Careful Examination of Thyroid Specimen Intraoperatively to Reduce Incidence of Inadvertent Parathyroidectomy During Thyroid Surgery

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Objective: To assess the incidence and clinical relevance of inadvertent parathyroidectomy during thyroidectomy, and the possibility of reducing its occurrence.

Design: Retrospective study.

Setting: University hospital.

Patients: Consecutive patients who underwent thyroidectomy from 1999 to 2005, divided into 2 groups (group 1, those with inadvertent parathyroidectomy; and group 2, those without inadvertent parathyroidectomy). Patients who underwent surgical procedures for recurrent thyroid disease, intentional parathyroidectomy, and resection of central compartment viscera were excluded.

Interventions: All pathology reports were reviewed for the presence of any parathyroid tissue in the resected specimen. Age, sex, preoperative diagnosis, thyroid hormonal status, substernal thyroid extension, number of parathyroid glands identified and spared at the time of surgery, autotransplantation of parathyroid gland, and final histologic findings were recorded.

Main Outcome Measures: Identification of parathyroid tissue in resected specimens and postoperative symptomatic hypocalcemia.

Results: A total of 307 patients were included. Surgical procedures included bilateral or unilateral thyroidectomy (95% and 5% of procedures, respectively). Central neck lymph node dissection was performed in 5% of cases. Pathologic findings showed inadvertent parathyroidectomy in 12% of cases. Of these, 32% were recognized intraoperatively. The parathyroid tissue was found in extracapsular locations in 37% of cases, intracapsular locations in 39%, and intrathyroidal locations in 24%. There was no statistical difference between the 2 groups in terms of sex, preoperative diagnosis, substernal extension, extent of surgery, pathologic diagnosis, and occurrence of postoperative hypocalcemia, except for the presence of thyroiditis.

Conclusion: Careful examination of the surgical specimen intraoperatively decreases the incidence of inadvertent parathyroidectomy during thyroidectomy.


HYROIDECTOMY IS A FREQUENT AND RELATIVELY SAFE SURGICAL PROCEDURE AND IS ASSOCIATED WITH A MINIMAL COMPLICATION RATE.1-3 HOWEVER, THE PROXIMITY OF THE THYROID TO CERTAIN IMPORTANT STRUCTURES MAKES THIS SURGICAL PROCEDURE INTERESTING AND CHALLENGING. THE MAIN POSTOPERATIVE COMPLICATIONS INCLUDE WOUND HEMORRHAGE, TRANSIENT OR PERMANENT HYPOPARATHYROIDISM (EG, INJURY, DE-VASCULARIZATION, REMOVAL OF THE PARATHYROID GLAND), AND INJURY TO THE LARYNGEAL NERVES (RECURRENT AND EXTERNAL BRANCH OF THE SUPERIOR LARYNGEAL NERVE). TO MINIMIZE MOR-BIDITY, IT HAS BEEN PROPOSED THAT THESE ANATOMIC STRUCTURES BE RECOGNIZED DURING SURGERY; HOWEVER, THE SURGEON SHOULD KEEP IN MIND THE ANATOMIC VARIATIONS, ESPECIALLY THOSE OF PARATHYROID GLANDS.4,5 THE COMPLICATION RATE IN THYROID SURGERY IS INVERSELY PROPORTIONAL TO THE EXPERIENCE OF THE OPERATING SURGEON AND DIRECTLY PROPORTIONAL TO THE EXTENT OF SURGERY.6

Inadvertent parathyroidectomy during thyroid surgery is a potential complication of this procedure; its occurrence varies widely among centers and among surgeons, depending on the regional and individual experience.1-10 During thyroidectomy, preservation of the parathyroid glands can be achieved by careful dissection directly on the thyroid capsule and separating the parathyroid glands gently from the thyroid gland. Nonetheless, even with meticulous dissection, every thyroid surgeon is occasionally surprised by a pathology report revealing the presence of parathyroid tissue along with the thyroid specimen. Although the removal of 1 or
more parathyroid glands may not necessarily have any clinical relevance, for some authors. it has been a risk factor for postthyroidectomy hypocalcemia. Thus, it is important for the thyroid surgeon to be able to identify factors that could potentially increase the risk of inadvertent parathyroidectomy during thyroid surgery and therefore to take appropriate caution with those patients.

