Unintentional parathyroidectomy during thyroid surgery

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Objective
The aim of this study is to evaluate the potential causes of unintentional parathyroidectomy during thyroid surgery.
Patients and methods
A total of 157 patients who underwent total thyroidectomy for benign or malignant diseases between May 2016 and May 2018 in the Endocrine Surgery Unit of Ain Shams University Hospital and Helwan University Hospital. Patients with recurrent thyroid disease and parathyroid gland disease requiring parathyroidectomy were excluded.
Results
There were 18 parathyroid glands removed in 16 patients; seven were intracapsular and six were intrathyroidal parathyroid glands, with a mean size of 4.7 mm which is less than the mean size of the parathyroid gland. In spite of the high percentage of women in the unintentional parathyroidectomy group this was not statistically significant. Also, we found that the patients in the unintentional parathyroidectomy group were higher in BMI (32.25±3.62 kg/m^2) with a lower thyroid specimen weight average of 52.56±3.25 g. Total thyroidectomy with lateral neck dissection was found to be associated with high risk of unintentional parathyroid gland removal.
Conclusion
There are several factors that may affect unintentional parathyroidectomy such as the BMI, thyroid gland weight, site and size of the parathyroid gland and type of operations.

Keywords:
parathyroidectomy, thyroid surgery, unintentional

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Introduction

Total thyroidectomy in the 21st century has become safe and effective, with improved outcome and minimal morbidity [1].

Many centers discharge patients as early as the first postoperative day indicating that this procedure is safe especially in the hands of experienced surgeons [2].

Thyroidectomy is done for thyroid malignancy and several benign thyroid diseases [3]. The most common complication post-thyroidectomy is transient hypocalcemia which occurs either due to unintentional parathyroidectomy during the operation or at least disruption of its blood supply during dissection [4].

The rate of this complication differs greatly in the published literature ranging from 6 to 31% in primary thyroid surgery [5–8].

The four parathyroid glands have variable positions, appearance, and relation to the thyroid gland so they are at risk of unintentional resection or at least disruption of their blood supply [9].

Even with the most experienced thyroid surgeons and with taking into consideration the safe operative techniques for dissection of the gland, unintentional parathyroidectomy occurs and it is discovered in the postoperative pathology report [7].

Hypothesis

The aim of our study was to identify the factors associated with unintentional parathyroidectomy during total thyroidectomy.

Patients and methods

Patients

This study was conducted in the Endocrine Surgery Unit of Ain Shams University Hospital and Helwan University Hospital on 157 patients who underwent total thyroidectomy for benign or malignant diseases between May 2016 and May 2018. Patients with recurrent thyroid disease and parathyroid gland

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disease requiring parathyroidectomy were excluded. Written informed consent was signed by all patients.

Operative

Total thyroidectomies were performed by highly experienced surgeons who perform at least 50 thyroidectomies per year. Total thyroidectomies were performed by the classic suture ligation technique or with conventional electrothermal bipolar vessel sealing handle. In each surgery, we tried to preserve parathyroid glands as much as possible by following the capsular principle of dissection, but excessive dissection to identify all the parathyroid glands was avoided.

Following surgery postoperative calcium was assessed 12 and 24 h, postoperatively. Uncomplicated cases were discharged on the first day postoperatively.

Specimens were sent to our Pathology Department and were examined by experienced pathologists in thyroid and parathyroid cases. Pathology reports were reviewed to identify if there is unintentional removal of the parathyroid gland. Patients were divided into two groups: group A: no parathyroid gland removed, group B: unintentional removal of one or more parathyroid glands occurred. The number, size, and location: extracapsular, intracapsular (just deep to the capsule), or intrathyroidal (deep in the thyroid tissue) of the removed parathyroid was recorded. Also, patient's age, sex, BMI, operative time, thyroid specimen weight, operation, and pathologic diagnosis were compared between the two groups to assess them as factors potentially affecting the occurrence of unintentional parathyroidectomy during total thyroidectomy.

Statistical analysis

Continuous variables are expressed as mean and SD. Categorical variables are expressed as frequencies and percentage. Student's *t*-test was used to assess the statistical significance of the difference between two study group means. χ^2-test was used to examine the relationship between categorical variables. A significance level of P less than 0.05 was used in all tests. All statistical procedures were carried out using SPSS, version 20 for Windows (SPSS Inc., Chicago, Illinois, USA).

