Assessment of the Morbidity and Complications of Total Thyroidectomy

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Objective: To determine the incidence and predictive factors for complications after total thyroidectomy.

Design: Cross-sectional analysis of a national database on total thyroidectomy cases.

Methods: The National Hospital Data Survey database was examined and all cases of total thyroidectomy performed during 1995 to 1999 were extracted. In addition to demographic information, postoperative complications including hypocalcemia, recurrent laryngeal nerve paralysis, wound complications, and medical morbidities were identified. Statistical analysis was conducted to determine potential predictive factors for postoperative complications.

Results: A total of 517 patients were identified (mean age, 48.3 years). The most common indications for total thyroidectomy were thyroid malignancy and goiter (73.9% of cases). Eighty-one patients (15.7%) underwent an associated nodal dissection along with total thyroidectomy, and 16 patients (3.1%) underwent parathyroid reimplantation. The mean length of stay was 2.5 days (95% confidence interval, 2.3-2.8 days). The incidence of postoperative wound hematoma was 1.0%, wound infection was 0.2%, and mortality rate was 0.2%. The incidence of postoperative hypocalcemia was 6.2%. Younger age was statistically associated with an increased incidence of hypocalcemia ($P = .002$, t test), whereas sex ($P = .48$), indication for surgery ($P = .32$), parathyroid reimplantation ($P > .99$), and associated neck dissection ($P = .21$) were not. The mean length of stay was 2.5 days and was unaffected by occurrence of postoperative hypocalcemia. The incidences of unilateral and bilateral vocal cord paralyses were 0.77% and 0.39%, respectively.

Conclusions: Postoperative hypocalcemia is the most common immediate surgical complication of total thyroidectomy. Other complications, including recurrent laryngeal nerve paralysis, can be expected at rates approximating 1%.
METHODS

The National Hospital Discharge Survey (NHDS) database for the calendar years 1995 to 1999 was examined, and the records of patients undergoing total thyroidectomy as the primary surgical procedure (International Classification of Diseases, Ninth Revision [ICD-9], procedure code 6.40) were extracted. These data were imported into a SPSS database (version 10.0, SPSS Inc, Chicago, Ill) for subsequent analysis. In addition to total thyroidectomy, associated procedures such as lymph node dissection and parathyroid reimplantation were identified using corresponding ICD-9 procedure codes.

For each case, presence or absence of individual surgical complications including wound infection, postoperative hemorrhage, fistula formation, hypocalcemia, and death was determined based on corresponding ICD-9 codes. In addition, analysis for medical complications including myocardial infarction, stroke, and pneumonia was conducted. Descriptive statistics were computed for the patient population under study including demographic variables, indications for total thyroidectomy, complication rates, length of stay (LOS), and disposition.5

χ² Analysis was conducted to determine if patient sex, surgical indication for total thyroidectomy, or lymph node dissection (in addition to the thyroidectomy or parathyroid reimplantation) had any influence on the incidence of postoperative hypocalcemia. The t test was used to determine if age impacted on incidence of postoperative hypocalcemia and also to determine if the presence of postoperative hypocalcemia significantly added to the LOS.

RESULTS

From 1995 to 1999, a total of 517 patients were identified with total thyroidectomy as their primary procedure in the NHDS database. The mean patient age was 48.3 years, and 81.8% of the patients were female. The indications for surgery are listed in Table 1. The most common indications for surgery were thyroid malignancy and goiter, together accounting for 73.9% of cases. Eighty-one patients (15.7%) underwent an associated nodal dissection along with total thyroidectomy, and 16 patients (3.1%) received parathyroid reimplantation. The mean LOS was 2.5 days (95% confidence interval, 2.3-2.8 days). Medical morbidities were distinctly unusual, with rates for myocardial infarction, stroke, and pneumonia determined at 0.2%, 0.6%, and 0.6%, respectively. Five patients (1.0%) encountered a postoperative hematoma or hemorrhage, 1 patient (0.2%) experienced a postoperative wound infection, and 1 patient died (mortality rate, 0.2%). Overall, 32 patients (6.2%) were identified with postoperative hypocalcemia. None of the 3 patients who underwent total thyroidectomy for parathyroid disorders had postoperative hypocalcemia. Four patients (0.77%) were diagnosed as having an associated unilateral vocal cord paralysis and 2 patients (0.39%) had bilateral vocal cord paralysis.

