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Outcomes and complications of thyroid surgery: retrospective study

甲狀腺手術的結果與併發症：回顧性研究

Objective. To study the outcome and complications of thyroid surgery.
Design. Retrospective study.
Setting. Regional hospital, Hong Kong.
Patients. Three hundred and twelve patients (266 women and 46 men) underwent thyroid surgery between January 1994 and December 1999.
Main outcome measures. Complications of thyroidectomy for various thyroid diseases according to surgical technique used.
Results. Capsular dissection gradually became a more popular surgical technique: 33% and 58% in the first and second halves of the study period respectively (P<0.001). The overall rate of permanent vocal cord palsy was 2%. Near-total thyroidectomy became the preferred surgical treatment for toxic goitre over the study period. The incidence of recurrent hyperthyroidism was reduced from 21% to 7% (P>0.1, not significant). The incidence of hypoparathyroidism was approximately 30% after thyroidectomy for cancer.
Conclusion. Capsular dissection is increasingly utilised in thyroid surgery. Low complication rates can be achieved after thyroidectomy for benign diseases. Hypoparathyroidism, however, is a relatively common complication after surgery for thyroid cancer.

目的：研究甲狀腺手術的結果和併發症。
設計：回顧性研究。
安排：香港，地區醫院。
患者：在 1994 年 1 月至 1999 年 12 月期間做過甲狀腺手術的 312 名患者 (266 名女性及 46 名男性)。
主要結果測量：根據所使用的外科手術方法，對各種甲狀腺病患作甲狀腺切除手術後的併發症。
結果：把腺體切開已日漸成為甲狀腺切除手術常用的方法，在研究前半期和後半期，這種手術的使用率分別為33%和58%(P<0.001)。總體永久性聲帶麻痺率是 2% 。在研究期間，處理毒性甲狀腺腫瘤的首選手術是近全切的甲狀腺切除術。甲狀腺功能亢進的復發率從 21% 減至 7%(P>0.1 ，不顯著)。在甲狀腺癌切除後，甲狀旁腺功能減退的病例約佔 30%。
結論：在甲狀腺手術中，把腺體切開已日漸普遍。對於良性腫瘤，甲狀腺切除後併發症發病率較低。然而，對於甲狀腺癌，甲狀旁腺功能減退是手術後一種較常見的併發症。

Key words:
Dissection;
Hyperthyroidism;
Hypoparathyroidism;
Thyroidectomy;
Vocal cord paralysis

關鍵詞：
解剖；
甲狀腺功能亢進；
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Introduction

Thyroidectomy is a common operation with an extremely low mortality.[1] It is associated with specific morbidities which are related to the experience of the surgeon, however.[2] Very low surgical morbidity rates for

thyroidectomy are reported in specialised centres.[2] In Hong Kong, most thyroid surgery is performed in general hospitals. This paper reports the clinical audit of thyroid surgery for adult patients undertaken at the United Christian Hospital in Hong Kong. The complications of thyroidectomy are highlighted and compared to published data. Contributing factors and remedial measures, as well as differences in surgical strategy and techniques during the study period are also discussed.

Methods

All adult patients who underwent thyroidectomy between January 1994 and December 1999 at the United Christian Hospital were included in the audit. Patient medical notes were reviewed retrospectively and complications specific to thyroidectomy were recorded. These included permanent vocal cord palsy, permanent hypoparathyroidism, hypothyroidism, and recurrent hyperthyroidism for toxic goitre. Of note, preoperative vocal cord assessment by flexible laryngoscopy was mandatory, whereas postoperative vocal cord examination was performed only when hoarseness occurred. Permanent vocal cord palsy was defined as continued postoperative vocal cord paralysis 6 months after surgery. Similarly, patients requiring more than 6 months of calcium or vitamin D supplementation for postoperative hypocalcaemia were defined as suffering from permanent hypoparathyroidism. Patients were classified as having hypothyroidism if both clinical and biochemical supportive evidence were present.

