



Research Article

Prevalence of Incidental Parathyroidectomy among Thyroid Surgery in a Tertiary Level Hospital

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Abstract

Introduction: Thyroid surgery is a commonly performed procedure for thyroid problems. Inadvertent removal of the parathyroid glands is one of its recognized complications, which occurs more frequently in certain high-risk patients.

Objective: The aim of this study was to identify the prevalence and clinical relevance of incidental parathyroidectomy during thyroid surgery.

Methodology: Pathology reports were reviewed to identify the specimens that included parathyroid tissue and underlying thyroid pathology. Association between pathological conditions of thyroid gland and nature of thyroid surgery with incidental parathyroidectomy was assessed.

Results: During the study period, 53 thyroidectomies were performed and 5 (9.43%) patients had incidentally removed parathyroid glands. Risk factors for inadvertent parathyroid resection included total thyroidectomy ($P=0.00371$), malignant conditions of thyroid gland ($p=0.0028$). Postoperative hypocalcemia occurred in 16 patients who underwent total thyroidectomy.

Conclusion: The prevalence of incidental removal of parathyroid tissue during thyroidectomy was 9.43%. Total thyroidectomy with neck dissection and malignancy of thyroid gland were found to be the risk factors. Hypocalcemia was significantly higher among patients who had inadvertent parathyroidectomy. Incidental parathyroidectomy was not associated with variables like age and sex.

Keywords: Incidental parathyroidectomy; Malignancy; Neck dissection; Thyroid surgery

Introduction

The standard procedure for the establishment of thyroid related ailments is thyroidectomy. One of its recognized complications is unintended removal of the parathyroid glands, which happens much frequently in certain high risk patients. The risk factors that were discovered to be total thyroidectomy in thyroid diseases particularly tumors and toxic conditions with significant adhesions. [1] The thyroid gland is situated in the

lower anterior neck straddling the upper trachea. It is the largest endocrine organ in the body. It weighs 15-20 g in adulthood. [2,3] It is an extremely vascular, reddish-brown, bi-lobed structure with each lobe joined together by a narrowed isthmus. Each lobe is pear-shaped, measuring approximately 5 cm in length, 3 cm in breadth and 1.5 cm in depth. The apex of each lobe is narrow and extends beneath the sternothyroid muscle up to its insertion on the oblique line of the thyrocartilage. The more rounded lower pole extends down to the level of the fourth or fifth tracheal ring. It lies lateral to the oesophagus and trachea and medial to the carotid sheath. The isthmus overlies the second to fourth tracheal rings [4].

The thyroid gland, together with the oesophagus and trachea, is invested in a visceral layer of deep fascia known as the pretracheal fascia. [5] It is attached superiorly to the hyoid bone and extends inferiorly into the mediastinum, fusing with the fascia surrounding the aorta, pericardium and parietal pleura at the level of the carina. Laterally the fascia blends with the carotid sheath. Anteriorly the fascia forms a distinct layer separating the thyroid from the strap muscles and posteriorly it merges with the prevertebral fascia. On the posterior aspect of the isthmus the fascia is sometimes known as the anterior tracheal ligament and is perforated by small tracheal vessels, but at the upper part on each side it is much thicker and binds the gland firmly to the sides of the cricoid cartilage and first tracheal ring. This condensation the 'suspensory ligament of Berry'. Its fixation to the trachea causes the thyroid gland to move up and down on swallowing. During thyroid surgery it must be divided with care and by sharp dissection as the recurrent laryngeal nerve may lie lateral, medial or within the ligament just before it enters the larynx. [4] The main aim of the study is to assess the prevalence of incidental parathyroidectomy among patients undergoing thyroid surgery, to identify the association of incidental parathyroidectomy with nature of thyroid surgery and to identify the association between incidental parathyroidectomy with pathological features of thyroid gland.

Method

Descriptive cross sectional study was used to assess the prevalence of incidental parathyroidectomy among patients undergoing thyroid surgery in the Department of Otorhinolaryngology and Head and Neck Surgery, National Academy of Medical Science (NAMS), Bir Hospital, Mahaboudha, Nepal. Patients undergoing thyroid surgery in Bir Hospital, Mahaboudha was selected as participants. Sample size was calculated considering prevalence of 16.4% of incidental removal of parathyroid tissue during thyroidectomy, 10% acceptable margin of error. Inclusion criteria were Any patient undergoing thyroid surgery in Bir Hospital, Kathmandu during 1 year study period was included in the study and the patients presenting to the ORL & HNS OPD and diagnosed as thyroid disease and planned for surgical procedure such as Total /Subtotal/ Near Total/hemithyroidectomy was included in this study whereas patient having revision thyroid surgery were excluded. Research instrument were; structured questionnaire was used to identify socio- demographic information and thyroid surgery related questionnaire was used to identify incidental parathyroidectomy.