Results

Among the 157 patients who underwent total thyroidectomy there were 115 women and 42 men, with a mean age of 45.03±10.96 with a range of 21–65 years; the mean BMI was 29.38±4.20 kg/m^2 ranging from 21 to 38 kg/m^2. The overall operative time which was calculated from skin to skin, ranged from 70 to 98 min with a mean of 85.36±7.91 min. The mean weight of the total thyroidectomy specimens was 54.95±4.14 g with a range of 49–62 g. Out of the 157 patients, 123 patients underwent total thyroidectomy, whereas 22 others underwent total thyroidectomy with central neck dissection and only 12 patients underwent total thyroidectomy with lateral neck dissection.

After reviewing the pathology reports, the preoperative clinical and laboratory data of the patients, the final diagnosis of the cases were 68 cases of multinodular goiter, 22 cases of toxic nodular goiter, 16 cases of Graves' disease, 39 cases of papillary carcinoma, and 12 cases of follicular carcinoma. Pathology reports also confirmed that there were 16 (10.19%) cases with unintentional parathyroid gland removal. It was only one parathyroid gland in 14 cases and two parathyroid glands in two cases (Tables 1 and 2).

Table 1 Clinical and demographic characteristics of the total group

Variables	Total group [*n* (%)]
Age (mean±SD) (years)	45.03±10.96
Sex	
Men	42 (26.8)
Female	115 (73.2)
BMI (mean±SD) (kg/m^2)	29.38±4.20
Operative time (mean±SD) (min)	85.36±7.91
Specimen weight (mean±SD) (g)	54.95±4.14
Operation	
Total thyroidectomy	123 (78)
Total thyroidectomy+central neck dissection	22 (14)
Total thyroidectomy+unilateral neck dissection	12 (8)
Diagnosis	
Multinodular goiter	68 (43)
Toxic nodular goiter	22 (14)
Grave's disease	16 (10)
Papillary carcinoma	39 (25)
Follicular carcinoma	12 (8)

Table 2 Data of removed parathyroid glands

Variables	Total group [*n* (%)]
Mean size of the removed glandSite of removed parathyroid glands	4.7±0.57
Extracapsular	5 (27.78)
Intracapsular	7 (38.89)
Intrathyroidal	6 (33.33)

Overall, 18 parathyroid glands were unintentionally removed during our study in 16 patients; the mean size of the removed parathyroid glands was 4.7±0.57 mm. As regards the site, pathology reports confirmed that five of them were extracapsular. These five parathyroid glands were in cases of papillary carcinoma with unilateral neck dissection, seven of them were intracapsular, and six were intrathyroidal.

By comparing patients of the two groups we found that there is no significant difference between them as regards the age (P=0.608). Also, we found that the percentage of women was higher in group B (87.5%) in comparison to group A (12.5%), but this was not statistically significant (P=0.174). Also, there was no significant difference in the operative time between two groups: 85.13±8.02 and 87.44±6.83 min in groups A and B, respectively (P=0.224).

The factors that may predict unintentional removal of the parathyroid gland during total thyroidectomy are the BMI, specimen weight, and the type of operation.

As regards the BMI, it was found that patients of group B were higher in the mean BMI (32.25±3.62 kg/m^2) than those of group A (29.06±4.15 kg/m^2) and this difference was highly significant (P=0.004). The mean specimen weight was found to be less in group B (52.56 ±3.25 g) than in group A (55.23±4.16 g) and this was also found significant (P=0.007).

When comparing both groups as regards the operation, it was seen that there was a significant increase in the percentage of 'total thyroidectomy with lateral neck dissection' patients from 4.9 to 25% (P=0.012), which means an increase in the likelihood of unintentional parathyroidectomy with lateral neck dissection.

As regards the diagnosis, there was a decrease in the percentage of multinodular goiter within group A in comparison to group B from 46.1 to 18.8%; this means that unintentional parathyroidectomy is less likely to occur with cases of multinodular goiter, the opposite is seen in cases of toxic nodular goiter and papillary carcinoma where the percentage increased within group B in comparison to group A from 12.8 to 25% in toxic nodular goiter and from 23.4 to 37.5% in cases of papillary carcinoma. This increase was also observed in cases of Grave's disease but the increase was less than 3%; there was almost no change in the follicular carcinoma percentage (Table 3).

