CHARACTERISTICS OF THYROIDECTOMY IN TAIWAN

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Background and Purpose: Thyroidectomy is a common treatment for thyroid disorders in Taiwan, and constitutes a significant percentage of medical expenses. This study investigated the characteristics of thyroidectomy in Taiwan.

Methods: A total of 21 senior general surgeons from 16 medical centers and 5 regional hospitals participated. One surgeon from each hospital reviewed the hospital’s medical records of thyroid operations performed in the year 2001. Medical records for 3846 thyroidectomies were retrospectively analyzed, including surgical indications and modalities, complications, pathology reports, and the use of antibiotics.

Results: Most of the patients were women (85%). Indications for surgery included proven malignancy (9%), suspicious malignancy (30%), evident compression symptoms (20%), hyperthyroidism (20%), and cosmetic reasons (12%). The majority of patients (78%) underwent a surgical procedure with lobectomy or bilateral thyroidectomy; 13% had unilateral partial thyroidectomy. Prophylactic antibiotics were administered in 46% of procedures, and continued postoperatively in 12%. Postoperative complications occurred in 12% of patients. Hypocalcemia was the most common complication (8%), and its incidence was significantly correlated with the frequency of total thyroidectomy (p < 0.01). Complete pathology reports for the thyroidectomized specimens were available in only 65% of the cases. The frequency of cosmetic reasons for surgery, unilateral subtotal resection, routine antibiotic administration, and incomplete pathology reports were significantly higher in regional hospitals than in medical centers.

Conclusions: Reduction in the high rates of cosmetic reasons for surgery, unilateral partial thyroidectomy, incomplete pathology reports, and use of antibiotic prophylaxis are needed to improve the quality of thyroidectomy in Taiwan.

Key words: Antibiotics; Postoperative complications; Quality of health care; Retrospective studies; Thyroidectomy


Approximately 10,000 thyroid operations are performed annually in Taiwan.1 Although these clinical surgeries constitute a significant percentage of medical expenses in our health care system, there are limited data on the characteristics of thyroid surgery in Taiwan. The purpose of this study was to investigate the characteristics of thyroidectomy in Taiwan, including the surgical indications, preoperative diagnostic tools, surgical modalities, operative complications, antibiotic use, and completeness of pathology reports associated with thyroid surgery.

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Methods

Patient population and setting
A total of 3846 thyroid operations performed in 2001 at 21 hospitals were included. One senior surgeon from each hospital reviewed the hospital’s medical records of all thyroid surgeries performed. The number of cases for each hospital ranged from 28 to 580 (median, 145) with a female-to-male ratio of 8.5:1.5. The study centers included 6 public medical centers, 10 private medical centers, and 5 regional hospitals, as classified by the Taiwan Endocrine Surgeons Association. Data collected from the reviews included the surgical indication, preoperative diagnostic tools, surgical procedures, use of prophylactic antibiotics, postoperative complications, and completeness of pathology reports.

Indications for thyroid surgery included proven malignancy or suspicious malignancy, airway compression, hyperthyroidism, and others. Various symptoms and signs due to airway compression were considered, and the main reason for surgery due to hyperthyroidism was also investigated. Preoperative diagnostic tools included ultrasonography, chest X-ray, computed axial tomography (CAT) scanning or magnetic resonance imaging, thyroid function, isotope scanning, fine-needle aspiration cytology (FNAC), and intraoperative frozen sectioning (defined as immediate check of pathologic tissue taken from the patient during operation, using frozen tissue).

Surgical procedures used included total thyroidectomy, lobectomy, unilateral lobectomy and contralateral subtotal resection, bilateral subtotal resection, unilateral subtotal resection, enucleation, and central (or modified) neck lymph node dissection. The prophylactic or postoperative use of antibiotics and the types of antibiotics used were recorded. Postoperative complications, including immediate hypocalcemia (serum calcium level < 7.6 mg/mL with symptoms or signs of hypocalcemia), immediate hoarseness, hematoma, required tracheostomy, wound infection, and prolonged intubation due to tracheomalacia, were noted. The pathology reports were reviewed for the following 4 criteria: 1) microscopic findings; 2) description of gross appearance; 3) size; and 4) weight of both lobes. A report was considered complete if all 4 criteria were present.

