to wait until there was an available bed in the rehabilitation clinic.

Mortality

One-year mortality for the overall cohort was 22% and differed significantly between patients who were community dwelling before fracture and patients who were living in a nursing home (12% vs. 44%, $p < .001$). In Cooper's review, no overall one-year mortality rate was reported except data for mortality differences between males and females. In one of his main sources however, a one-year mortality of 24% in the US was reported [10]. Over the last four decades numerous publications have documented the outcomes after hip fracture with regard to mortality and the demographics of these patients. A total of 36 of these publications are listed in Haleem's review (2008) and show that one-year mortality has not changed noticeably during this time and is still in the range of between 22% to 29% [11].

Significant differences were observed in some baseline characteristics of surviving and non-surviving patients and increased mortality-risk in our cohort with respect to age, pre-fracture living situation, CCI (in particular dementia), mobility and ADL. In the literature, all these parameters are discussed as predictors of high mortality and are confirmed by our findings.

Mortality after hip fracture increases with age [5, 11–13]. In our cohort, we found a significantly higher mean age in the non-survivor group than in the surviving patients (86.9 vs. 83.2 years, $p = .001$).

An increased mortality for male hip fracture patients and a greater excess risk of death after fracture for men has been reported [5, 11–12]. Cooper (1997) cited one source that showed a relative risk for men of 1.7 [5]. We observed a similar trend with a non-significant, 1.5-fold one-year mortality risk for men compared to women.

The presence of concomitant medical illness or poor health status is a negative predictor for survival following a hip fracture. Different co-morbidities and poor health status (e.g. malnutrition) contribute to major postoperative complications including cardiac or pulmonary symptoms, infections or delirium; these considerably increase the mortality risk [5, 12–16]. Furthermore, not only co-morbidities and complications, but also frailty, poor pre-fracture functional status and associated pre-fracture reduced mobility with the use of assistive devices are all linked to increased risk of mortality [5, 9, 13, 17].

Community dwelling patients: Status before and one year after fracture

To enable patients with a hip fracture to return to their previous living situation at home is a major goal. However, the possibility of returning home is linked to adequate cognitive functioning and a certain independence in ADL and mobility, and is decreased after postoperative complications, such as delirium, that worsen these outcomes [18, 19].

The subgroup of our pre-fracture community dwelling patients are, in many aspects, comparable to other studies that investigated the residential situation and functional independence of previously community dwelling patients, 6 or 12 months after the fracture. A total of 17% of our pre-fracture community dwelling patients were newly admitted to a nursing home one year after the fracture. This is less compared to Cooper (1997) who reported 27%, and similar to a more recent German survey that reported 14% of patients newly residing in nursing homes [5, 20]. Patients with pre-fracture known dementia, ADL- or mobility deficits in our cohort were significantly more at risk to being newly admitted to a nursing home. These findings are in accordance with Penrod et al. (2007), who examined heterogeneity in hip fracture patients in order to predict variation in functional outcomes. By using the simple pre-fracture characteristics of age, ADL, mobility and dementia status at baseline, 90% of patients could be correctly classified into different groups with measurably different 6-month outcomes. The worst outcomes with regards to mortality, ADL- and mobility-dependence, were in patients aged 75 and older with dementia and pre-fracture walking- and ADL dependency [21].

Regarding functional dependence, the current study found that 30% of patients reported less independence in ADL one year after the fracture than before, and the number of patients with good mobility status decreased from 80% before to 57% one year after the fracture. Cooper (1997) reported similar data with 60% who had difficulty with at least one essential ADL and about 40% of patients who were still unable to walk independently after one year. One quarter of formerly independent people became at least partially dependent and half of those who already required assistance at home were admitted to nursing homes. Similar results were found in more recent studies: The majority of survivors showed loss of competence and mobility post-fracture and the functional outcomes were found to be disappointing [20]. A progressive lessening in most areas of functioning and new dependence in physical and instrumental tasks for those not requiring assistance pre-fracture was found elsewhere [7]. Nevertheless, rehabilitation services should be offered to these patients in order to improve functional status outcomes and enable them to return to the community. Hip fracture patients are a heterogeneous cohort, and a strong correlation was found between cognitive and physical functioning in patients at baseline of the fracture [22]. For these reasons, community dwelling patients with mild or moderate dementia and with ADL problems before the fracture may especially benefit from targeted rehabilitation services [21, 22].

Strengths and Limitations

The present survey provides important outcome information of a Swiss hip fracture population in regard to mortality, place of residence, required help and mobility. A further strength in this survey is the high follow-up rate of patients one year after the fracture, which presumes reliable results.

The major limitations are the lack of validated tools for assessment of ADL- and mobility impairment (e.g., Barthel, Katz ADL index, Functional Independent Measure [FIM] or Parker-mobility index respectively) and for cognitive impairment (e.g., Mini Mental Status Examination). The survey was primarily a quality evaluation measure for further improvement of clinical services and not a scientif-

ic research study. For this reason, data collection was conducted during routine clinical care with limited resources. The results therefore must be considered with caution and more studies with validated assessment tools are needed in the future. Another limitation is the describing character of possible predictors for outcomes without performing multivariate interference-statistics. It is planned that this will be done with an enlarged sample in the future. The present study included hip-fracture patients from only one fracture-centre (in a region with a high average age, compared to the whole country), leaving out results from other centres. For this reason, a potential selection bias cannot be excluded and further research in different fracture centres is needed to make generalisations.

Conclusion

Our results confirm many aspects of the frequently cited Cooper (1997) report and are comparable to results of similar cohorts in other, more recent studies from different healthcare systems. Differences exist in the rate of patients who were newly living in a nursing home, which might be due to different services and the already implemented DRG in the US healthcare system. DRG's will soon be a reality in our country and our results provide important baseline data for hip fracture patients regarding evaluation research of DRG-implementation in Switzerland. Furthermore, we hope to attain better outcomes for hip fracture patients by implementing recommended, comprehensive, and multi-professional interventions in the future GFC [12, 23, 24]. In order to do that, a structured pathway has already been developed and is being implemented step-by-step in our clinic. This approach of managed care requires close collaboration between surgeons, geriatricians and advanced practice nurses. The pathway includes documentation of living situation and functional dependence as well as structured assessments in specific areas. As such, it serves as an important baseline for the subsequent individual treatment of patients [25, 26]. In this way, the data of the present survey are also a baseline measurement at the beginning of the implementation of the above described pathway and give us relevant information about patient groups who particularly need support.

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