



ORIGINAL ARTICLE

Frequency and outcomes of parathyroid preservation in total thyroidectomy.

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ABSTRACT... Objective: To determine the frequency and its outcome of parathyroid preservation in total thyroidectomy. **Study Design:** Case Series study. **Setting:** Department of Otorhinolaryngology, HMC, MTI, Peshawar. **Period:** 23rd June 2022 to 23rd Dec 2022. **Methods:** A total of 246 patients who underwent thyroidectomy were included in the study and followed up to determine the preservation of parathyroid gland, hypocalcaemia and recurrent laryngeal nerve injury. **Results:** The mean age of the sample was 37.7 + 12.3 years. There were 52.8% male patients and 47.2% female patients. 28.9% of patients had thyroid nodule and subtotal thyroidectomy was the most performed procedure Parathyroid gland preservation was recorded in 72%. On follow up, hypocalcemia was recorded in 16.3% and recurrent laryngeal nerve injury in 20.3%. **Conclusion:** Hypocalcemia and RLNI are significantly common after thyroidectomy. Hypocalcemia was significantly high in patients with low non preserved parathyroid gland. More research on high sample size and addressing other effect modifiers are recommended with intervention to preserve parathyroid gland.

Key words: Parathyroid Gland, Recurrent Laryngeal Nerve Injury, Serum Calcium, Thyroidectomy.

INTRODUCTION

Over the past few decades, advancements in thyroid surgery have led to significant improvements in safety and a reduction in complication rates. Certain cases can now be managed as 'day surgery.' The most common postoperative complication is hypocalcaemia, which occurs in 16-55% of patients, depending on the lowest total serum calcium level recorded.^{1,2} This condition is characterized by a serum calcium level falling below 8 mg/dL (or <2 mmol/L) within 24 hours post-surgery, necessitating calcium and vitamin D supplementation before hospital discharge.³ Factors contributing to postoperative hypocalcaemia include surgical stress, calcitonin release during the procedure, vitamin D deficiency, or hemodilution, as well as potential intraoperative damage to the parathyroid glands, which may result from mechanical or thermal injury, loss of blood supply, or accidental removal of parathyroid tissue.^{4,5,6} Typically, hypocalcaemia is transient and subclinical. Prolonged hyperparathyroidism is indicated by abnormal

parathyroid hormone (PTH) levels (below 13 pg/mL) and/or the requirement for calcium and vitamin D supplementation 4-6 weeks following surgery. In contrast, clinically permanent hyperparathyroidism, although rare, is a serious complication characterized by persistently low PTH levels and ongoing need for supplementation one year after total thyroidectomy.³ This condition can significantly impact quality of life and may lead to severe complications, including infections and neurocognitive issues.⁷ Additionally, incidental or unintentional parathyroidectomy is a complication of thyroid surgery that has not been thoroughly investigated, leaving its consequences largely unexplored.^{6,7}

The presence of parathyroid glands (PGs) removed incidentally during thyroid surgery does not always lead to biochemical or clinical hypocalcemia, although some studies have reported a risk of hypocalcemia when one or more PGs are incidentally removed during thyroidectomy.^{2,3,8}

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Early thyroid surgery was associated with high morbidity and mortality rates. Over 40% of patients undergoing thyroidectomy experienced fatal outcomes, and morbidity rates were also exceedingly high.⁹

Symptomatic hypocalcemia is a distressing complication that has been documented in 1% to 30% of patients who undergo total thyroidectomy. The preservation of the parathyroid glands during total thyroidectomy was approximately 70-80%.¹⁰

The rationale of the current study is to the frequency of parathyroid preservation in total thyroidectomy and its outcomes. Regardless of surgeon experience, an incidental parathyroid gland features occasionally in the pathology reports of thyroid specimens. The aims of present study are to find out the incidence of the incidental parathyroid excision (IPE) during thyroidectomy and its effects on the postoperative calcium levels and also to evaluate the factors underlying its occurrence.

OBJECTIVE

To determine the frequency and its outcome of parathyroid preservation in total thyroidectomy.

