

# UNINTENTIONAL PARATHYROIDECTOMY DURING TOTAL THYROIDECTOMY

Andreas Manouras, MD, PhD,<sup>1</sup> Haridimos Markogiannakis, MD,<sup>1</sup> Emmanuel Lagoudianakis, MD,<sup>1</sup> Pantelis Antonakis, MD,<sup>1</sup> Michael Genetzakis, MD,<sup>1</sup> Artemis Papadima, MD,<sup>2</sup> Eleftheria Konstantoulaki, MD,<sup>1</sup> Dimitrios Papanikolaou, MD,<sup>1</sup> Panagiotis Kekis, MD, PhD<sup>1</sup>

<sup>1</sup> First Department of Propaedeutic Surgery, Hippokration Hospital, Athens Medical School, University of Athens, Athens, Greece. E-mail: markogiannakis@easy.com

<sup>2</sup> Department of Anaesthesiology, Hippokration Hospital, Athens, Greece

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**Abstract:** *Background.* Unintentional parathyroidectomy during thyroidectomy has been evaluated in a few studies. Moreover, the impact of the surgeon's experience and operative technique has not been evaluated. Our aim was to identify the incidence of unintentional parathyroidectomy during total thyroidectomy, its clinical consequences, and factors affecting its occurrence.

*Methods.* We reviewed all total thyroidectomies during a 2-year period. Patients were categorized into 2 groups: those with unintentional parathyroidectomy (parathyroidectomy group) and those without unintentional parathyroidectomy (no-parathyroidectomy group).

*Results.* Incidental parathyroidectomy occurred in 100 (19.7%) of the 508 patients. The groups were comparable in age, thyroid weight and pathology, operative time, surgeon experience (high/low volume), operative technique (suture-ligation, LigaSure, or Ultracision), postoperative calcium, and transient hypocalcemia. No permanent hypocalcemia occurred. However, 11% of the parathyroidectomy group was men compared with 22% of the no-parathyroidectomy group ( $p = .002$ ).

*Conclusions.* Unintentional parathyroidectomy, although common, has no clinical consequences. Unlike surgeon's experience and operative technique, patient sex was the only factor affecting its occurrence. © 2007 Wiley Periodicals, Inc. *Head Neck* 30: 497–502, 2008

**Keywords:** unintentional parathyroidectomy; total thyroidectomy; hypocalcemia; surgeon's experience; operative technique

Total thyroidectomy in the 21st century has become safe and effective, with improved outcome and minimal morbidity.<sup>1–3</sup> It is considered to be the standard procedure for patients with malignant thyroid tumors and several benign thyroid diseases.<sup>1–3</sup> Safe operative technique for dissection of the gland is essential to avoid damage to the delicate and important adjacent structures, such as the superior and recurrent laryngeal nerves and the parathyroid glands.

Even the most experienced thyroid surgeons, however, have probably received a pathology report stating that an incidental parathyroid gland was found in the submitted thyroidectomy specimen. Although unintentional parathyroidectomy is a recognized complication of thyroid surgery, it has been evaluated in few studies in the literature.<sup>4–10</sup> In addition, the potential impact of the surgeon's experience and operative technique on inadvertent parathyroidectomy has not been evaluated in any study. The aim of our study was to identify the incidence of unintentional parathyroidectomy during total thyroidectomy and its potential clinical consequences and, furthermore, to evaluate factors associated with the occurrence

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Correspondence to: H. Markogiannakis

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of incidental parathyroidectomy, including the surgeon's experience and operative technique.

## MATERIALS AND METHODS

This is a retrospective study of prospectively collected data on all total thyroidectomies performed in our department between July 2004 and June 2006. Institutional review board approval was obtained, and written informed consent was signed in all patients.

**Patients.** All patients aged 14 years or older, with benign or malignant thyroid disease, who were admitted for total thyroidectomy in our department during the 2-year study period were included. Patients undergoing lobectomy, subtotal or near-total thyroidectomy, and intentional parathyroidectomy during total thyroidectomy, because of preoperatively or intraoperatively diagnosed concurrent parathyroid disease, were excluded from the study. Additionally, patients with intraoperative identification of a removed or devascularized parathyroid gland that underwent parathyroid gland reimplantation into the sternocleidomastoid muscle were also excluded.