Results of the statistical analysis examining for associations between patient characteristics, surgical indications, and procedures performed are displayed in Table 2. No statistically significant associations between the occurrence of hypocalcemia and sex, indication for surgery, presence of a nodal dissection, or parathyroid reimplantation were identified. The mean age of patients with postoperative hypocalcemia was 40.6 years, whereas the mean age for patients without hypocalcemia was 48.8 years (P = .002, t test). Although LOS was slightly longer for patients with postoperative hypocalcemia (mean LOS, 3.1 days) than those without (mean LOS, 2.5 days), this difference was not statistically significant (P = .10, t test).

As a cross-check in the database, the diagnosis of hypocalcemia was cross-validated with the diagnosis of hypoparathyroidism to determine accuracy of coding within the database. Every patient who experienced postoperative hypocalcemia was also designated as postoperative hypoparathyroidism, indicating 100% concordance.

COMMENT

The NHDS is an annual survey conducted by the National Center for Health Care Statistics, which is a public agency

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Table 1. Surgical Indications for Total Thyroidectomy

<table>
<thead>
<tr>
<th>Indication</th>
<th>No. (%)</th>
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<tbody>
<tr>
<td>Carcinoma</td>
<td>272 (52.6)</td>
</tr>
<tr>
<td>Benign disease</td>
<td>29 (5.6)</td>
</tr>
<tr>
<td>Thyrotoxicosis</td>
<td>58 (11.2)</td>
</tr>
<tr>
<td>Goiter</td>
<td>110 (21.2)</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>34 (6.6)</td>
</tr>
<tr>
<td>Parathyroid disorder</td>
<td>3 (0.6)</td>
</tr>
<tr>
<td>Unknown</td>
<td>11 (1.7)</td>
</tr>
<tr>
<td>Total</td>
<td>517 (100)</td>
</tr>
</tbody>
</table>

Table 2. Incidence of Hypocalcemia According to Potential Predictive Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypocalcemia Incidence, %</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.26</td>
<td>.48</td>
</tr>
<tr>
<td>Female</td>
<td>6.62</td>
<td></td>
</tr>
<tr>
<td>Indication for surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid carcinoma</td>
<td>8.46</td>
<td></td>
</tr>
<tr>
<td>Benign thyroid lesions</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Nontoxic nodular thyroid disease</td>
<td>5.17</td>
<td></td>
</tr>
<tr>
<td>Toxic nodular disease/thyrotoxicosis</td>
<td>3.64</td>
<td>.32</td>
</tr>
<tr>
<td>Goiter</td>
<td>2.94</td>
<td></td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Parathyroid disease</td>
<td>11.11</td>
<td></td>
</tr>
<tr>
<td>Nodal dissection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5.50</td>
<td>.21</td>
</tr>
<tr>
<td>Yes (n=81)</td>
<td>9.88</td>
<td></td>
</tr>
<tr>
<td>Parathyroid reimplantation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6.19</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Yes (n=16)</td>
<td>6.25</td>
<td></td>
</tr>
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</table>

*Pearson χ² statistic.
charged with tracking health care utilization on a yearly ba-
sis across the United States. From the aggregate group of
all US hospitals, representative institutions are randomly
selected to provide data for the NHDS. A sample of discharge
records from this national sample of nonfederal hospitals
from all 50 states and the District of Columbia are reviewed;
trained staff members collect data both manually and elec-
tronically. Community hospitals, teaching hospitals, and
tertiary care centers are all sampled. This data set has been
frequently used to determine benchmarks for incidence of
disease, rates of surgery, and annual trends. In addition, it
has been used to investigate mortality and morbidity in both
surgical and medical patient populations.4,7

