Comparison of the Incidence of Postoperative Hypocalcemia following Total Thyroidectomy vs Completion Thyroidectomy

Shlomo Merchavy, MD1,2,3, Tal Marom, MD4, Veronique-Isabelle Forest, MD5, Michael Hier, MD, FRCSC1, Alex Mlynarek, MD1, Tobial McHugh1, and Richard Payne, MD, FRCSC1

Abstract

Objective. To study the rate of postoperative hypocalcemia following completion thyroidectomy (CT), in comparison with the hypocalcemia rate following total thyroidectomy (TT).

Study Design and Setting. A retrospective study, performed at the McGill University Thyroid Cancer Center, Montreal, Quebec, Canada, from 2007 to 2012.

Subjects and Methods. Medical records of adult patients undergoing CT and TT operated by a single surgeon were reviewed. Data were extracted for demographics, postoperative calcium levels, surgical logs, and final surgical pathology. Hypocalcemia was defined as corrected serum calcium level ≤1.90 mmol/L, with concurrent serum parathyroid hormone <8 ng/L, and/or any signs or symptoms of hypocalcemia.

Results. There were 68 CTs and 146 TTs. Transient hypocalcemia occurred in 1 of 68 (1.5%) and 18 of 146 (12.5%) patients in the CT and TT groups, respectively. The rate of hypocalcemia was significantly lower in the CT compared with the TT group (P = .02). In both groups, there were no cases of permanent hypocalcemia.

Conclusion. The risk of transient of hypocalcemia in patients undergoing CT is significantly lower than the rate of hypocalcemia in patients undergoing TT.

Keywords
total thyroidectomy, completion thyroidectomy, hypocalcemia, hypoparathyroidism, complication

Received July 2, 2014; revised September 10, 2014; accepted September 30, 2014.

Hemithyroidectomy is occasionally recommended to patients with indeterminate thyroid nodules on preoperative fine-needle aspiration biopsies. When final diagnostic pathology of hemithyroidectomy yields a malignancy, completion thyroidectomy (CT) is often required. In contrast, the most common complication following total thyroidectomy (TT) is hypocalcemia, which can be either transient or permanent. The causes for this complication are attributed to devascularization, injury, or excision of the parathyroid glands during the surgery.1,2 The incidence of transient hypocalcemia following TT ranges from 5% to 60%, according to different criteria used by different authors to define and measure it over time.3,4 A controversy exists as to whether the risks of hypocalcemia after CT are the same, increased, or decreased compared with TT.

In this study, we analyzed and compared the incidence of postoperative hypocalcemia in patients who underwent TT with patients who were initially treated with hemithyroidectomy, followed by CT.

Methods

Ethics approval for this study was obtained from our hospital’s research ethics board. This retrospective study was performed at the McGill University Thyroid Cancer Center in Montreal, Quebec, Canada. To design a study with ≥80% power, we matched all patients who underwent CT during

1Department of Otolaryngology–Head and Neck Surgery, Sir Mortimer B. Davis–Jewish General Hospital, McGill University, Montréal, Quebec, Canada
2Department of Medicine, Segal Cancer Centre and Lady Davis Institute for Medical Research, Sir Mortimer B. Davis–Jewish General Hospital, McGill University, Montréal, Quebec, Canada
3Department of Otolaryngology–Head and Neck Surgery, Padeh Medical Center, Poriya, Israel
4Department of Pediatrics, University of Texas Medical Branch, Galveston, Texas, USA
5Department of Otolaryngology–Head and Neck Surgery, Université de Montréal, Montréal, Quebec, Canada

Corresponding Author:
Shlomo Merchavy, MD, Department of Otolaryngology–Head and Neck Surgery, Padeh Medical Center, 15208 Poriya, Israel.
Email: Merchavy@gmail.com
2007 to 2012 with a group of patients who underwent TT during the same time period, which was at least twice bigger. All patients were operated on by a single surgeon (R.P.). Patients who underwent central compartment neck dissection (levels VI and VII), when it was indicated, were included in our analysis. It is notable that not all patients who underwent thyroid surgery at our institution were included in our analysis (eg, patients who underwent hemithyroidectomy or patients who were operated on by other surgeons). Seventy patients underwent a CT, and they were matched with 146 patients who underwent TT. Patients with abnormal parathyroid function or hypocalcemia before the surgery were excluded from this study, as well as patients who had any suspicious or proven neck involvement by their thyroid neoplasm that was beyond the central compartment of the neck (these patients underwent a more extensive neck dissection, in addition to thyroidectomy).