Two types of surgical technique were differentiated —the capsular versus the non-capsular technique.[3] Operative records were reviewed in detail. When the branches of the superior or inferior arteries were ligated individually as well as directly on the surface of the thyroid gland, the procedure was considered to be capsular dissection. The procedure was designated non-capsular dissection when the superior pedicle was divided by mass ligation, when the main inferior thyroid artery was divided, or when the parathyroid gland was removed en bloc with the thyroid lobe. Operations undertaken during the first and second halves of the study period were reviewed, looking for changes in management approach, surgical techniques, and also any differences in outcome after thyroidectomy.

Results

Overall results

A total of 312 patients, aged between 16 and 87 years (mean, 44.5 years), underwent thyroid surgery during the study period. Patients included 266 women and 46 men (female:male, 5.8:1). Histopathological diagnoses for each case are summarised in Table 1, whereas the number of patients undergoing each type of operation is detailed in Table 2. One hundred and thirty-seven (43.9%) operations were performed with capsular dissection, whereas 167 (53.5%) operations were performed using the non-capsular dissection technique. The specific dissection technique used could not be ascertained in the remaining eight cases.

The annual number of cases of thyroid surgery ranged from 47 to 62 during the study period. The number of malignant cases remained relatively constant, with 20 and 19 cases occurring in the first and second halves of the study period, respectively. There was no operative mortality noted in this series. Surgical morbidity associated with thyroidectomy undertaken during the study period is detailed in Table 3.

Table 1. Histopathological diagnoses for patients undergoing thyroidectomy

Histopathological diagnosis	1994-1996 n=164 [No. (%)]	1997-1999 n=148 [No. (%)]	Total n=312 [No. (%)]
Hyperplastic/colloid nodule/haemorrhagic cyst	52 (31.7)	49 (33.1)	101 (32.4)
Toxic goitre (diffuse and nodular)	26 (15.9)	27 (18.2)	53 (17)
Thyroid cancer (papillary, follicular, and medullary)	20 (12.2)	19 (12.8)	39 (12.5)
Adenoma (including four toxic adenomas)	24 (14.6)	22 (14.9)	46 (14.7)
Non-toxic nodular goitre (including unilateral nodular goitre)	37 (22.6)	25 (16.9)	62 (19.9)
Miscellaneous cases	5 (3)	6 (4.1)	11 (3.5)

Table 2. Surgical approach to thyroidectomy

Types of operation	1994-1996 n=164 [No. (%)]	1997-1999 n=148 [No. (%)]	Total n=312 [No. (%)]
Hemithyroidectomy (including isthmectomy)	104 (63.4)	98 (66.2)	202 (64.7)
Subtotal thyroidectomy	35 (21.3)	18 (12.2)	53 (17)
Near-total thyroidectomy	12 (7.3)	16 (10.8)	28 (9)
Total thyroidectomy (with or without neck dissection)	13 (7.9)	16 (10.8)	29 (9.3)

Table 3. Operative morbidity

Complications		1994-1996 No. (%)	1997-1999 No. (%)	Total No. (%)
Permanent vocal cord palsies	per case	5 (3)	4 (2.7)	9 (2.9)
	per nerve	(2.2)	(2)	(2.1)
Permanent hypoparathyroidism (excluding hemithyroidectomy)		10 (16)	8 (16)	18 (16)
Hypothyroidism (excluding hemithyroidectomy and total thyroidectomy)		14 (30)	14 (41)	28 (35.5)
Recurrent hyperthyroidism (toxic goitre)		6 (23)	3 (11)	9 (17)
Haematoma requiring exploration		0	2 (1.4)	2 (0.7)
Minor wound complications		6 (3.7)	2 (1.4)	8 (2.6)

A comparison between phase A and phase B

A total of 164 patients (141 women, 23 men) underwent thyroidectomy in phase A (1994 to 1996) and 148 patients (125 women, 23 men) underwent thyroidectomy in phase B (1997 to 1999). Capsular dissection was used increasingly—53 (32.3%) in phase A versus 84 (56.8%) in phase B (χ^2=17.5; P<0.001). The distribution of histopathological diagnoses was constant in both phases (Table 1).

A trend towards near-total thyroidectomy replacing subtotal thyroidectomy as the choice of surgery for toxic goitre was seen (Table 2). The number of subtotal thyroidectomy operations for toxic goitre was 23 in phase A versus 15 in phase B, whereas the number of near-total thyroidectomy procedures was three and 11 for phases A and B respectively (χ^2=4.79; P<0.05).