Statistical analysis
Differences among public medical centers, private medical centers, and regional hospitals were evaluated by chi-squared test. Pearson correlation was also applied to check the correlation. A value of $p < 0.05$ was defined as statistically significant.

Results
The distribution of the patients by age and gender are shown in Fig. 1. Surgery was indicated due to proven malignancy in 334 cases (9%), suspicious malignancy in 334 cases (9%), hyperthyroidism in 191 cases (5%), and others in 2754 cases (71%).

Fig. 1. The distribution of patients by age and gender (n = 3846).
in 1161 (30%), hyperthyroidism in 779 (20%), airway compression in 762 (20%), cosmetic reasons in 475 (12%), and psychological uneasiness in 554 (14%). Neoplasm (proven or suspicious) was the most common indication for surgery in public medical centers, hyperthyroidism in private medical centers, and cosmetic reasons in regional hospitals (Table 1). Symptoms and signs in patients with airway compression included dysphonia (21%), dyspnea (27%), dysphasia (58%), tracheal deviation (50%), and venous engorgement on the chest (2%). At presentation, 67% of patients with hyperthyroidism had failure of medical treatment (defined as recurrence after discontinuation of antithyroid drugs), 19% had intolerance of long-term medication, 14% had recommendation for evaluation of indications for thyroidectomy by a physician, and 1% had unsuitable radioiodine treatment. Preoperative diagnostic evaluations included ultrasonography (85% of cases), CAT scanning (7%), and isotope studies (16%). For preoperative diagnosis, 52% of all patients (66% of 3025 nodular lesions) had FNAC analysis, but only 19% had frozen section histology. Among the cases with proven malignancy, 20% had a frozen section to reconfirm the diagnosis during surgery. Thirty percent of cases with preoperative suspicious malignancy required intraoperative frozen sectioning to establish the diagnosis, and 28% of those lesions studied by frozen section were malignant. FNAC sampling was used more often in medical centers than in regional hospitals (Table 1).

The operative procedures included total thyroidectomy (19%), lobectomy (23%), unilateral lobectomy and contralateral subtotal resection (17%), bilateral subtotal resection (19%), unilateral subtotal resection (12%), enucleation (1%), and neck lymph node dissection (9%). Public medical centers had a significantly higher frequency of total thyroidectomy procedures ($p < 0.01$; Table 2). Unilateral partial thyroidectomy (unilateral subtotal resection plus enucleation) was performed more frequently in the private hospital group ($p < 0.01$). Prophylactic antibiotics were given to 46% of the patients and were most commonly used in regional hospitals, followed

### Table 1. Comparison of the indications for thyroid surgery and use of preoperative fine-needle aspiration cytology in medical centers and regional hospitals in Taiwan ($n = 3846$).

<table>
<thead>
<tr>
<th>Indication</th>
<th>Public vs private medical centers</th>
<th>Public medical centers vs regional hospitals</th>
<th>Private medical centers vs regional hospitals</th>
<th>Public and private medical centers vs regional hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoplasm (%)</td>
<td>47.7*</td>
<td>34.6</td>
<td>47.7*</td>
<td>34.6*</td>
</tr>
<tr>
<td>Hyperthyroidism (%)</td>
<td>14.1*</td>
<td>22.4</td>
<td>14.1*</td>
<td>22.9</td>
</tr>
<tr>
<td>Cosmetic reasons (%)</td>
<td>16.8*</td>
<td>9.1</td>
<td>NS</td>
<td>9.1*</td>
</tr>
<tr>
<td>Use of fine-needle aspiration cytology (%)</td>
<td>59.2*</td>
<td>54.3</td>
<td>59.2*</td>
<td>54.3*</td>
</tr>
</tbody>
</table>

* $p < 0.01$.  
† $p < 0.05$.  
NS = not significant.

### Table 2. Comparison of the surgical procedures and use of prophylactic antibiotics for thyroid surgery in medical centers and regional hospitals in Taiwan ($n = 3846$).