Clinicodemographic data collected encompassed age, sex, preoperative and postoperative corrected serum calcium (Cca), and parathyroid hormone (PTH) levels. In addition, information on the intraoperative management of the parathyroid gland was obtained from the surgical reports. According to our institution’s postoperative hypocalcemia treatment algorithm, calcium supplementation is not routinely administered to patients undergoing CT or TT. The Cca and PTH levels are measured at 6, 12, and 20 hours postoperatively, respectively. Hypocalcemia was defined as Cca ≤1.90 mmol/L with concurrent PTH <8 ng/L and/or any signs or symptoms of hypocalcemia (eg, perioral numbness, digital paresthesia, or positive Trousseau’s sign). The surgical interval, defined as the time elapsed between the first surgery and completion thyroidectomy, was recorded. Final pathology results were retrieved and reviewed, with attention given to the presence of parathyroid glands in the surgical specimen. Although we recorded if patients underwent central compartment neck dissection (CCND) during their thyroid surgery, we did not record the number of lymph nodes in the surgical specimen. It is standard practice at our institution to autotransplant a parathyroid gland in the ipsilateral sternocleidomastoid muscle if it had been removed during surgery or if it had appeared devascularized. Information on the intraoperative management of the parathyroid gland was also obtained from the surgical reports.

Statistical analysis was performed using the Statistical Package for the Social Science (SPSS) software version 19.0 (SPSS, Inc, an IBM Company, Chicago, Illinois). Demographic and pathologic data were summarized using descriptive statistics. Differences in the rate of hypocalcemia between the CT and TT patients in terms of demographic data and pathologic findings were analyzed by using the χ² analysis.

**Results**

Of the 216 charts retrieved and reviewed, 214 were included in the study. Two patients from the CT group were excluded due to preoperative hypocalcemia. Of the 68 patients in the CT group, 58 were women and 10 were men. Their mean (SD) age was 52.1 (13.1) years (range, 22-76 years). The mean surgical interval between the primary surgery and CT was 95 days (range, 27-184 days). In the TT group, 146 patients were included. In this group, there were 125 women and 21 men, with a mean (SD) age of 50.2 (14.2) years (range, 20-76 years). No significant differences were noted between the 2 groups for both age and sex (P = .37 and P = .88, respectively).

Postoperative transient hypocalcemia was recorded in 18 patients (12.5%) in the TT group and in 1 patient in the CT group (1.5%, P = .02) (Table 1). There were no documented cases of permanent hypocalcemia. The correlation between the number of patients diagnosed with hypocalcemia and the time elapsed following surgery is illustrated in Figure 1.

None of the patients underwent level VII dissection. In the TT group, 5 patients required parathyroid gland autotransplantation, whereas 1 patient in the CT group required parathyroid gland autotransplantation. None of the patients requiring parathyroid autotransplantation, from either group, experienced postoperative hypocalcemia (P = .45). In the CT group, there were 12 (18%) patients with parathyroid gland(s) or parathyroid tissue found in the specimen compared with 47 (32%) patients in the TT group. There was no statistically significant correlation between the presence of a parathyroid tissue in the surgical specimen and hypocalcemia (P = .34).

All patients who were scheduled for CT had thyroid malignancy in their primary thyroid surgery (n = 68). Of them, 54 had a confirmed malignancy in the contralateral lobe of the thyroid in their second surgery (either micro- or macroscopic disease), whereas in 12 patients, the surgical pathology was reported as “benign” or “thyroiditis,” with no foci of thyroid malignancy. Rates of hypocalcemia for malignant and benign diseases were also compared. Overall, 186 patients had thyroid malignancies, with papillary thyroid carcinoma being the most common type. Of those

<table>
<thead>
<tr>
<th>Group</th>
<th>Normal Calcium, No. (%)</th>
<th>Hypocalcemia, No. (%)</th>
<th>P Value</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT</td>
<td>128 (88)</td>
<td>18 (12)</td>
<td>.02</td>
<td>0.106</td>
</tr>
<tr>
<td>CT</td>
<td>67 (98.5)</td>
<td>1 (1.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>195</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
patients, 17 (9%) had developed postoperative hypocalcemia, while 2 of 28 (7%) patients with benign thyroid disease developed postoperative hypocalcemia ($P = .72$). When we matched the malignant and benign diseases groups to the CT and TT groups, 54 patients in the CT group had a malignancy in the contralateral lobe of the thyroid, and 1 case of postoperative hypocalcemia was found. In the TT group, 132 patients had thyroid malignancy, of whom 17 developed hypocalcemia, and of the 14 patients with benign disease, 1 developed postoperative hypocalcemia.