We assessed the incidence and clinical relevance of inadvertent parathyroid removal during thyroidecrtery and identified factors that might predict patients at increased risk to decrease these potential complications.

METHODS

POPULATION STUDY

This study was a retrospective review of all thyroidecrteries (unilateral or bilateral) performed at the department of General Surgery in the Hotel Dieu de France Hospital, Beirut, Lebanon, from January 1999 to June 2005. Patient demographics and data regarding preoperative diagnosis and surgical procedures were collected. The local hospital medical ethics committee approved the database review. Informed consent was obtained from all the patients to review their medical files and to be included in the study. Two groups of patients were studied: those in group 1 had experienced inadvertent parathyroidectomy following thyroid surgery and those in group 2 had not. Patients undergoing concomitant central neck lymph nodal dissection were included in the study, whereas those who required more extensive surgical resection of central compartment viscera (eg, the larynx, trachea, or esophagus) were excluded. Patients who had undergone repeated surgical procedures for recurrent or persistent thyroid disease and patients who had undergone intentional parathyroidectomy were excluded from the study. The following parameters were recorded for all patients: age, sex, preoperative diagnosis, thyroid hormonal status, substernal thyroid extension, number of parathyroid glands identified and spared during the surgery, autotransplantation of parathyroid gland, and final histologic findings.

SURGICAL TECHNIQUE

All surgical procedures were performed by a single surgeon (B.A.). Iodine-free solutions (chlorhexidine) were used to swab the operative field. Thyroidecrteries was performed via a transverse cervicotomy under general anesthesia. The thyroidecrteries were all performed in a similar fashion, with careful dissection along the thyroid capsule while attempting to identify and preserve the parathyroid glands with their vascular supply, as well as the recurrent laryngeal nerves. Total thyroid resection was conducted intracapsularly when necessary to preserve the vascularization of the parathyroid glands. Identification of all parathyroid glands was attempted to facilitate preservation, but excessive dissection to search for missing glands was avoided. Unequivocally devascularized parathyroid glands were removed routinely for immediate autotransplantation. All resected thyroid specimens were carefully examined intraoperatively to identify inadvertently removed parathyroid glands and to perform immediate parathyroid autotransplantation after confirmation by frozen section analysis. The glands were minced into small (0.5-mm) pieces, and the parathyroid tissue was then immediately autotransplanted into a pocket fashioned in the ipsilateral sternocleidomastoid muscle. The transplantation site was closed with permanent silk suture to prevent graft extrusion and to serve for future identification. Cervical wounds were closed without drain tubes.

PATHOLOGIC FINDINGS

Definitive pathologic study was obtained for all resected tissues. Pathology reports were evaluated for the presence and the number of parathyroid glands inadvertently removed with the thyroid specimen, the location of the parathyroid glands within the submitted thyroid tissue (extracapsular, intracapsular, or intrathyroidal), and histological appearance of both thyroid and parathyroid tissue. Serial gross sections every 2 mm in thickness were performed on the thyroid tissue.

POSTOPERATIVE PERIOD AND FOLLOW-UP

Postoperative complications, mainly vocal cord paralysis and temporary or permanent hypocalcemia, were noted. Data on postoperative biochemical and clinical hypocalcemia were thoroughly searched. The presence and the type of hypocalcemic signs were recorded by a surgeon or by a nurse, together with the evaluation of the Chvostek sign. Biological hypocalcemia was defined as a serum calcium concentration of less than 8 mg/dL on at least 1 postoperative measurement (to convert serum calcium to millimoles per liter, multiply by 0.25). Serum calcium levels were measured preoperatively and on the first day after surgery. In patients who received calcium replacement therapy, more measurements of serum calcium levels were performed later following discontinuation of replacement therapy to detect permanent hypoparathyroidism. Patients were classified as having transient hypocalcemia if they were normocalcemic 2 weeks after stopping all follow-up medications. Postoperative hypocalcemia requiring treatment and associated with a low parathyroid hormone level (reference range, 9-55 pg/mL, to convert parathyroid hormone to nanograms per liter, multiply by 0.1053) more than 1 year after surgery was classified as permanent.