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Public vs private medical centers</th>
<th>Public medical centers vs regional hospitals</th>
<th>Private medical centers vs regional hospitals</th>
<th>Public and private medical centers vs regional hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total thyroidectomy (%)</td>
<td>22.7*</td>
<td>10.8</td>
<td>17.6*</td>
<td>10.8</td>
</tr>
<tr>
<td>Unilateral partial thyroidectomy (%)</td>
<td>N5</td>
<td>12.7*</td>
<td>18.4</td>
<td>10.9*</td>
</tr>
<tr>
<td>Prophylactic antibiotics (%)</td>
<td>61.3*</td>
<td>33.8</td>
<td>61.3*</td>
<td>79.7</td>
</tr>
<tr>
<td>Postoperative antibiotics (%)</td>
<td>31.8*</td>
<td>50.9</td>
<td>31.8*</td>
<td>51.5</td>
</tr>
</tbody>
</table>

* $p < 0.01$.  
† $p < 0.05$.  
NS = not significant.
by private medical centers; they were used least often in public medical centers \((p < 0.001)\). Postoperative antibiotics were administered to 46% of the patients. Antibiotic use was significantly higher in regional hospitals \((p < 0.01)\). The types of preoperative antibiotics used included cephalosporins (70%), aminoglycosides (0.5%), and a combination of cephalosporins and aminoglycosides (24%). Postoperative antibiotics included cephalosporins (70%), aminoglycosides (0.5%), or combined cephalosporins and aminoglycosides (24%).

The overall operative complication rate was 12%; complications included immediate hypocalcemia (8%), immediate hoarseness (2%), hematoma (0.4%), tracheostomy requirement (0.2%), wound infection (0.68%), and prolonged intubation due to tracheomalacia (0.008%). Among patients with complications, 1% were readmitted for further treatment. The overall complication rate was significantly lower \((p < 0.05)\) in the regional hospitals (8.8%) than in the medical centers (12.6%; Table 3). The incidence of postoperative hypocalcemia in the regional hospitals (5.0%) was also significantly lower \((p < 0.05)\) than in the medical centers (8.3%). There was a significant correlation between the incidence of hypocalcemia and the frequency of total thyroidectomy \((p < 0.01, r^2 = 0.465); \text{Fig. 2}.\) Only 65% of the pathology reports reached the standard of completeness. Reports from medical centers were significantly more complete than those from regional hospitals (Table 3).

### Discussion

As in other countries, the present study confirmed that women comprise the majority of patients (85%) who have thyroid disease or thyroid surgery.\(^2,3\) Since FNAC is widely used in Taiwan, thyroid neoplasm was the main indication for surgery (39%). Thyrotoxicosis was the second most frequent indication (20%), with most cases involving failure of medical control (67%). In Taiwan, bed availability is usually scarce in public medical centers, and the criteria for surgical intervention are therefore stricter. Consequently, different populations may undergo thyroidectomy in the various types of hospitals.

Iodine has been added to salt since 1967 in Taiwan, and the incidence and severity of multinodular goiter has sharply decreased. In this study, only 20% of patients had an operation to resolve airway compression. However, another 20% of patients had surgery for minor reasons such as cosmetic reasons.

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**Table 3. Comparison of overall complication rate, hypocalcemia and completeness of pathology reports for thyroid surgery in medical centers and regional hospitals in Taiwan \((n = 3846)\).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Public vs private medical centers</th>
<th>Public medical centers vs regional hospitals</th>
<th>Private medical centers vs regional hospitals</th>
<th>Public and private medical centers vs regional hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public (n = 1043)</td>
<td>Private (n = 2407)</td>
<td>Public (n = 1043)</td>
<td>Hospitals (n = 396)</td>
</tr>
<tr>
<td>Overall complication rate (%)</td>
<td>NS</td>
<td>NS</td>
<td>13.0*</td>
<td>8.9</td>
</tr>
<tr>
<td>Hypocalcemia (%)</td>
<td>NS</td>
<td>NS</td>
<td>8.6*</td>
<td>5.0</td>
</tr>
<tr>
<td>Complete pathology report (%)</td>
<td>65.2*</td>
<td>69.0</td>
<td>65.2†</td>
<td>43.4</td>
</tr>
</tbody>
</table>

\* \(p < 0.05\).