**Surgeon's Experience and Operative Technique.** Total thyroidectomy was performed by 10 surgeons. Regarding surgeon experience, surgeons were categorized into 2 groups based on the number of total thyroidectomies they perform annually: those performing 50 or more total thyroidectomies constituted the high-volume group, and those performing less than 50, constituted the low-volume group.

Total thyroidectomy was performed by classic suture ligation technique or with electrothermal bipolar vessel sealing system (LigaSure Precise, Tyco Int., Valleylab, Boulder, CO) or with harmonic scalpel (Ultracision, CS-14C, Ethicon Endosurgery, Cincinnati, OH). According to the operative technique, patients were categorized into 3 groups: SL group, patients who underwent total thyroidectomy with the classic technique; L group, patients who underwent thyroidectomy with electrothermal bipolar vessel sealer; and U group, patients who underwent thyroidectomy with harmonic shears. The choice of the technique was based on the surgeon's decision. Both devices were solely used during the whole procedure for vascular ligation of all vessels, and no suture ligations, ties, or clips were used.

**Postoperative Treatment.** Serum calcium was determined 12 and 24 hours postoperatively.

Uncomplicated patients were discharged on the first postoperative day when calcium levels were within normal range (8.5–10.5 mg/dL). All patients were followed up 1, 2, and 4 weeks after surgery.

**Data Collected and Statistical Methods.** Recorded data were demographics, preoperative and postoperative serum calcium levels, operative time (from skin incision to skin closure), operative technique (classic, LigaSure, or Ultracision), surgeon's experience (high volume or low volume), intraoperative bleeding, thyroid gland specimen weight and pathologic diagnosis, hospitalization time, and postoperative complications such as bleeding, injury to the superior and inferior laryngeal nerves, hypocalcemia, cervical haematoma, wound infection, need for blood transfusion, and death.

Final pathology reports of all patients were reviewed to determine the incidence of unintentional parathyroidectomy during total thyroidectomy, the number of removed parathyroid glands found within the thyroid gland specimen, and their location (extracapsular, intracapsular, or intrathyroidal) along with thyroid gland weight and pathologic diagnosis. On the basis of the occurrence of parathyroidectomy, patients were allotted in 2 groups: those with parathyroidectomy (parathyroidectomy group) and those without (no-parathyroidectomy group). Age, patient sex, operative time, surgeon's experience, operative technique, and thyroid specimen weight and pathologic diagnosis were compared between these 2 groups, in order to be evaluated as factors potentially affecting the occurrence of incidental parathyroidectomy. Moreover, postoperative serum calcium levels along with transient and permanent hypocalcemia rates between the 2 groups were compared to evaluate the potential clinical consequences of unintentional parathyroidectomy during total thyroidectomy.

Statistical analysis was performed using *t* test for numeric variables, and chi-square test and Fisher's exact test for categorical variables. Data were expressed as means  $\pm$  SE (standard error of the mean) unless otherwise specified. All tests were 2-sided, and the level of statistical significance was set to  $p < .05$ .

## RESULTS

During the study period, 508 consecutive patients underwent total thyroidectomy in our depart-

**Table 1.** Clinical and demographic characteristics of the total study group.

Variable	Total study group ( <i>n</i> = 508)
Age, mean (SE), y	50.5 (0.7)
Sex, <i>n</i> (%)	
Men	101 (19.9)
Women	407 (80.1)
Preoperative calcium, mean (SE), mg/dL	9.2 (0.3)
Operative time, mean (SE), min	80.6 (9.2)
Surgeon's experience, <i>n</i> (%)	
High-volume group	338 (66.6)
Low-volume group	170 (33.4)
Operative technique, <i>n</i> (%)	
Classic (SL group)	107 (21.1)
Ligasure (L group)	188 (37)
Ultracision (U group)	213 (41.9)
Thyroid gland weight, mean (SE), g	53.1 (2.3)
Diagnosis, <i>n</i> (%)	
Multinodular goiter	261 (51.3)
Diffuse goiter	66 (13)
Hashimoto's thyroiditis	58 (11.4)
Grave's disease	13 (2.5)
Papillary cancer	73 (14.4)
Follicular cancer	9 (1.8)
Follicular adenoma	28 (5.6)
Postoperative calcium, mean (SE), mg/dL	8.9 (0.5)
Transient hypocalcemia, <i>n</i> (%)	16 (3.1)
Superior laryngeal nerve palsy, <i>n</i> (%)	3 (0.6)
Inferior laryngeal nerve palsy, <i>n</i> (%)	4 (0.8)
Unintentional parathyroidectomy, <i>n</i> (%)	100 (19.7)
Hospital stay, mean (SE), days	1.4 (0.5)