STATISTICAL ANALYSIS

Continuous data are expressed as mean (SD) or as mean (range). Categorical data are expressed as frequencies and percentages and were compared using the chi-square statistic, corrected by Fisher exact test when appropriate. All tests were 2-sided except for incidence of inadvertent parathyroidectomy associated with parathyroid autotransplantation, which we hypothesized could not reduce incidence of inadvertent parathyroidectomy without parathyroid autotransplantation. P < .05 was considered statistically significant.

RESULTS

A total of 307 patients (239 female and 68 male) who underwent thyroidecrteries in our department and satisfied the inclusion and exclusion criteria were retained for the study. Their mean age was 53 years (range, 16-76 years). The thyroid function was within reference range in 211 patients (69%). Hyperthyroidism was exhibited by 89 patients (29%), and 7 patients (2%) had hypothyroidism. All 89 patients with hyperthyroidism were treated with methimazole and propylthiouracil. Postthyroidectomy hypocalcemia was exhibited by 21 patients (69%). Temporary hypocalcemia was exhibited by 19 patients (59%), and 2 patients (6%) had permanent hypocalcemia. Six patients (18%) required calcium replacement therapy later following discontinuation of follow-up medications. The majority of patients who experienced postoperative hypocalcemia had undergone thyroidectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmusectomy with contralateral near total lobectomy and isthmus
pectomy (n=187 [61%]), total thyroidectomy (n=103 [34%]), and lobectomy (n=17 [5%]).

During the intervention, the frequencies of parathyroid glands identified were as follows: 4 glands in 233 patients, 3 in 58 patients, 2 in 14 patients, and 1 in 2 patients. Following resection of the thyroid gland and after carefully examining the surgical specimen intraoperatively, an inadvertently removed parathyroid was recognized and confirmed by frozen section analysis in 12 of 307 patients (4%). Nine of these were in the extracapsular location (75%) and 3 in the intracapsular location (25%). Ten of these 12 patients had 1 parathyroid gland (83%) and 2 (17%) had 2 parathyroid glands salvaged. Parathyroid autotransplantation in the sternocleidomastoid muscle was then performed in all 12 patients at the time of thyroid surgery.

**HISTOPATHOLOGIC RESULTS**

Histopathologic examination of the resected thyroid revealed the presence of benign thyroid disease and thyroid malignant neoplasms in 196 patients (73%) and 73 patients (27%), respectively (Table 1). Overall, 38 of the 307 patients (12%) (Table 2) were found to have inadvertent removal of parathyroid tissue (group 1). Twenty-nine of these specimens (76%) were for thyroidectomies for benign conditions, and 9 (24%) were for thyroid malignant neoplasms. Thirty-three patients (87%) had 1 and 5 patients (13%) had 2 parathyroid glands in their specimens. The examination of the location of the parathyroid tissue within the thyroid specimen showed that of the inadvertently removed parathyroid glands, 14 (37%) were found in the extracapsular location, defined as lying outside the thyroid capsule; 15 (39%) were seen in the intracapsular location, defined as being enmeshed within the thyroid capsule or lying just beneath the capsule; and 9 (24%) were located in the intrathyroidal position, defined as being completely surrounded by thyroid parenchyma. The mean (SD) diameter of the inadvertently removed parathyroids was 4 (2) mm. In all of the 38 patients in group 1, the excised parathyroid was normal. The careful inspection of the thyroid specimen intraoperatively allowed reimplantation of inadvertently removed parathyroid glands during thyroidectomies in our series of patients, allowing a statistically significant reduction of the percentage of parathyroid glands discovered by the pathologist on the final surgical specimen (from 12% [38/307] to 8% [26/307]; P=0.049, 1-sided t test).

**COMPARISON OF GROUPS 1 AND 2**

The incidence rate of inadvertently removal parathyroid glands was 14% (9 of 63 patients) in those who had a malignant thyroid tumor compared with 12% (29 of 244) in those who had a benign tumor (P=0.67). Subternal thyroid extension was not predictive of inadvertent parathyroid removal. A total of 35 of 269 patients (13%) undergoing thyroidectomy without inadvertent parathyroid removal had subternal thyroid lesion, whereas 4 of the 38 patients (11%) with inadvertent parathyroid removal had a substernal extension (P<0.05). Central lymph node dissection was performed in 16 patients (5%), of whom 3 (19%) had an inadvertently removed parathyroid in their specimen compared with 36 of 291 patients (12%) who did not undergo central lymph node dissection (P=0.41). Table 3 summarizes the statistical analysis of various parameters as a function of inadvertent parathyroidectomy. There was no statistically significant higher percentage of women in group 1 than in group 2 (84% vs 73%; P=0.31). The presumed (preoperative) and histological diagnoses of thyroid disease (benign vs malignant) were not found to correlate with inadvertent parathyroidectomy. Similarly, the type of surgery (bilateral or unilateral thyroidectomy), central neck lymph node dissection, and the presence of substernal extension of the thyroid gland were not related to inadvertent parathyroidectomy. Conversely, the presence of thyroiditis (Hashimoto thyroiditis) did differ significantly between the 2 groups (P=0.04).