**Discussion**

Our study demonstrates a significant lower risk for hypocalcemia following CT compared with TT. Transient hypocalcemia is a common complication of total thyroidectomy.\(^4,5\)

Surprisingly, only a few reports have compared the rates of hypocalcemia following TT with CT. Also, the range of hypocalcemia after thyroid surgery reported in the literature varies widely. This may reflect either true incidence rates or can be explained by the different definitions of hypocalcemia used. Mehanna et al.\(^6\) applied different definitions of hypocalcemia on the same cohort of 202 patients who underwent CT or TT; they have shown that depending on the definition used, the rates of hypocalcemia varied from 0% to 46%. Our rates of hypocalcemia are substantially lower than those from Mishra and Mishra,\(^7\) who reported a 17% rate of transient hypocalcemia in 48 patients who underwent CT compared with a 26% rate of transient hypocalcemia in 95 patients who underwent primary TT. Our numbers are closer to hypocalcemia rates reported by Vaiman et al,\(^8\) who did not look at CT vs TT but, more generally, hemithyroidectomy vs TT.

While malignancy is associated with a higher risk for postoperative hypocalcemia,\(^9\) in this study, we showed that there was no correlation between the final pathology and hypocalcemia evolution. This is in line with a report by Mehrabi et al.,\(^10\) who also showed that thyroid malignancy is not a risk factor for hypoparathyroidism after thyroidectomy. The clinical relevance of incidental parathyroidectomy in thyroid surgery is debatable in the literature. In our study, we did not find a correlation between the presence of parathyroid tissue in the surgical specimen and the development of hypocalcemia after thyroid surgery. Likewise, several articles have shown that incidental parathyroid removal is not a true risk factor for hypocalcemia.\(^11,12\)

The only patient in the CT group who developed hypocalcemia had 1 parathyroid gland autotransplanted during the completion surgery. In the literature, there is no consensus as to the reason for the lower rates of hypocalcemia observed in patients undergoing CT. One possible explanation involves the time interval between the first surgery and the CT. Glockzin et al.\(^13\) have recommended preforming CT after 3 months to allow enough time for the devitalized parathyroid glands to be revascularized. On the contrary, El-Sharacky et al.\(^14\) showed that devascularized parathyroid glands usually recover their function within 4 weeks following surgery. In our cohort, all CTs were performed >4 weeks after the initial surgery, which would have allowed sufficient time for the parathyroid glands to recover to normal function. This can also explain the low rate of hypocalcemia in the CT group (1/68 [2%]). Another plausible explanation for our low rates of hypocalcemia is that our study took place in a tertiary hospital, with a high volume of thyroid surgeries performed by experienced surgeons with specialized training. Gonzalez et al.\(^15\) studied hypocalcemia rates in 225 patients who underwent thyroid surgery. Of them, 30 were operated by less experienced surgeons (surgeons performing <5 procedures per surgeon per year) and 195 by experienced surgeons (surgeons performing >40 procedures per surgeon per year). The incidence of hypocalcemia persisting beyond 12 months (bilateral procedures) was higher in the patient group who were operated by less experienced surgeons ($P = .028$).

However, the clinical relevance of incidental parathyroidectomy in thyroid surgery is still debatable in the literature. In our study, we did not find a correlation between the presence of parathyroid tissue in the surgical specimen and the development of hypocalcemia after thyroid surgery. Likewise, several articles have shown that incidental parathyroidectomy is not a risk factor for hypocalcemia.\(^11,16\)

Autotransplantation of parathyroid glands did not significantly alter the risk of temporary hypocalcemia. However, it is interesting to note that the only case of hypocalcemia in the CT group occurred in a patient who had an autotransplantation of a parathyroid gland. Our results correlate with other reports showing that autotransplantation of the parathyroid glands is also not a risk factor for hypocalcemia.\(^16\)

In our study, patients who underwent central compartment neck dissection (level VI only; there were no level VII dissections in our cohort) were included in our analysis. During our data collection, we decided that we would not consider the presence of lymph nodes in the surgical specimens, since temporary hypoparathyroidism is primarily
explained by the higher chance of unintentional removal or devascularization of parathyroid glands during dissection and not by the number of lymph nodes removed in that dissection. Although the lack of these data in our work may be considered a weakness, several authors showed that central neck dissection per se is not a risk factor for postoperative hypocalcemia.16-20

In summary, our study demonstrates that CT is associated with a significantly lower rate of hypocalcemia than TT. The rate of hypocalcemia was independent of autotransplantation of a parathyroid gland in the TT group.

Author Contributions
Shlomo Merchavy, retrieving data, writing the manuscript, drafting, final approval, accountability for manuscript content; Tal Marom, data analysis, drafting, writing the manuscript, statistics, final approval, accountability for manuscript content; Veronique-Isabelle Forest, data analysis, drafting, final approval, accountability for manuscript content; Michael Hier, data analysis, drafting, final approval, accountability for manuscript content; Alex Mlynarek, critically reviewing the manuscript, data analysis, drafting, final approval, accountability for manuscript content; Tobial McHugh, data analysis, drafting, final approval, accountability for manuscript content; Richard Payne, critically reviewing the manuscript, drafting, final approval, data analysis, accountability for manuscript content.

Disclosures
Competing interests: None.
Sponsorships: None.
Funding source: None.

References