Abbreviation: SE, standard error of the mean.

ment. No patient had a history of neck surgery, radiation treatment of the gland, or radioiodine ablation. No extrathyroidal invasion of malignant thyroid tumors was identified in our study group, and no patients underwent cervical lymphadenectomy. Total thyroidectomy was complete in all patients. Two surgeons composed the high-volume group (performing the 66.6% of our patients); the remaining 8 surgeons, the low-volume group. Demographic and clinical data of the total study group are presented in Table 1.

No significant intraoperative or postoperative bleeding, cervical haematoma, wound infection, need for blood transfusion, or mortality was recorded. Transient hypocalcemia occurred in 16 patients (3.1%). In all patients, hypocalcemia was asymptomatic and responsive to medical treatment with oral calcium supplementation for 1 week. No patients had refractory hypocalcemia and permanent hypoparathyroidism. Superior and recurrent laryngeal nerve palsy occurred in 0.6% and 0.8% of the patients, respectively. In all these patients, the symptoms were mild and grad-

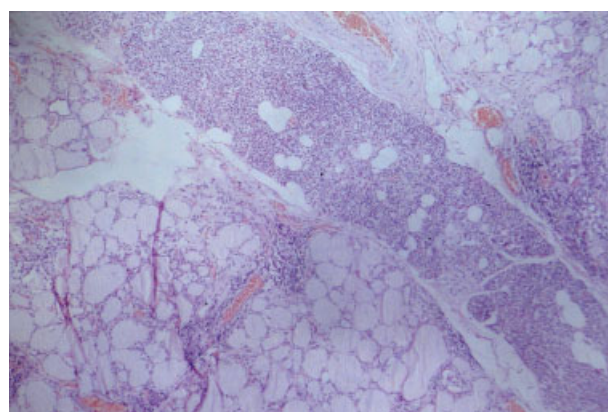
ually subsided within 1 month postoperatively. No permanent nerve damage was recorded in our study.

Unintentional parathyroidectomy was verified in the pathology report in 100 (19.7%) patients (parathyroidectomy group). The majority of these patients contained only a single incidentally removed parathyroid gland; however, 6 of these specimens contained 2 glands, whereas no specimens contained 3 or more glands. Thus, 106 parathyroid glands were found within these 100 specimens.

A substantial share of the incidentally removed parathyroid glands was intrathyroidal. Particularly, 52 (49%) of the 106 glands were found in the intrathyroidal position, defined as being completely surrounded by thyroid parenchyma (Figure 1). Thirty-four glands (32%) were located in the extracapsular location, defined as lying outside the thyroid capsule, and 20 (19%) in the intracapsular location, defined as being encased within the thyroid capsule or lying just beneath the capsule.

The results of the comparison between the parathyroidectomy and the no-parathyroidectomy group are shown in Table 2. The 2 groups were comparable in terms of age, thyroid gland weight and pathology, and operative time (Table 2). Patient sex was the only factor that significantly affected the occurrence of unintentional parathyroidectomy; 11% of the parathyroidectomy group patients were men compared with 22% of the no-parathyroidectomy group ( $p = .002$ ) (Table 2).

To further analyze the potential protective role of men to unintentional parathyroidectomy, a subgroup analysis of nonintrathyroidal parathyroid



**FIGURE 1.** Photomicrograph of an intrathyroidal parathyroid gland (hematoxylin-eosin stain, original magnification  $\times 100$ ). [Color figure can be viewed in the online issue, which is available at [www.interscience.wiley.com](http://www.interscience.wiley.com).]

**Table 2.** Comparison between patients with unintentional parathyroidectomy (parathyroidectomy group) and those without parathyroidectomy (no parathyroidectomy group).

