

Paediatric thyroid surgery is safe – experiences at a tertiary surgical centre

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Summary

PRINCIPLES: Thyroidectomy in children is rare and mostly performed because of thyroid neoplasms. The aim of this study based on prospective data acquisition was to evaluate whether thyroid surgery in children can be performed as safely as in adults when undertaken by a team of adult endocrine surgeons and paediatric surgeons.

METHODS: Between 2002 and 2012, 36 patients younger than 18 years underwent surgery for thyroid gland pathologies. All surgical procedures were performed by an experienced endocrine surgeon and a paediatric surgeon. Baseline demographic data, surgical procedure, duration of operation, length of hospital stay, and postoperative morbidity and mortality were analysed.

RESULTS: The median age of all patients was 13 years (range 2–17 years), with predominantly female gender (n = 30, 83%). The majority of operations were performed because of benign thyroid disease (n = 27, 75%) and only a minority because of malignancy or genetic abnormality with predisposition for malignant transformation (MEN) (n = 9, 25%). Total thyroidectomy was performed in the majority of the patients (n = 24, 67%). The median duration of the surgical procedure was 153 minutes (range 90–310 minutes). The median hospital stay was 5 days (3–11 days). One patient developed persistent hypoparathyroidism after neck dissection due to cancer. One persistent and two temporary recurrent nerve palsies occurred.

CONCLUSION: This study demonstrated that paediatric thyroidectomy is safe as performed by this team of endocrine and paediatric surgeons, with acceptable morbidity even when total thyroidectomy was performed in the case of benign disease.

Key words: otolaryngology; child; thyroidectomy; hypoparathyroidism; postoperative complications

Introduction

Thyroidectomy has become standard surgical treatment for hyperthyroidism, thyroid nodules and thyroid malignancy in adults. Several studies have shown that thyroidectomy is

a safe procedure with low rates of postoperative morbidity [1–3].

Thyroidectomy in children is rare and mostly performed because of thyroid neoplasms [4]. Surgical management of benign thyroid disease has often been avoided because of concerns for increased postoperative morbidity. However, a long-term observation showed that paediatric thyroidectomy is associated with low operative risk [5] and low rates of disease recurrence [6]. Typical undesirable complications after thyroid surgery are nerve lesions with consequent vocal cord paralysis and hypocalcaemia [5]. Both complications impact on further quality of life due to hoarseness or permanent medical substitution. Comparably to the treatment of thyroid diseases in adults [7, 8], it has been shown that total thyroidectomy in children has benefits compared with partial thyroidectomy because of reduced disease recurrence and thus avoidance of need for reoperation with additional operative risk of nerve lesions [6, 9–11].

Despite a recently published retrospective analysis, there is still controversy regarding who should perform thyroid surgery in children: paediatric surgeons or endocrine surgeons [12, 13]. Burke et al. [4] reported that the introduction of an interdisciplinary Endocrine Surgery Centre including paediatricians had a positive effect on the treatment of children with thyroid diseases.

The aim of this retrospective historical case series at a Swiss tertiary medical centre was to evaluate whether thyroid surgery in children can be performed with a comparable morbidity rate as in adults when treated by a team of adult endocrine surgeons and paediatric surgeons.

Materials and methods

Patients

Between 2002 and 2012, data of all patients younger than 18 years undergoing surgery for thyroid gland pathologies were collected prospectively and analysed retrospectively with the primary aim of quality control at our institution. Ethical committee approval was given from the University of Bern, Switzerland.

Surgical procedure

All surgical procedures were performed by an experienced endocrine surgeon and a paediatric surgeon. Standardised visualisation of the recurrent laryngeal nerves and of the parathyroid glands were routinely performed during all procedures. The recurrent laryngeal nerves were routinely monitored in all patients.

Outcome parameters

Baseline demographic data recorded were gender, age and thyroidal pathology. Furthermore, the surgical procedure (total thyroidectomy, hemithyroidectomy, lymphadenectomy), duration of operation, length of hospital stay, postoperative morbidity (recurrent laryngeal nerve palsy, hypoparathyroidism) and mortality were analysed. Before and after the operation, vocal cord function was routinely examined by means of laryngoscopy in all patients. Recurrent nerve palsy lasting over 12 months was defined as persistent recurrent laryngeal nerve palsy. Hypocalcaemia persisting longer than 12 months after the operation was defined as hypoparathyroidism.

Statistics

All data are expressed as medians with ranges and were generated with GraphPad Prism Version 5.0 (GraphPad Software, Inc., La Jolla, CA 92037, USA).