Biochemical and clinical hypocalcemia was observed in 9 (24%) and 4 (11%), respectively, of the patients in...
The incidence rate of inadvertent parathyroidectomy during thyroid surgery was 12% in our patients, which compares favorably with rates reported in the literature (8%-19%) \(^1,7-10\). The careful inspection of the thyroid specimen intraoperatively allowed reimplantation of inadvertently removed parathyroid glands during thyroidectomies in our series of patients, this retrieval being statistically significant (from 12% [38/307] to 8% [26/307], \(P=0.049\); 1-sided \(t\) test). Lee et al.\(^7\) described their experience reporting an incidence rate of 11% for inadvertent parathyroid removal during thyroidectomy. Sasson et al.\(^7\) reported an incidence rate of 13% in a series of 141 thyroidectomies. In most cases, only 1 parathyroid gland was inadvertently resected with the thyroid (there was an incidence rate of 87% for removal of 1 gland in our study). By adhering to anatomical principles and strict surgical guidelines, it has been well established that the incidence rate of iatrogenic hypoparathyroidism after thyroidectomy may be minimized to 0.5% to 4%.\(^2,6,11-13\) However, little has been written about the actual incidence and clinical relevance of inadvertent parathyroid gland removal during thyroidectomy. Furthermore, despite some controversy, most authors agree that identifying parathyroid glands during thyroid surgery can result in a lower incidence of inadvertent parathyroidectomy. However, dissection in search of all parathyroid glands during thyroid surgery is unwarranted and may be hazardous.\(^10\)

Familiarity with the anatomy of parathyroid glands and their blood supply is necessary to prevent inadvertent injury or devascularization or resection of the parathyroid parenchyma.\(^7\) Although there is great variability in their number, most commonly there are 4 glands (approximately 6-8 mm in diameter) commonly located extra-capsularly on the posterior surface of the thyroid gland. They can, however, also be found within the thyroid capsule or, rarely, within the substance of the thyroid gland itself. The superior parathyroids are fairly consistently located at the superior pole of the thyroid. The inferior parathyroids are more variable in location and, at times, are intrathyroidic. The inferior parathyroid artery always arises from the inferior thyroid artery. The superior parathyroid gland also usually receives its blood supply from the inferior thyroid artery. Occasionally, it may derive its blood supply from an anastomotic loop between the superior and inferior thyroid arteries or exclusively from a branch of the superior thyroid artery. The incidence of intrathyroidal location of parathyroid glands is approximately 0.2% according to autopsy studies, but this incidence rises to 2% to 5% in patients with primary hyperparathyroidism and up to 11% in those with persistent or recurrent hyperparathyroidism. Inadvertently excised parathyroids, however, have been reported in an intrathyroidal location in 40% to 50% of cases.\(^1,6,12,13\) In our study, the inadvertently resected parathyroid was intrathyroidal in 24% of cases. Obviously, in these cases, im-