† \(p < 0.01\).

NS = not significant.

**Fig. 2.** Scatter-plot analysis of the number of cases with hypocalcemia and cases with total thyroidectomy. There was a significant correlation \((p < 0.01, r^2 = 0.465)\) between the incidence of hypocalcemia and the frequency of total thyroidectomy.
and psychological uneasiness, and unilateral subtotal lobectomy or enucleation was performed in 15%. These results imply that the necessity of surgery was questionable in 13% to 20% of the patients. Because FNAC is widely used (66%) for diagnosing nodular lesions, the need for intraoperative frozen sectioning has decreased (19%). Especially for follicular cancer, the role of frozen section in thyroid surgery is limited.14,15 In this series, it is interesting that most of surgeons did not order intraoperative frozen sections to help confirm the diagnosis even for preoperative suspicious malignancy lesions. Thirty one patients had follicular cancer in this study, but no cases of follicular cancer were diagnosed by frozen section of the suspicious lesions. Identification of diffuse enlargement of the thyroid gland on ultrasonography, complete thyroid function tests, and wide availability of autoimmune profiling (anti-thyroid peroxidase antibody and thyroid-stimulating hormone receptor antibody) have replaced isotope scanning, which was performed in only 16% of cases in the diagnosis of hyperthyroidism.

In this study, the incidence of hypocalcemia (8%) and hoarseness (2%) were within the range reported in previous studies: 0.6% to 29% and 1.0% to 10%, respectively.3,10-15 The incidence of surgical complications depends mostly on the extent of surgery and the surgeon’s experience. In this study, the complication rate associated with total thyroidectomy in medical centers (19%) was much higher than in regional hospitals (10.5%). Hypocalcemia, the most common complication of thyroid surgery, was positively correlated with bilateral extensive resection. The higher complication rates in medical centers than in regional hospitals may have been due to the following reasons: 1) the medical centers handled the more advanced cases; 2) the medical centers performed more lobectomy or total thyroidectomy rations (Table 2); and 3) more fellows or chief residents performed operations at medical centers because of training obligations. Although some recent reports have emphasized the application of quick intact parathyroid hormone (iPTH) to predict postthyroidectomy hypocalcemia,16,17 it is not widely used in Taiwan.

Hypocalcemia can usually be detected within 2 days postoperatively and the increased costs for iPTH probably limit the use of quick iPTH. A high percentage of postoperative hypocalcemia or vocal cord palsy turns out to be transient.10,11,16,17 However, due to incomplete follow-up data in this retrospective study, we could not clearly differentiate the outcome of postoperative hypocalcemia or vocal cord palsy. Although 20% of the cases had tracheal compression, very few cases (3/762) developed severe tracheomalacia that required long-term intubation. That is, the duration or degree of compression did not cause severe disease in most of the cases.18 Furthermore, more patients may have had the proper attitude or financial means to receive early surgical intervention in Taiwan. The National Health Insurance program may be one of the more important reasons for this.

The total infection rate of 0.68% in our study was similar to the rate of 0.9% reported by Johnson and Wagner.19 Prophylactic (46%) or postoperative (46%) administration of antibiotics was quite common in all of the hospitals. Regional hospitals had relatively higher frequent use of antibiotic use. In this study, we were not able to draw any conclusions about the effectiveness of prophylactic antibiotics. The surgeons’ habitual use of antibiotics and apprehension concerning sterilization in the operative theater may be 2 important reasons for their using prophylactic antibiotics. However, the prophylactic administration of antibiotics seems to be unnecessary for this clean wound surgery.

Complete pathology reports were found for only 65% of specimens. Absence of specimen weight was the most common defect (35% of the reports); medical centers had better performance than regional hospitals in terms of pathology reports. The intrinsic requirement of the teaching model for pathology interns or residents in most medical centers may be an important factor determining the completeness of pathology reports.

In conclusion, reduction in use of cosmetic indication and unilateral partial thyroidectomy, and improvement in the reporting of pathology and more selective use criteria for prophylactic antibiotics are needed to improve the quality of thyroidectomy in Taiwan.

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References
5. Kesmodel SB, Terhune KP, Canter RJ, et al: The diagnostic...