Results

Patient characteristics

During the observation period between December 2002 and October 2012, a total of 36 surgical procedures because of thyroidal pathology in 34 patients younger than 18 years were performed. The median follow-up was 57 months (14–130 months) in all patients. At the time of surgery the majority of the patients had normal thyroid hormone state ($n = 31$; 86%). The median age of all patients was 13 years (range 2–17 years), with predominantly female gender ($n = 30$, 83%). The indications for operation are listed in table 1. Malignancy was diagnosed in 17% of patients. There were five patients with papillary thyroid carcinoma (PTC) and one patient with follicular thyroid carcinoma (FTC). In 11

patients (31%), a preoperative fine needle aspiration was performed.

Surgical procedure

Total thyroidectomy was performed in the majority of the patients ($n = 24$, 67%), hemithyroidectomy was performed in 12 patients (33%), whereas in two patients a second operation on the contralateral side after initial hemithyroidectomy was necessary. The median duration of the surgical procedure was 153 minutes (range 90–310 minutes). In the five cases with thyroidal malignancy, a modified neck dissection was performed for lymphadenectomy in addition to total thyroidectomy. In three patients, replantation of a parathyroid gland into the sternocleidomastoid muscle was necessary after accidental removal of the gland (table 2).

Postoperative course

The median hospital stay was 5 days (3–11 days). During the hospital stay, one patient with severe psychomotor development disorder as a result of a congenital cytomegalovirus infection developed a postoperative pneumonia with need of antibiotic treatment. Despite replantation of the parathyroid gland, one patient with neck dissection developed persistent hypoparathyroidism with consequent substitution therapy of symptomatic hypocalcaemia (3.3%; table 3). In one patient, persistent recurrent nerve palsy occurred after total thyroidectomy and neck dissection due to thyroid cancer. Two patients developed transient nerve palsies and in five patients with normal intraoperative neuro-monitoring, reduced mobility of the vocal cord was diagnosed during routine laryngoscopy, without any clinical signs. Because of thyroid carcinoma two patients had to undergo postoperative radiotherapy. Another patient was treated with radiotherapy owing to recurrence of a PTC (pT3pN1b(49/96)cM0) 4 years after resection and neck dissection.

Discussion

Thyroid pathologies are common in adults but less common in children. Therefore, numbers of large series of paediatric thyroidectomy cases are rare as thyroid surgery in children was often assumed to have increased operative

Median age in years (range)	13 (2–17)	
Female gender	$n = 30$ (83%)	
Indication for operation	Uni- or multinodular goitre	$n = 18$ (50%)
	Graves' disease	$n = 9$ (25%)
	Malignancy	$n = 6$ (17%)
	Genetic tumour predisposition (MEN)	$n = 3$ (8%)
Preoperative fine needle biopsy	$n = 11$ (31%)	

Median duration of operation in (minutes) (range)	153 (90–310)	
Extent of operation	Total thyroidectomy	$n = 24$ (67%)
	Hemithyroidectomy	$n = 12$ (33%)
Intraoperative nerve stimulation	$n = 36$ (100%)	
Weight of resected tissue in grams (range)	29 (4–110)	
Modified lymph node dissection	$n = 5$ (14%)	
Re-implantation of a parathyroid gland	$n = 3$ (8%)	

risk. This study demonstrates that paediatric thyroidectomy can be performed safely by a team of endocrine adult surgeons and paediatric surgeons with an acceptable morbidity rate even when performing a total thyroidectomy in the case of benign disease.

Benign thyroid diseases such as thyroid nodules and Graves' disease were the leading indication for surgery. The incidence of thyroid cancer in the study population was 17%, which is comparable to the previously reported incidence of thyroidal malignancy in adults in Switzerland [7], but which is higher than in other European countries [14, 15]. In comparison with previous reports of up to 37%, the incidence of paediatric thyroid cancer in this study was considerably lower [5, 13], with predominance of papillary thyroid carcinoma over follicular thyroid carcinoma. Unfortunately, these patients with paediatric thyroid cancer showed a more aggressive type with an increased recurrence rate during further follow-up [16, 17]. The low rate of cancer incidence in the present study might be explained by the lower threshold for the decision to use surgical treatment in the case of nonmalignant thyroid pathology.

Sosa et al. [18] reported that children undergoing thyroid or parathyroid surgery are at higher risk for operative complications than adults. In the present study the overall operative morbidity was 11%, which was lower than the previously reported morbidity rate of up to 22% [18] and is comparable to the findings of Morris et al. [19] and Burke et al. [4] that paediatric thyroidectomy can be performed safely without increased morbidity rate.