Regarding operative morbidity, no differences were observed between the two phases other than a decrease in the incidence of recurrent hyperthyroidism after surgery for toxic goitres from six (23%) cases to three (11%) cases (Table 3). This difference, however, was not statistically significant (χ^2=0.54; P>0.1). In contrast, the incidence of hypoparathyroidism was the same at 16% over two phases, if hemithyroidectomy cases were excluded. Of these cases, 50% occurred in cancer patients in phase A and 70% in phase B, the implication of which will be discussed later.

Toxic goitre

A total of 52 patients with toxic goitre (45 diffuse and eight nodular) underwent thyroidectomy during the study period. Subtotal thyroidectomy was performed for 38 patients (35 women, three men; 35 diffuse, three nodular goitres). Operative complications are shown in Table 4.

Fourteen patients underwent near-total thyroidectomy (13 female, one male; 10 diffuse, four nodular goitres). One (7.1%) patient developed wound haematoma due to movement during reversal of anaesthesia and required immediate exploration. No instances of permanent vocal cord palsy occurred in either group. The majority of cases of near-total thyroidectomy were performed in phase B. The difference between the groups with respect to recurrent hyperthyroididsm was not statistically significant (χ^2=0.58; P>0.1).

Thyroid cancer

A total of 39 patients with thyroid cancer underwent surgery during the study period. Papillary carcinoma comprised the majority of cases (35; 89.7%), with a further three cases of follicular carcinoma and one of medullary carcinoma. The extent of surgery ranged from hemithyroidectomy to total thyroidectomy plus neck dissection (Table 5).

The increased use of central compartment lymph node dissection in addition to total thyroidectomy over the study period was striking—22% (2/9) in phase A compared to 50% (5/10) in phase B. The overall incidence of vocal cord palsy was 2.6% and the incidence of hypoparathyroidism was 30.8% throughout the study period (25% in phase A and 36.8% in phase B).

Table 4. Complications after subtotal and near-total thyroidectomy for toxic goitre

Complications	Subtotal thyroidectomy n=38 [No. (%)]	Near-total thyroidectomy n=14 [No. (%)]	Total n=52 [No. (%)]
Permanent vocal cord palsy	0	0	0
Hypoparathyroidism	3 (7.9)	0	3 (5.8)
Recurrent hyperthyroidism	8 (21.1)	1 (7.1)	9 (17.3)
Hypothyroidism	15 (39.5)	7 (50)	22 (42.3)
Haematoma requiring exploration	0	1 (7.1)	1 (1.9)
Minor wound morbidity	4 (10.5)	0	4 (7.7)

Table 5. Types of surgery performed for thyroid cancer

Types of surgery	1994-1996 No.	1997-1999 No.
Hemithyroidectomy	7	5
Near-total thyroidectomy	1	1
Total thyroidectomy	7	5
Total thyroidectomy plus central compartment lymph node dissection	2	5
Total thyroidectomy plus central and lateral neck dissection	3	3

Discussion

The proportion of each histopathological diagnosis, including malignant cases, remained constant throughout the study period, whereas the annual number of cases of thyroidectomy demonstrated a small decrease over time. This reflects the hospitals' consistent policy of patient selection for thyroidectomy, by means of clinical features and the results of fine-needle cytology, to avoid unnecessary surgery and undue complications where possible.[4] Near-total thyroidectomy for toxic goitre seems to reduce the rate of recurrent hyperthyroidism compared to subtotal thyroidectomy (7% versus 21%). The incidence of hypothyroidism, however, appears slightly increased from 39% to 50%,[5] although this difference was not statistically significant, possibly reflecting the small sample size of the near-total thyroidectomy group.

Recurrent hyperthyroidism after surgery for toxic goitre has been reported to occur in between 4% and 16.2% of cases.[6-8] This is affected by the amount of thyroid remnant, the patients' age, and the duration of postoperative follow-up. Recurrent hyperthyroidism after near-total thyroidectomy is more amenable to repeat surgery, as dissection will be limited to one side, an advantage over subtotal thyroidectomy.