### Table 3. Statistical Analysis Comparing Group 1 With Group 2a

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group 1 (Inadvertent Parathyroidectomy)</th>
<th>Group 2 (No Inadvertent Parathyroidectomy)</th>
<th>(P) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>32 (84)</td>
<td>207 (77)</td>
<td>.31</td>
</tr>
<tr>
<td>Benign preoperative diagnosis</td>
<td>29 (76)</td>
<td>215 (80)</td>
<td>.61</td>
</tr>
<tr>
<td>Type of surgical procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total thyroidectomy</td>
<td>13 (34)</td>
<td>90 (33)</td>
<td>.90</td>
</tr>
<tr>
<td>Total lobectomy + isthmusectomy + near total contralateral lobectomy</td>
<td>23 (61)</td>
<td>164 (61)</td>
<td>.99</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>2 (5)</td>
<td>15 (6)</td>
<td>.94</td>
</tr>
<tr>
<td>Central neck lymph node dissection</td>
<td>3 (8)</td>
<td>13 (5)</td>
<td>.85</td>
</tr>
<tr>
<td>Parathyroid autotransplantation</td>
<td>12 (32)</td>
<td>33 (12)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Benign thyroid pathologic characteristics</td>
<td>28 (74)</td>
<td>196 (73)</td>
<td>.91</td>
</tr>
<tr>
<td>Presence of Hashimoto thyroiditis</td>
<td>3 (8)</td>
<td>4 (2)</td>
<td>.04</td>
</tr>
<tr>
<td>Subternal goiter</td>
<td>4 (11)</td>
<td>34 (13)</td>
<td>.71</td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biochemical</td>
<td>9 (24)</td>
<td>41 (15)</td>
<td>.19</td>
</tr>
<tr>
<td>Clinical</td>
<td>4 (11)</td>
<td>13 (5)</td>
<td>.24</td>
</tr>
</tbody>
</table>

\(\text{a}\) Data are given as number (percentage) in each group.

**COMMENT**

In our series of 141 thyroidectomies, in most cases, only 1 parathyroid gland was inadvertently resected with the thyroid (there was an incidence rate of 87% for removal of 1 gland in our study). By adhering to anatomical principles and strict surgical guidelines, it has been well established that the incidence rate of iatrogenic hypoparathyroidism after thyroidectomy may be minimized to 0.5% to 4%. However, little has been written about the actual incidence and clinical relevance of inadvertent parathyroid gland removal during thyroidectomy. Furthermore, despite some controversy, most authors agree that identifying parathyroid glands during thyroid surgery can result in a lower incidence of inadvertent parathyroidectomy. However, dissection in search of all parathyroid glands during thyroid surgery is unwarranted and may be hazardous. Familiarity with the anatomy of parathyroid glands and their blood supply is necessary to prevent inadvertent injury or devascularization or resection of the parathyroid parenchyma. Although there is great variability in their number, most commonly there are 4 glands (approximately 6-8 mm in diameter) commonly located extra-capsularly on the posterior surface of the thyroid gland. They can, however, also be found within the thyroid capsule or, rarely, within the substance of the thyroid gland itself. The superior parathyroids are fairly consistently located at the superior pole of the thyroid. The inferior parathyroids are more variable in location and, at times, are intrathyroidic. The inferior parathyroid artery always arises from the inferior thyroid artery. The superior parathyroid gland also usually receives its blood supply from the inferior thyroid artery. Occasionally, it may derive its blood supply from an anastomotic loop between the superior and inferior thyroid arteries or exclusively from a branch of the superior thyroid artery. The incidence of intrathyroidal location of parathyroid glands is approximately 0.2% according to autopsy studies, but this incidence rises to 2% to 5% in patients with primary hyperparathyroidism and up to 11% in those with persistent or recurrent hyperparathyroidism. Inadvertently excised parathyroids, however, have been reported in an intrathyroidal location in 40% to 50% of cases. In our study, the inadvertently resected parathyroid was intrathyroidal in 24% of cases. Obviously, in these cases, im-
proven in surgical technique cannot eliminate the risk of inadvertent parathyroidectomy; therefore, inadvertent parathyroidectomy may occur even in the hands of more experienced thyroid surgeons.

In our review of thyroidectomies with inadvertent excision of parathyroid tissue within the thyroid specimen, we noted that in most cases (76%) the parathyroid tissue was found either in the extracapsular or intracapsular positions (37% and 39% of cases, respectively). It is conceivable that the parathyroid gland tissue in the extracapsular and intracapsular positions would be in locations where it could be identified and preserved during the surgery. Possibly, more careful examination of the thyroid capsule during and after thyroidectomy would decrease this incidence. Following resection of the thyroid gland in our series of patients, and after examining the surgical specimen intraoperatively, an inadvertently excised parathyroid was recognized and autotransplanted after confirmation by frozen section analysis in 12 patients. In our series of patients, careful examination of the thyroid specimen was conducted intraoperatively, which resulted in identification of 32% (12/38) of inadvertently removed parathyroid glands. The 24% of parathyroid tissue that was found in an intrathyroidal location would have been more difficult to preserve even with more careful dissection or inspection.