The NHDS data have been previously used to deter-
mine the incidence of various procedures, the prevalence
of disease, and year to year trends in surgery.8 We have pre-
viously reported on the use of this database for assessing
mortality, morbidity, and LOS for head and neck surgical
procedures.3 In general, NHDS data are believed to accu-
mately reflect disease and surgical mortality, but less accu-
rately reflect morbidity.3 The NHDS data collection sys-
tem consists of a random sampling of these institutions,
carefully chosen to represent an accurate cross section of
medical practice in United States. Therefore, treatment bi-
ases, selection biases, and institutional biases are less likely
to play a role.3 The NHDS data extracted in this study dif-
fer significantly from the patient populations in most of the
head and neck surgical literature because almost all pre-
viously published literature reflects experiences from single
academic institutions. This introduces an inherent bias, since
teaching hospitals have a well-documented lower mortal-
ity rate and different patient populations than community
hospitals.8

Several authors have reported on institutional se-
ries of thyroid surgery for benign and malignant dis-
ease. However, to accrue significant surgical case vol-
umes with which to study incidence and trends, the
majority of the studies have been retrospective, encom-
passing 10- to 20-year periods at a single institution. This
makes a true assessment of these incidences somewhat
difficult because of variabilities in surgical technique, ac-
curacy of medical records, and other factors that may
change over time. Furthermore, many of these series in-
clude several different procedures including total thy-
roidectomy, subtotal thyroidectomy, completion thy-
roidectomy, and even unilateral thyroid lobectomy. One
reason for analyzing the NHDS database was to study a
large volume of procedures occurring in a short period
without institutional biases.

Postoperative hypocalcemia after total thyroidec-
tomy has been reported to range from 1% to 40%.0,13 Re-
cently, Sasson and associates14 reported on a 9-year series
of 141 thyroidectomies (69 total thyroidectomies). Not
unexpectedly, total thyroidectomy was strongly associated
with postoperative hypocalcemia (incidence, 13%) when com-
pared with other forms of thyroid surgery. Interestingly,
unintentional parathyroidectomy was not associated with
an increased risk of postoperative hypocalcemia.23 Many
of the published series regarding the incidence of hypo-
calcemia after thyroidectomy include several different pro-
cedures aggregating unilateral lobectomy, subtotal thy-
roidectomy, and total thyroidectomy. Careful review of each
study is necessary to determine the incidence of hypocal-
cemia in the total thyroidectomy subgroups.11,14,15 Calcula-
tion of hypocalcemia rates, while including the unilat-
eral thyroidectomies in the denominator, will tend to
underestimate its overall incidence.

Controversy still exists regarding factors that are as-
associated with postoperative hypocalcemia. Overall, the
pathogenesis of postoperative hypoparathyroidism is likely
to be multifactorial.16 Although patients with nodal dis-
section were almost twice as likely to manifest postopera-
tive hypocalcemia, we did not find this association to be
statistically significant. Other investigators have found neck
dissection to be associated with higher incidences of both
temporary and permanent hypoparathyroidism, and cite
this risk as an argument against prophylactic neck dissec-
tion.11,17 As neck dissection may contribute to postopera-
tive hypoparathyroidism via devascularization or other sur-
gical trauma, it should be reserved for cases with clinically
evident nodal disease.

Similarly, while some authors have identified para-
thyroid reimplantation as a risk factor for postoperative
hypocalcemia, other authors have not found this to be
the case.14,18 We failed to find an association between para-
thyroid reimplantation and the presence or absence of
postoperative hypoparathyroidism. Therefore, it seems
that parathyroid reimplantation neither protects against
postoperative hypocalcemia nor predisposes to it. The
decision to reimplant should be based on clinical factors
at the time of surgery, retaining the parathyroid glands
in situ whenever possible.10

We were somewhat surprised that the indication for
total thyroidectomy was not found to influence the rate of
hypocalcemia. Other smaller series have found that total
thyroidectomy for malignancy is associated with higher
rates of postoperative hypocalcemia.14 However, many of
these studies include both hemithyroidectomy and total
thyroidectomy in their patient populations, or they group
patients differently.11 As patients with malignancy are
more likely to also undergo total thyroidectomy, the true
variable predicting hypocalcemia may be in fact the ex-
tent of surgery. Although mean LOS was slightly higher
for patients with postoperative hypocalcemia than for
those without, this difference was not statistically sig-
nificant. This suggests that corrective measures for early
postoperative hypocalcemia are able to rapidly correct
serum values or that other factors (such as suction drain
output) more strongly influence LOS.11,20 Since postop-
erative hypocalcemia generally manifests within 24 hours
of surgery, delay in the diagnosis of postoperative hypo-
parathyroidism does not tend to contribute to an in-
creased LOS.