The incidence of postoperative hypothyroidism after near-total thyroidectomy in this patient series was comparable to that reported by Andaker et al[6] (44%), and Miccoli et al[7] (46.3%). The former study was a randomised controlled study involving 50 patients with a mean follow-up of 3.6 years, whereas the latter, though not a randomised study, was a large series of 140 patients. Hypothyroidism is less of a treatment issue than recurrent hyperthyroidism.

Approximately one third of patients having diffuse toxic goitres will eventually become hypothyroid in the absence of treatment, due to the natural behaviour of this disease.[9] Of note, no hypoparathyroidism was seen after thyroidectomy for toxic goitres in the last 2 years of the study period. This, we believe, can be attributed to the adoption of capsular dissection.

The 2% incidence of vocal cord palsy seen in this series is in concordance with reported incidence figures (0.1%-4.5%).[10-13] Complications of thyroidectomy are largely related to the magnitude of the operation and the experience of the surgeon involved.[2] The majority of thyroid operations at the United Christian Hospital are performed by specialists or by advanced trainees under supervision. This may account for the desirable paucity of vocal cord palsy seen.

Permanent hypoparathyroidism has been reported to occur after total thyroidectomy in between 0.1% and 32% of patients overall.[1,2,10-17] The risk is higher for cancer surgery and ranges from 3% to 32%.[1,2,10,12-14,16,17] Most published reports in the last five years, however, quote a figure below 10%.[12,13,17] The incidence of hypoparathyroidism after thyroidectomy for cancer (30%) noted in the current series thus appears high. Potential reasons are manifold. Firstly, the incidence could be overestimated in this series, as no attempt to discontinue calcium and vitamin D supplementation was apparent in five cases, accounting for approximately half of the number of hypoparathyroid cases among cancer patients. Owing to geographical location, these patients were followed postoperatively by an oncologist in hospitals other than that in which the supplementation was prescribed, and may have experienced only temporary hypothyroidism. Effective communication between surgeon and oncologist, especially in the setting of joint clinic, is crucial to ensure calcium and vitamin D supplementation are discontinued if indicated. Secondly, the non-capsular dissection technique popular in phase A may be another cause for the high incidence of hypoparathyroidism, as the parathyroid gland is vulnerable to devascularisation or inadvertent removal with the thyroid gland during such a procedure. The fact that hypoparathyroidism did not occur in any case undergoing near-total thyroidectomy for toxic goitre in the latter half of the study period supports the success of capsular dissection in reducing this complication.

Unfortunately hypoparathyroidism among cancer cases remained high in phase B. The emergence of central compartment lymph node dissection (22% in phase A compared to 50% in phase B for cases treated with total thyroidectomy) may be a third reason for this complication, particularly in phase B. The rationale for elective central compartment dissection is to avoid recurrent nodal disease, as the complications of hypo-

parathyroidism and vocal cord palsy are more common in repeat surgery. This procedure per se may, however, induce hypoparathyroidism as the parathyroid gland and its blood supply is endangered through bilateral paratracheal lymphadenopathy. Moreover, only 13% of differentiated thyroid cancers experience regional relapse despite the fact that 50% of cases harbour occult nodal malignancy.[18] This indicates a low aggressiveness of occult nodal disease, which is further supported by Shah et al's data.[19] In fact, lymph node status is not regarded as prognostically important on the basis of various large retrospective studies.[19-22] Hence it appears that the marginal benefit of performing elective central compartment dissection in this patient context is outweighed by the undue hypoparathyroidism inherent to this procedure.

Currently at United Christian Hospital, ipsilateral paratracheal dissection rather than central compartment dissection is performed, to maintain the integrity of parathyroid glands on the contralateral side.[23] Elective lymphadenectomy in the tracheo-oesophageal region is only completed ipsilateral to the tumour. Further studies are, however, required to document the benefit of this approach.

Conclusion

The surgical approach to thyroidectomy varied at the United Christian Hospital over the period of this retrospective study, in efforts to improve patient outcome. A low incidence of operative morbidity for benign disease has been maintained throughout the study period, however. Near-total thyroidectomy for toxic goitre appeared to reduce the rate of recurrent hyperthyroidism seen in this series. The incidence of hypoparathyroidism, however, was noted to be high after thyroidectomy for cancer. Modification of the surgical strategy in such cases, along with close collaboration with oncologists may see a reduction in the rates of this complication in the future.

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