METHODS

A case series study was conducted in the otorhinolaryngology department at HMC, MTI Peshawar, as a descriptive case series from June 23, 2022, to December 23, 2022, after approval and acceptance of the study from the College of Physician and Surgeon (CPSP) Reference No: 50926). With a 5% margin of error and a 95% confidence level, a total sample size of 246 was determined. It was projected that 80% of patients receiving complete thyroidectomy kept their parathyroid. The method used was consecutive (non-probability) sampling. Patients with goiter who underwent any kind of thyroid surgery and those who were 60 years of age or older were the inclusion criteria; patients with a history of neck surgery or preoperative hoarseness of voice were the exclusion criteria.

Detailed histories were taken and recorded on a proforma, followed by physical examinations

and necessary investigations mostly conducted on an outpatient basis. Patients needing surgery were admitted, and surgeries were performed by a single team under a consultant surgeon with at least 5 years of experience. Data on demographics and clinical details were recorded.

Inclusion Criteria

- Patient aged of 18 -60 years or above
- All patients with goiter, who underwent any sort of thyroid surgery (i.e. lobectomy, isthmusectomy, subtotal thyroidectomy, near total thyroidectomy or total thyroidectomy)

Exclusion Criteria

- Patient with previous history of neck surgery
- Patient with preoperative hoarseness of voice

The data was entered into SPSS version 15, with frequencies and percentages computed for categorical variables such as gender, hypocalcemia, and recurrent laryngeal nerve injury, and numerical variables like age presented with mean \pm SD. Common complications were stratified by age, gender, disease, and type of procedure to observe effect modifiers. Results were presented in tables and graphs, with P-values calculated using the chi-square test.

RESULTS

The study included 246 patients, the average age of whom was 37.7 + 12.3 years. According to the age distribution, there were 81 (32.9%) patients between the ages of 19 and 30, 49 (19.9%) between the ages of 30 and 40, 66 (26.8%) between the ages of 40 and 50, and 50 (20.3%) between the ages of 50 and 60. There were 116 (47.2%) females and 130 (52.8%) males in terms of gender. In terms of the reason for surgery, 145 patients (58.9%) had goiter, 30 patients (12.2%) had thyroid cancer, and 71 patients (28.9%) had thyroid nodules. A total thyroidectomy was performed on 30 patients (12.2%), a subtotal thyroidectomy was conducted on 150 patients (61.0%), and a lobectomy was performed on 66 patients (26.8%). Out of the total patients, 177 (72.0%) had parathyroid preservation, whereas 69 (28.0%) did not have it. Hypocalcemia was observed in 40 (16.3%) patients, and 50 (20.3%)

patients experienced recurrent laryngeal nerve injury (RLNI). (summarized in Table-I)

With 55 (67.9%) in the 19-30 age group, 39 (79.6%) in the 30-40 age group, 39 (59.1%) in the 40-50 age group, and 44 (88.0%) in the 50-60 age group, parathyroid preservation was greater in the younger age groups. The preservation rate was greater in male patients (n = 99; 76.2%) than in female patients (n = 78; 67.2%). Goiter patients had the greatest preservation rate (79.3%) when it came to the indication for surgery, followed by thyroid nodules (56.3%) and thyroid cancer (73.3%) at 22 and 40, respectively. Preservation rates were as follows: for lobectomy, 50 (74.8%), for partial thyroidectomy, 105 (70.0%), and for complete thyroidectomy, 22 (73.3%). (summarized in Table-II)

With 18 (22.2%) in the 19-30 age group, 6 (12.2%) in the 30-40 age group, 12 (18.2%) in the 40-50 age group, and 4 (8.0%) in the 50-60 age group, hypocalcemia was more common in younger patients. In terms of gender, the incidence was greater in men at 24 (18.5%) than in females at 16 (13.8%). In cases of thyroid nodules, the rationale for surgery was a greater prevalence of hypocalcemia (18.4%), followed by thyroid cancer (20.0%) and goiter (11.0%). Twelve patients (18.2%) who had lobectomies, twenty-two (14.7%) who had subtotal thyroidectomies, and six (20.0%) who had complete thyroidectomies had hypocalcemia. Hypocalcemia rates were substantially lower in the preserved group (p < 0.001) compared to the non-preserved group (34, 49.3%) with only 6 (3.4%) in the preserved group. (summarized in Table-III)