Variable	Parathyroidectomy group ( <i>n</i> = 100)	No-parathyroidectomy group ( <i>n</i> = 408)	Test, <i>p</i> value
Age, mean (SE), y	49.7 (1.5)	50.7 (0.8)	<i>t</i> test, NS
Sex, <i>n</i> (%)			Fisher's exact, .002
Men	11 (11)	90 (22)	
Women	89 (89)	318 (78)	
Diagnosis, <i>n</i> (%)			Chi-square, NS
Multinodular goiter	51 (51)	210 (51.5)	
Diffuse goiter	13 (13)	53 (13)	
Hashimoto's thyroiditis	11 (11)	47 (11.5)	
Grave's disease	3 (3)	10 (2.4)	
Papillary cancer	14 (14)	59 (14.5)	
Follicular cancer	2 (2)	7 (1.7)	
Follicular adenoma	6 (6)	22 (5.4)	
Surgeon's experience, <i>n</i> (%)			Chi-square, NS
High-volume group	65 (65)	273 (66.9)	
Low-volume group	35 (35)	135 (33.1)	
Operative technique, <i>n</i> (%)			Chi-square, NS
Classic (SL group)	20 (20)	87 (21.4)	
Ligasure (L group)	38 (38)	150 (36.7)	
Ultracision (U group)	42 (42)	171 (41.9)	
Thyroid gland weight, mean (SE), g	53.6 (3.3)	52.8 (2.0)	<i>t</i> test, NS
Operative time, mean (SE), min	80.1 (5.7)	80.9 (8.2)	<i>t</i> test, NS
Postoperative calcium, mean (SE), mg/dL	9.0 (0.3)	9.0 (0.2)	<i>t</i> test, NS
Transient hypocalcemia, <i>n</i> (%)	3 (3)	13 (3.1)	Chi-square, NS
Permanent hypocalcemia, <i>n</i> (%)	0 (0)	0 (0)	Chi-square, NS

Abbreviations: SE, standard error of the mean; NS, not significant.

glands was performed. When patients with incidentally removed intrathyroidal parathyroid glands were excluded, comparison between the parathyroidectomy and no-parathyroidectomy groups regarding patient sex revealed no statistically significant difference ( $p = .1$ ). Moreover, men constituted 10% of patients with intrathyroidal parathyroid glands and 21% of those with nonintrathyroidal location; however, this difference did not marginally reach statistical significance ( $p = .07$ ).

Furthermore, surgeon experience and operative technique had no impact on the incidence of inadvertent parathyroidectomy (Table 2). We also performed a subgroup analysis comparing the rate of inadvertent nonintrathyroidal parathyroidectomy for the 2 groups of experience. Excluding patients with incidental parathyroidectomy of intrathyroidal parathyroid glands, no difference could be established ( $p = .1$ ); thus, surgeon experience had no impact on unintentional parathyroidectomy rate, regardless of parathyroid glands location.

Additionally, unintentional parathyroidectomy did not cause any significant clinical consequences, since there was no difference between

the 2 groups regarding postoperative serum calcium levels and the incidence of transient hypocalcemia, while no permanent hypocalcemia was observed (Table 2).

## DISCUSSION

Total thyroidectomy is frequently performed by both general and head and neck surgeons. However, even the most experienced thyroid surgeon can occasionally be surprised by a pathology report, stating that an incidental parathyroid gland was found in the thyroidectomy specimen. We sought to identify the incidence of unintentional parathyroidectomy during total thyroidectomy and its potential clinical consequences and, furthermore, to evaluate factors affecting its occurrence. This is the only study evaluating such issues in solely total thyroidectomies; to our knowledge, all the other series in the literature include different thyroid surgical procedures, such as lobectomies and subtotal, near-total, and total thyroidectomies.<sup>4–10</sup>

Parathyroid glands are commonly extracapsular on the posterior surface of the thyroid gland, but they can also be found within the thyroid cap-



sule or within the parenchyma of the thyroid gland.<sup>4,5,7-9,11</sup> This was also seen in our study (Figure 1). During total thyroidectomy, preservation of the parathyroid glands can be achieved by careful dissection, directly on the thyroid capsule separating the parathyroid glands gently from the thyroid gland.<sup>10-12</sup> Even with this careful dissection, however, approximately 20% of the pathology reports in our study noted the presence of accidentally removed parathyroid gland in the thyroid specimen. Unintentional parathyroidectomy rates in the literature are similarly high, ranging from 9.1% to 21.6%.<sup>4-10,13</sup>