Discussion

Unintentional removal of the parathyroid gland during thyroidectomy is a known complication even with experienced surgeons [4]. The difference between published literatures about the percentage of this complication ranged from 6.4% in the study by Sipple *et al.* [8] to 31% in the study by Ondik *et al.* [9]. In our study, it was about 10.19% which is consistent with the results of Lee and colleagues and Lin and colleagues. This high difference is most probably because of the different designs of the study; some of these studies addressed certain operation as solely total thyroidectomy [7], others studied recurrent thyroid surgeries [9]. A large cohort study assessing more than 1300 patients who underwent total thyroidectomy reported than the rate was about 11.3 which is consistent with our results [10].

The mean size of the excised parathyroid tissue in this study was 4.7±0.57 mm; this was consistent with the results of Sasson *et al.* [6], Lee *et al.* [11], and Du *et al.* [12], but this is less than the average diameter of the normal parathyroid gland, which was described by previous authors to be about 6 mm [5]. This means that the smaller gland is more susceptible to be accidently removed or that not all of the gland was resected during accidental parathyroidectomy.

The literature reported different rates for the site of unintentionally removed parathyroid gland but most of them described that the removal of the parathyroid gland outside the thyroid tissue is not common ranging from 5% in Lee *et al.* [11] to 32% in Manouras *et al.* [7] In our study it was 27.78% which is within the range of the reported rates. Mansoura *et al.* [7] also reported that his rate of intrathyroidal location was 49% which are more difficult to be preserved in comparison to the extracapsular and intracapsular which are more easily to be preserved. In our study, we found that 33.33% of the resected parathyroid glands were intrathyroidal which was also consistent with his result.

Christakis and colleagues in his large cohort study reported that the male sex is an independent risk factor for unintentional parathyroidectomy which was against what was reported by Manouras *et al.* [7] and by Sakorafas *et al.* [13], who reported a protective role of men to unintentional parathyroidectomy and attributed this to the smaller number of male patients with intrathyroidal parathyroid glands. In our study there were more women in the unintentional parathyroidectomy

Table 3 Comparison between the two groups

Variables	Group A	Group B	*P*-value
Age (years)	45.17±11.06	43.75±10.25	0.608
Sex [*n* (%)]			
Men	40 (28.4)	2 (12.5)	0.174
Female	101 (71.6)	14 (87.5)	
BMI (kg/m^2)	29.06±4.15	32.25±3.62	0.004
Operative time (min)	85.13±8.02	87.44±6.83	0.224
Specimen weight (g)	55.23±4.16	52.56±3.25	0.007
Operation			
Total thyroidectomy	114	10	0.012
% of diagnosis	91.9	8.1	
% within group	80.9	62.5	
Total thyroidectomy+central neck dissection	20	2	
% of diagnosis	90.9	9.1	
% within group	14.2	12.5	
Total thyroidectomy+lateral neck dissection	7	4	
% of diagnosis	63.6	36.4	
% within group	4.9	25	
Diagnosis			
Multinodular goiter	65	3	0.257
% of diagnosis	95.6	4.4	
% within group	46.1	18.8	
Toxic nodular goiter	18	4	
% of diagnosis	81.8	18.2	
% within group	12.8	25	
Grave's disease	14	2	
% of diagnosis	87.5	12.5	
% within group	9.9	12.5	
Papillary carcinoma	33	6	
% of diagnosis	84.6	15.4	
% within group	23.4	37.5	
Follicular carcinoma	11	1	
% of diagnosis	91.7	8.3	
% within group	7.8	6.3	

group which was consistent with Manouras and colleagues but this was not statically significant.

The mean size of the removed thyroid gland was 52.56 ±3.25 g in the unintentional parathyroidectomy group which is less than the other group (55.23±4.16 g) and this was statically significantly; this may be attributed of the difficult handling of the small gland rendering it more difficult and increase that rate if there is incidence of unintentional parathyroidectomy. Christakis and colleagues found in his study, in the univariate analysis, and not in the multivariate analysis, a correlation between smaller weight of the thyroid gland and unintentional parathyroidectomy and this was opposite to what have been reported by Rajinikanth *et al.* [14] and Zhou *et al.* [15]. Sippel and colleagues found no correlation between the size of the gland and unintentional parathyroidectomy.

Another factor which was significant in our study is the BMI, we found that patients with a higher BMI were more susceptible to unintentional parathyroidectomy that can be attributed to increased fat around the parathyroid gland masking it and rising the possibility of accidently removing it. In the published literature that was reviewed no one studied the effect of BMI or patients' weight on the unintentional parathyroidectomy.