Theoretically, the risk of inadvertent parathyroidectomy may be increased in some cases, such as in patients who are undergoing extensive surgery for malignant thyroid disease, in the presence of extrathyroid extension, or in the presence of bulky lymph node metastases. Lin et al. and Sasson et al. reported the notable association of inadvertent parathyroidectomy with dissection of tracheoesophageal groove lymph nodes and modified neck dissection concomitant with thyroidectomy, respectively. This may be related to the more extensive dissection performed during such a procedure. In the literature, completion thyroidectomy or repeated surgical procedures have been correlated with an increased risk for inadvertent parathyroidectomy, probably resulting from the formation of scar tissue and fibrosis, which may cause operative difficulty. In our study, however, patients who underwent a repeated surgical procedure for recurrent or persistent thyroid disease were excluded. Some authors have described thyroiditis as a risk factor for inadvertent parathyroidectomy. In our study, Hashimoto thyroiditis was observed in 8% (3/38) and 2% (4/269) of patients with or without inadvertent parathyroidectomy, respectively, and the difference was statistically significant (P = .04).

Besides recommending particular care with intraoperative identification and preservation of the parathyroids, it may also be prudent to examine the thyroidectomy specimens of these patients carefully with the intention of identifying healthy parathyroid glands that may be suitable for autotransplantation. Careful inspection of the resected thyroid or neck dissection specimens for the presence of normal parathyroid tissue, anticipating possible autotransplantation without compromising the oncological indication for resection, is prudent. Autotransplantation should be strongly considered, and its routine application during thyroid surgery resulted in less than 1% incidence of permanent hypoparathyroidism. In this study, parathyroid autotransplantation was performed in 12 patients (32%) who had inadvertent parathyroid removal.

Biochemical hypocalcemia has been reported in most patients (up to 83%) following thyroid surgery. Clinical hypocalcemia is observed much less frequently. Although there were no sequelae of permanent hypocalcemia in any of our patients, percentages cited in the literature range from 0.3% to 5% for temporary and from 0% to 0.5% for permanent hypocalcemia. The association between intraoperative identification of parathyroid glands and development of postoperative hypocalcemia is variable. Our policy has been to identify and preserve the parathyroid glands as a matter of routine for every patient undergoing any form of thyroidectomy for benign tumors or malignant disease. Despite this approach, as our analysis reports, a percentage of patients will have 1 or more parathyroids excised inadvertently. Most often, only 1 parathyroid gland is likely to be removed. In our study, no correlation was found between inadvertent parathyroidectomy and clinical and biochemical hypocalcemia. This has been the experience of other investigators as well.

In conclusion, inadvertent excision of parathyroid glands occurred in 12% of patients undergoing thyroidectomy in our experience. Most of this parathyroid tissue (76%) was found in the extracapsular and intracapsular locations; therefore, it is possible that these parathyroid glands may be identified and preserved with more meticulous inspection of the thyroid capsule during and after thyroidectomy to decrease the incidence of inadvertent parathyroidectomy during thyroidectomy in the future. The careful inspection of the thyroid specimen intraoperatively allowed reimplantation of inadvertently removed parathyroid glands during thyroidectomies in our series of patients, this retrieval being statistically significant (P = .049), and allowed immediate autotransplantation of the parathyroid tissue. A notable percentage of inadvertently removed parathyroid glands are intrathyroidal, and therefore some inadvertent parathyroidectomies are obviously unavoidable. Most patients had 1 parathyroid gland identified in their specimen. Although inadvertent parathyroidectomy with autotransplantation does not seem to correlate with postoperative permanent hypocalcemia, every attempt should be made to avoid this potentially preventable complication of thyroid resection.

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Author Contributions: Drs Abboud, Sleilaty, Braidy, Zeineddine, Ghorra, Abadjian, and Tabchy had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Abboud, Ghorra, and Tabchy. Acquisition of data: Abboud, Braidy, Zeineddine, and Abadjian. Analysis and interpretation of data: Sleilaty.
Drafting of the manuscript: Abboud, Braidy, and Zeineddine. Critical revision of the manuscript for important intellectual content: Abboud, Sleilaty, Ghorra, Abadjian, and Tabchy. Statistical analysis: Sleilaty and Zeineddine. Study supervision: Abboud.

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