The age group of 40-50 years had the highest prevalence of RLNI (17-25.8%), followed by 19-30 years (19-23.5%), > 30-40 years (7-14.3%), and > 50-60 years (7-14.0%). At age 29, the incidence was greater in males (22.3%) than in females (18.1%). Patients with goiter accounted for 32 (22.1%) of the cases of RLNI, followed by those with thyroid nodules (15 (21.1%) and thyroid carcinoma (3 (10.0%). For lobectomy, the RLNI rates were 16 (24.2%), for partial thyroidectomy, 31 (20.7%), and for total thyroidectomy, 3

(10.0%). According to the level of parathyroid preservation, 12 (17.4%) of the patients in the non-preserved group and 38 (21.5%) of those with preserved parathyroids suffered RLNI (p = 0.475). (summarized in Table-IV)

Category	Subcategory	Frequency (%)
Age Group	19-30 years	81 (32.9)
	> 30-40 years	49 (19.9)
	> 40-50 years	66 (26.8)
	> 50-60 years	50 (20.3)
	Total	246 (100.0)
Gender	Male	130 (52.8)
	Female	116 (47.2)
	Total	246 (100.0)
Indication of Surgery	Thyroid Nodule	71 (28.9)
	Goiter	145 (58.9)
	Thyroid Cancer	30 (12.2)
	Total	246 (100.0)
Type of Procedure	Lobectomy	66 (26.8)
	Subtotal Thyroidectomy	150 (61.0)
	Total Thyroidectomy	30 (12.2)
	Total	246 (100.0)
Parathyroid Preservation	Yes	177 (72.0)
	No	69 (28.0)
	Total	246 (100.0)
Hypocalcemia	Yes	40 (16.3)
	No	206 (83.7)
	Total	246 (100.0)
Recurrent Laryngeal Nerve Injury	Yes	50 (20.3)
	No	196 (79.7)
	Total	246 (100.0)

Table-I. Clinicodemographic of patients

Category	Yes (n=177)	No (n=69)	P-Value
Age Group			0.002
19-30 years	55 (67.1%)	26 (32.9%)	
> 30-40 years	39 (79.6%)	10 (20.4%)	
> 40-50 years	39 (59.1%)	27 (40.9%)	
> 50-60 years	44 (88.0%)	6 (12.0%)	
Gender			0.120
Male	99 (76.2%)	31 (23.8%)	
Female	78 (67.2%)	38 (32.8%)	
Indication of Surgery			0.002
Thyroid Nodule	40 (56.3%)	31 (43.7%)	
Goiter	115 (79.3%)	30 (20.7%)	
Thyroid Cancer	22 (73.3%)	8 (26.7%)	
Type of Procedure			0.675
Lobectomy	50 (75.8%)	16 (24.2%)	
Subtotal Thyroidectomy	105 (70.0%)	45 (30.0%)	
Total Thyroidectomy	22 (73.3%)	8 (26.7%)	

Table-II. Comparison of parathyroid preservation with clinicodemographic variables