Published rates of recurrent laryngeal nerve injury vary
widely in the literature. This is likely due to differences in
definition of palsy, diagnostic biases, and reporting bi-
ases. However, it is generally believed that recurrent la-
ryngeal nerve injury, either temporary or permanent, is likely
to occur in approximately 1% of unilateral lobectomy cases
and 2% to 3% of total thyroidectomy cases.11,15 Total thy-
roidectomy carries an increased risk for recurrent laryn-
geal nerve palsy, not only because both recurrent laryn-
geal nerves are placed at risk, but also likely because patients
undergoing total thyroidectomy often have more ad-
vanced disease. In this series, the rates of unilateral and bilateral vocal cord paralysis were too small to undergo meaningful statistical analysis for predictive factors.

Our data clearly indicate that total thyroidectomy is a safe procedure, with an expected mortality rate of only 0.2%. Medical complications such as myocardial infarction, stroke, and postoperative pneumonia are quite rare. Similarly, rates for local wound complications such as postoperative hematoma and wound infection are distinctly low. The identified morbidity and mortality rates for total thyroidectomy compare favorably with other series that include both unilateral and bilateral surgery. These relatively rare morbidities should not deter surgeons from performing total thyroidectomy when appropriate for the patient’s level of disease.

Although analysis of the large randomly sampled national database such as the NHDS data set has distinct advantages in diminishing selection biases and reporting biases, there are several limitations in its use for the present analysis. Because the analysis is essentially retrospective, it is difficult to assess causality. Rather, we are able to compute the incidence of selected complications and identify associations between these postoperative complications and clinical factors. For example, it is possible that some patients may have had preoperative unilateral vocal cord paralysis, and therefore it would be inaccurate to list such patients as having had recurrent laryngeal nerve injury after total thyroidectomy. However, detailed review of the data indicates that 3 of the 4 patients with unilateral vocal cord paralysis underwent total thyroidectomy for benign disease. As these patients would be unlikely to have preoperative paralysis, it is fair to conclude that the vocal cord paralysis resulted from total thyroidectomy. Similarly, both patients with bilateral vocal cord paralysis underwent surgery for benign disease (goiter), and would be unlikely to have had preoperative bilateral vocal cord paralysis.

Also, the current methodology will fail to capture patients whose complications were not diagnosed during their inpatient stay, but were subsequently diagnosed in the outpatient setting. Given that the mean LOS approached 2.5 days, we would expect that most cases of postoperative hypoparathyroidism would be captured, since greater than 94% of cases of hypocalcemia manifest within 24 hours after total thyroidectomy. It is also possible that some surgeons may have administered oral calcium as part of routine postoperative management. This may mask the immediate onset of postoperative hypocalcemia, tending to deflate the overall incidence of immediately diagnosed postoperative hypoparathyroidism. In addition, it is possible that some patients experienced postoperative recurrent laryngeal nerve paralysis, but the diagnosis was not confirmed until postoperative follow-up evaluation in the outpatient setting. The best determination of the true incidence of postoperative recurrent laryngeal nerve paralysis would be obtained by examining all patients before and after thyroidectomy with laryngoscopy with electromyographic confirmation of selected cases. Understanding these limitations, our data can be interpreted as minimum values for recurrent laryngeal nerve complications in the total thyroidectomy setting since initially undetected cases may be subsequently diagnosed on an outpatient basis.

Despite the fact that total thyroidectomy is a more involved procedure that exposes more parathyroid glands and recurrent laryngeal nerves to surgical risk than unilateral thyroid lobectomy, it is an inherently safe procedure. Local complications such as recurrent laryngeal nerve paralysis and wound complications can be expected to occur at rates near 1%, while postoperative hypoparathyroidism may occur in approximately 6% of cases. Neither nodal dissection nor parathyroid reimplantation seems to affect the risk of postoperative hypocalcemia. Since few modifiable factors can be identified that predict increased surgical risk for these complications, the extent of thyroidectomy surgery should be based on patient preferences, the experience of the operating surgeon, and the overall clinical setting.

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REFERENCES