The expected concern of the surgeon is how this unintentional parathyroid gland removal occurred, why it was not recognized in the operating room so that the appropriate measures of reimplanting the parathyroid tissue could be performed, and, more important, how this incident could be prevented. Diligent examination of the thyroid capsule and the thyroid gland is essential. Extracapsular and intracapsular parathyroid glands could possibly be identified and preserved during the operative procedure with more careful examination of the thyroid capsule during and after thyroidectomy, thereby decreasing this incidence. In contrast, 49% of glands found in an intrathyroidal location (Figure 1) would be more difficult to preserve, even with more careful dissection or inspection. Interestingly, the number of specimens containing intrathyroidal parathyroid glands in our patients was higher than would be expected based on other published reports.<sup>4,7-9</sup> Similarly, Sasson et al<sup>5</sup> noticed that 50% of the unintentionally removed parathyroid glands were intrathyroidal.

Although incidental parathyroidectomy in thyroid surgery is considered to be a common complication even with experienced surgeons,<sup>4-10</sup> to the best of our knowledge, the potential impact of the surgeon's experience on its occurrence has not been evaluated to date. The results of our study showed that surgeon's experience had no significant impact on the rate of unintentional parathyroidectomy, regardless of parathyroid glands location.

Electrothermal bipolar vessel sealing system and harmonic scalpel are novel hemostatic devices that have been shown to be safe and effective for total thyroidectomy in terms of hemostasis, complications, and reduction of operative time in several studies from our team and others.<sup>14,15</sup> Since a blood-stained operative field makes it difficult to identify and preserve the parathyroid glands, we

postulated that utilization of bipolar vessel sealer or harmonic scalpel may result in a reduction of the incidence of unintentional parathyroidectomy during total thyroidectomy. Such an evaluation has not been attempted, until now, in the literature. Our results, however, showed that utilization of these devices had no impact on unintentional parathyroidectomy.

In contrast, patient sex was the only factor that significantly affected the occurrence of incidental parathyroidectomy. The percentage of men in the no-parathyroidectomy group was twice that in the parathyroidectomy group. This finding is in agreement with that reported by Sakorafas et al.<sup>8</sup> The protective role of men to unintentional parathyroidectomy may, at least in part, be explained by the finding that intrathyroidal parathyroid glands were less frequent in men. This difference did not marginally reach statistical significance, probably owing to the small number of patients with intrathyroidal parathyroid glands.

Thyroid gland weight and pathologic diagnosis had no significant impact on unintentional parathyroidectomy rate. In other studies, thyroid gland pathology, malignant or benign disease,<sup>5,7,8</sup> or thyroiditis<sup>8</sup> has also not been found to affect accidental parathyroidectomy. However, Gourgiotis et al<sup>9</sup> reported that thyroid malignancy may reduce its incidence. Other factors potentially associated with an increased risk of inadvertent parathyroidectomy in thyroid surgery are modified radical neck dissection,<sup>5</sup> reoperative thyroid surgery,<sup>7</sup> and tracheoesophageal lymph node dissection.<sup>7</sup>

In accordance with the literature,<sup>4,5,7-10</sup> unintentional parathyroidectomy did not cause any significant clinical consequences in our patients, since there was no difference between the 2 groups in postoperative serum calcium and transient or permanent hypocalcemia incidence. Furthermore, hypocalcemia was asymptomatic in all patients. The transient hypocalcemia rate in our study was 3%; in the literature, it ranges from 0.3% to 29%.<sup>1-3,5,8,9,13,16,17</sup> Moreover, similar to other studies,<sup>4,7,9</sup> no patients with unintentional parathyroidectomy developed permanent hypocalcemia. The absence of permanent hypocalcemia is not surprising, because several studies have shown that permanent hypocalcemia rate after thyroidectomy is very low, ranging from 0% to 4%.<sup>1-3,5,7-10,13,16,17</sup>

Unintentional parathyroidectomy incidence during total thyroidectomy is quite high. However, it has no significant clinical consequences.

Patient sex was the only factor significantly affecting its occurrence; surgeon's experience and operative technique had no impact on it. Diligent examination of the thyroid capsule and the thyroid gland during and after thyroidectomy is essential. A substantial share of the incidentally removed parathyroid glands was extracapsular and intracapsular; therefore, they may be identified and preserved with more meticulous inspection to decrease unintentional parathyroidectomy rate in the future.

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