Also, we found that total thyroidectomy with lateral neck dissection was associated with more unintentional parathyroidectomy; this could be due to the recognition of the parathyroid gland as one of the lymph nodes and not the gland. Du and colleagues also reported that lateral cervical lymph node dissection would significantly increase the risk of unintentional parathyroidectomy.

No statically significant relation was found between the final diagnosis and the unintentional parathyroidectomy. This is consistent with what was reported by Masouras and colleagues [6,7,13]. However, Gourgiotis and

colleagues [16] reported that malignancy has a protective factor.

Conclusion

There are several factors that may affect unintentional parathyroidectomy such as the BMI, thyroid gland weight, site and size of parathyroid gland, and type of operations. Other factors may be associated with unintentional parathyroidectomy but more studies are needed to confirm or deny this, the diagnosis, and the gender of the patients.

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Conflicts of interest

There are no conflicts of interest.

References

1 Koyuncu A, Dökmetas HS, Turan M, Aydin C, Karadayi K, Sen M. Comparison of different thyroidectomy techniques for benign thyroid disease. Endocr J 2003; 50:723–727.

2 Prim MP, de Diego JI, Hardisson D, Madero R, Gavilan J. Factors related to nerve injury and hypocalcemia in thyroid gland surgery. Otolaryngol Head Neck Surg 2001; 124:111–114.

3 Friguglietti CU, Lin CS, Kulcsar MA. Total thyroidectomy for benign thyroid disease. Laryngoscope 2003; 113:1820–1826.

4 Bergamaschi R, Becouarn G, Ronceray J, Arnaud JP. Morbidity of thyroid surgery. Am J Surg 1998; 176:71–75.

5 Shaha AR, Jaffe BM. Parathyroid preservation during thyroid surgery. Am J Otolaryngol 1998; 19:113–117.

6 Sasson AR, Pingpank JF Jr, Wetherington W, Hanlon AL, Ridge JA. Incidental parathyroidectomy during thyroid surgery does not cause transient symptomatic hypocalcemia. Arch Otolaryngol Head Neck Surg 2001; 127:304–308.

7 Manouras A, Markogiannakis H, Lagoudianakis E, Antonakis P, Genetzakis M, Papadima A, *et al.* Unintentional parathyroidectomy during total thyroidectomy. Head Neck 2008; 30:497–502.

8 Sippel RS, Ozgül O, Hartig GK, Mack EA, Chen H. Risks and consequences of incidental parathyroidectomy during thyroid resection. ANZ J Surg 2007; 77:33–36.

9 Ondik MP, McGinn J, Ruggiero F, Goldenberg D. Unintentional parathyroidectomy and hypoparathyroidism in secondary central compartment surgery for thyroid cancer. Head Neck 2010; 32:462–466.

10 Christakis I, Zacharopoulou P, Galanopoulos G, Kafetzis ID, Dimas S, Roukounakis N. Inadvertent parathyroidectomy risk factors in1373 thyroidectomies-male gender and presence of lymphadenopathy, but not size of gland, independently increase the risk. Gland Surg 2017; 6:666–674.

11 Lee NJ, Blakey JD, Bhuta S, Calcaterra TC. Unintentional parathyroidectomy during thyroidectomy. Laryngoscope 1999; 109: 1238–1240.

12 Du W, Fang Q, Zhang X, Cui M, Zhao M, Lou W. Unintentional parathyroidectomy during total thyroidectomy surgery: a single surgeon's experience. Medicine (Baltimore) 2017; 96:e6411.

13 Sakorafas GH, Stafyla V, Bramis C, Kotsifopoulos N, Kolettis T, Kassaras G. Incidental parathyroidectomy during thyroid surgery: an underappreciated complication of thyroidectomy. World J Surg 2005; 29: 1539–1543.

14 Rajinikanth J, Paul MJ, Abraham DT, Nair A. Surgical audit of inadvertent parathyroidectomy during total thyroidectomy: incidence, risk factors, and outcome. Medscape J Med 2009; 11:29.

15 Zhou HY, He JC, McHenry CR. Inadvertent parathyroidectomy: incidence, risk factors, and outcomes. J Surg Res 2016; 205:70–75.

16 Gourgiotis S, Moustafellos P, Dimopoulos N, *et al.* Inadvertent parathyroidectomy during thyroid surgery: the incidence of a complication of thyroidectomy. Langenbecks Arch Surg 2006; 391:557–560.