In adults, recurrent nerve palsies are reported for between 1% and 13.6% of cases [7, 20–22]. In children, permanent nerve lesions are reported in up to 6% of cases [5, 9, 23]. In the present study, only one patient (3.3%) with thyroid cancer who had to undergo a total thyroidectomy including lymphadenectomy suffered from permanent recurrent nerve palsy because of tumour infiltration into the nerve, and transient nerve palsy was seen in two patients (6.6%). Intraoperative neuromonitoring was performed in all patients in this study and has become standard procedure in most centres as an important tool in case of loss of signal during total thyroidectomy to avoid bilateral nerve lesions [24–27]. In comparison with previous reports we had a high rate of laryngoscopically documented transient nerve palsies without clinical signs. This might be related to the routinely performed pre- and postoperative laryngoscopy during the hospital stay at postoperative day two or three, with identification of reduced mobility of the vocal cord without hoarseness or other clinical symptoms. This reduced mobility might be sequelae of local irritation caused by the intubation of these children because of the small size of the laryngopharyngeal tract in children.

Persistent postoperative hypocalcaemia due to hypoparathyroidism occurred in 3.3% of patients in this study, which is comparable to previous reports of rates between 1.1% and 8% [5, 9, 19]. As previously shown, persistent hypocal-

caemia is associated with increased costs and patients' dissatisfaction [19]. In comparison with adults, the anatomical structures in children are closer together and parts of the thymus gland may still be located next to the thyroid gland. Therefore, accurate knowledge of the anatomical differences in children and a precise surgical preparation technique is mandatory. In the case of extended lymphadenectomy the risk for accidental removal of the parathyroid gland is increased [19].

A preoperative fine needle aspiration biopsy was performed in only one third of patients. In previous reports [13] a preoperative biopsy was obtained in 50% of cases, in order to verify the surgical indication. Preoperative ultrasound-guided biopsies are reported to be associated with low interventional morbidity and high reliability [28, 29]. However, in our experience a biopsy is not always necessary as its diagnostic value is somehow limited due to false negative biopsy results, especially in the case of follicular histology [30–33], and might be too incriminatory in young children. From our experiences with adult and paediatric thyroidectomies in Switzerland, the indications for surgical revision were a dynamic change of a thyroid nodule with a diameter of at least 2 centimetres, increase in size over time and signs of activation in laboratory values independent of histological confirmation.

In the majority of our patients, total thyroidectomy was performed even for benign thyroidal pathologies, which is comparable to a recent published study that showed an increasing trend towards total thyroidectomy over time [34]. As previously shown in an adult patient group, total thyroidectomy can be performed without increased operative risk [7]. In the present study, permanent nerve palsies or hypoparathyroidism were rare and comparable to previous reports [4, 13]. In contrast to our experiences [7], the operative risk in cases of reoperation due to recurrence has been reported to be increased [35]. However, due to the low perioperative morbidity and the increasing confidence in surgical safety, a policy in favour of total thyroidectomy rather than limited resection has been increasingly adopted [4].

In general, as a result of the specific Swiss healthcare system, which is comparable to the German system, duration of postoperative hospital stay is prolonged in Swiss hospitals in comparison with other countries [36, 37]. In this study, median hospital stay was 5 days, which was longer than in previous paediatric [13] or adult patient series [38]. This might be a result of differences in general health policy and generally longer hospital stay of the paediatric patients independent of the surgical procedure [39, 40].

The following limitations of this study should be noted. The data analysis was performed retrospectively without a possibility for randomisation of patients. The time period of the observation was 10 years; therefore, an improvement in patient care during this time was possible and there was a wide range of postoperative follow-up. Finally, due to the small number of patients, statistical inferences were hard to

Table 3: Postoperative course and morbidity.

Median hospital stay in days (range)		5 (3–11)
Persistent hypoparathyroidism		n = 1 (3%)
Recurrent nerve palsy	Persistent	n = 1 (3%)
	Transient	n = 2 (6%)

draw. Apart from these limitations we are, however, convinced that our results reflect the clinical reality in some endocrine centres and, therefore, allow us to draw the following conclusions.

Thyroidectomy in a paediatric patient population treated by an interdisciplinary team of endocrine and paediatric surgeons can be performed safely, with acceptable postoperative morbidity rates. It has been shown that surgeon volume is one of the most important predictors of postoperative outcomes in paediatric thyroidectomy [41]. Therefore, the collaboration between high-volume adult thyroid surgeons and paediatricians is helping to optimise the patient outcome [42]. Due to a more liberal policy in favour of surgical treatment in cases of benign thyroid pathology, the rate of malignant diseases was comparable to the incidence of malignant diseases in adult patients. Postoperative morbidity with total thyroidectomy for benign disease was low and this should be considered in each case as treatment of choice to avoid surgical reinterventions with an increased overall operative risk in regard to nerve lesions or postoperative hypothyroidism.

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