Category	Hypocalcemia		P-Value
	Yes n(%)	No n(%)	
Age			0.146
19-30 years	18 (22.2%)	63 (77.8%)	
> 30-40 years	6 (12.2%)	43 (87.8%)	
> 40-50 years	12 (18.2%)	54 (81.8%)	
> 50-60 years	4 (8.0%)	46 (92.0%)	
Total	40 (16.3%)	206 (83.7%)	
Gender			0.322
Male	24 (18.5%)	106 (81.5%)	
Female	16 (13.8%)	100 (86.2%)	
Total	40 (16.3%)	206 (83.7%)	
Indication of Surgery			0.023
Thyroid Nodule	18 (25.4%)	53 (74.6%)	
Goitre	16 (11.0%)	129 (89.0%)	
Thyroid Cancer	6 (20.0%)	24 (80.0%)	
Total	40 (16.3%)	206 (83.7%)	
Type of Surgery			0.682
Lobectomy	12 (18.2%)	54 (81.8%)	
Subtotal Thyroidectomy	22 (14.7%)	128 (85.3%)	
Total Thyroidectomy	6 (20.0%)	24 (80.0%)	
Total	40 (16.3%)	206 (83.7%)	
Parathyroid Preservation			< 0.001
Yes	6 (3.4%)	171 (96.6%)	
No	34 (49.3%)	35 (50.7%)	
Total	40 (16.3%)	206 (83.7%)	

Table-III. Comparison of hypocalcemia with clinicodemographic variables

Category	RLN Injury		P-Value
	Yes n(%)	No n(%)	
Age			0.258
19-30 years	19 (23.5%)	62 (76.5%)	
> 30-40 years	7 (14.3%)	42 (85.7%)	
> 40-50 years	17 (25.8%)	49 (74.2%)	
> 50-60 years	7 (14.0%)	43 (86.0%)	
Total	50 (20.3%)	196 (79.7%)	
Gender			0.413
Male	29 (22.3%)	101 (77.7%)	
Female	21 (18.1%)	95 (81.9%)	
Total	50 (20.3%)	196 (79.7%)	
Indication of Surgery			0.321
Thyroid Nodule	15 (21.1%)	56 (78.9%)	
Goiter	32 (22.1%)	113 (77.9%)	
Thyroid Cancer	3 (10.0%)	27 (90.0%)	
Total	50 (20.3%)	196 (79.7%)	
Type of Surgery			0.271
Lobectomy	16 (24.2%)	50 (75.8%)	
Subtotal Thyroidectomy	31 (20.7%)	119 (79.3%)	
Total Thyroidectomy	3 (10.0%)	27 (90.0%)	
Total	50 (20.3%)	196 (79.7%)	
Parathyroid Preservation			0.475
Yes	38 (21.5%)	139 (78.5%)	
No	12 (17.4%)	57 (82.6%)	
Total	50 (20.3%)	196 (79.7%)	

Table-IV. Comparison of RLNI with clinicodemographic variables

DISCUSSION

Thyroidectomy is still a safe treatment, however post-thyroidectomy hypocalcaemia is a common consequence. Although it is often temporary, in certain situations the absence of a functional parathyroid gland might make it permanent. Patients who are impacted by this may have severe pain and may require long-term oral calcium and vitamin D supplementation.¹¹ Hypocalcemia may result from a number of conditions, including damage to the parathyroid glands or their blood supply, severe resection, thyroidectomy with neck dissection, Graves' disease, malignancy, and hemodilution.¹²⁻¹⁷ Of these, damage to the parathyroid gland is the most frequent cause of hypocalcemia. During the procedure, an effort should be made to locate every parathyroid gland and maintain its blood flow in order to reduce parathyroid damage. However, because there is

a good chance that damaging their blood supply during the search and dissection procedure, it is challenging to locate all parathyroid glands and to maintain those that have been found. The degree of thyroidectomy and node dissection also raises the risk of harming the parathyroid glands' blood supply.^{12,13} According to several accounts, when parathyroid glands are discovered to have been inadvertently removed or devascularized during surgery, parathyroid autotransplantation can lower the risk of hypocalcemia.^{18,19} When parathyroid glands are inadvertently removed during surgery together with the thyroid or lymph node, they might occasionally be discovered in the postoperative specimen.²⁰ Finding out how many parathyroid glands should be left in place to avoid hypocalcemia after surgery is an interesting question.

The growing use of ultrasonographic screening technologies has led to a rise in the incidence of thyroid surgery in recent years. Due to advancements in technology and increased understanding of thyroid anatomy, thyroidectomies have become safer procedures (21); that being said, even among highly skilled surgeons, problems may arise after the procedure. Thyroid surgery is associated with well-known consequences, including hemorrhage, parathyroid insufficiency, and damage to the recurrent laryngeal nerve.²²⁻²⁴ Even with careful dissection, it can be challenging to identify the normal parathyroid glands and preserve their blood supply, which makes parathyroid insufficiency a bit problematic when it comes to parathyroid gland preservation during total thyroidectomy. In this article, the incidence of hypocalcemia was 16.3%. This prevalence is consistent with earlier reports of thyroidectomy patients.^{25,26} After receiving oral calcium and vitamin D supplements to stabilize their calcium levels, the individuals with transitory hypocalcemia saw a progressive return to normalcy in their blood calcium levels within a month. Graves' illness, severe lymph node dissection, parathyroid damage, and parathyroid devascularization are the most well-known risk factors of postoperative hypocalcemia.^{27,28} It was established that postoperative hypocalcemia

was more common in individuals with Graves' disease.¹⁷

In this study, failure to preserve parathyroid glands and extensive central node dissection were risk factors for developing postoperative hypocalcemia. Thompson et al. have identified extensive central node dissection as a risk factor for hypocalcemia.¹¹ The inferior parathyroid glands and their blood supply might be more vulnerable to damage as a result of the dissection.

There are several reasons why efforts to keep the parathyroid glands intact might not succeed. If parathyroid glands are situated inside or ahead of the thyroid gland, they could not be properly maintained. It is also possible for parathyroid glands that were purposefully removed and then transplanted into muscle to not survive. The parathyroid gland is typically not conserved when it is directly impacted, resulting in gland discolouration. Inadvertent damage to the parathyroid glands' blood supply results in the glands' implantation or excision. In order to prevent hypoparathyroidism, Thomusch et al.¹⁴ stressed the need of identifying and preserving at least two parathyroid glands. They also discovered that having more than two parathyroid glands identified and conserved did not appear to provide any further benefits. Seventy-two percent of the parathyroid gland was preserved. It is important for the surgeon to try to locate as many parathyroid glands as feasible. According to Attie and Khafif²¹ and Wingert et al.¹⁷, the presence of two or more functioning parathyroid glands is required to prevent hypocalcemia, and the removal of two or more parathyroid glands raises the risk of hypocalcemia.

Similar to what we found in our investigation, Kihara et al.²⁹ analyzed 83 individuals in whom parathyroid preservation was attempted; of them, 1.7 parathyroid glands were successfully saved. In their investigation, the incidence of chronic hypoparathyroidism was 1.2%. In several of their patients with one or two preserved parathyroid glands on POD 1, they reported that the serum iPTH levels had dropped to below the normal range and the serum calcium had dropped

to low normal levels. Thirty days following the procedure, recovery towards preoperative values was nearly complete in the group whose iPTH levels were below normal. However, parathyroid function only returned to 70% of preoperative levels in the group whose iPTH levels dropped below the detectable limit.²⁹

In our investigation, transitory hypocalcemia was seen, and there were no differences in the levels between the two groups. The blood calcium, ionized calcium, and iPTH levels were lowered after one day of the operation and restored to a comparable range within seven days, as reported in previous studies.³⁰ Serum iPTH levels were lowered in a few individuals with one preserved parathyroid gland, but not to the point where it could be detected; these patients were able to fully recover to the normal range.

CONCLUSION

Hypocalcemia and RLNI are significantly common after thyroidectomy. Hypocalcemia was significantly high in patients with low non preserved parathyroid gland. More research on high sample size and addressing other effect modifiers are recommended with intervention to preserve parathyroid gland.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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




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3	Rahmatullah Khan	Data collection, Proof reading, Critical analysis.	
4	Adnan Ghani	Data collection, Proof reading, Critical analysis.	
5	Muhammad Idrees	Manuscript writing, Data analysis, Data collection, Final drafting.	
6	Waseem Ahmad Jadoon	Data collection, Proof reading, Critical analysis, Final drafting.	