After getting ethical approval from Institutional Review Board of National Academy of Medical Science, permission to conduct the study was obtained from the head of department of the ORL-HNS. Then, those patients presenting to the ORL & HNS OPD and diagnosed as various thyroid disease and who meet

the inclusion criteria was enrolled in the study. All the selected patients were approached and the researcher introduced himself and explained the purpose of the study to them. Informed written consent was taken from participants before the start of the surgery. Surgery was conducted by consultant ENT surgeon of NAMS. Specimen from surgical procedure of thyroid surgery was sent to histopathology department for examination and post operative calcium level will also be assessed. Confidentiality of the data was maintained by coding in each questionnaire and information was not disclosed to anyone. Pretesting in 10% of the participants was carried out to evaluate internal reliability of instrument. Pretesting was done to identify whether instrument need further changes or not and modification of instrument was done if necessary. Data was reviewed and was checked daily for completeness, consistency and accuracy. Data was entered in EpiData 3.1 and data was exported into SPSS 16 version. All variables were analyzed using frequency and percentage distribution in SPSS 16 version. Chi-square (χ^2) test was used to find out the association between incidental parathyroidectomy and selected variables.

Results

A total number of 53 patients who underwent thyroid surgeries were enrolled for the study. It shows that the number of patients of 20-30 years age groups were 8 in number (15.09%), 31-40 years age groups were 17 in number (32.08%), 41- 50 years age groups were 19 in number (35.85%), 51-60 years age groups were 7 in number (13.21%) and 60+ years age groups were 2 in number (3.77%). On the basis of gender, the number of male patients were 11 in number (20.75%) and female patients were 42 in number (79.25%). On the distribution of patients on the basis of preoperative indications of thyroid surgery, the number of patients in malignant conditions were 17 in number or 32.08%, Graves disease is 1 in number or 1.89% and Benign conditions were 35 in number or 66.04%. On the basis of benign conditions of thyroid gland, the patients diagnosed with multinodular goiter were 4 in number or 7.55%, Colloid cyst/ Goiter were 30 in number or 56.6% and Hurthle-cell adenomas were 2 in number or 1.89% among 53 or 100%. On the basis of malignant conditions of thyroid gland, the patients diagnosed as papillary carcinoma were 15 in number or 28.3% and follicular carcinoma were 2 in number or 3.77% among 53 or 100%. On the basis of nature of thyroid surgery, total thyroidectomy groups were 21 in number or 39.62% and hemithyroidectomy groups were 32 in number and 60.38%. On the basis of incidental parathyroidectomy, the patients with incidental parathyroidectomy were 5 in number and 9.43% and no incidental parathyroidectomy were 48 in number and 90.57%. On the basis of association of hypocalcemia with nature of thyroid surgery, hypocalcemia value were 16 (30.19%) with total thyroidectomy being "Yes" and 5 (9.43%) value being "No" and 32 (60.38%) with hemithyroidectomy being "No" and

0(0%) value being “Yes” On the basis of modified radical neck dissection, the patients who underwent modified radical neck dissection were 11 in number and 20.75% and not underwent modified radical neck dissection were 42 in number and 79.25%. For finding out the association of incidental thyroidectomy with different variables we assume the level of significance: 5% (Table 1).

				n=53
		Incidental Parathyroidectomy		
		Yes	No	p-value
Sex	Male	0	11	
	Female	5	37	0.06
Age	20-30	0	8	
	31-40	2	15	
	41-50	3	16	
	51-60	0	7	
	60	0	2	0.59
Post operative calcium level				
	Normal	0	37	
	Hypocalcemia	5	11	0.00035
Preoperative indications				
	Malignancy	5	12	
	Graves Disease	0	1	
	Benign	0	35	0.0028
Nature of Surgery				
	Total thyroidectomy	5	16	
	Hemi thyroidectomy	0	32	0.00371

Table 1: Association of Incidental Thyroidectomy with Different Variables.

Above table shows the p-value of different variables. Here the only p-value that were less than 0.05 were of variables “post operative calcium level”, “preoperative indications” and “nature of surgery”. Thus it showed that there were relation only in variables “post operative calcium level”, “preoperative indications” and “nature of surgery” but there is no co-relation between variables like sex and age with incidental parathyroidectomy.

Discussion

This was a study of prevalence of incidental parathyroidectomy among patients undergoing thyroid surgery in a tertiary level hospital. It was a descriptive cross sectional study. Study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, National Academy of Medical Science (NAMS), Bir Hospital, Mahaboudha, Nepal. Patients undergoing thyroid surgery in Bir Hospital, Mahaboudha has been selected as participants . Sample size has been calculated considering prevalence of 16.4% of incidental removal of parathyroid tissue during thyroidectomy with 10% acceptable margin of error. Sample size obtained was 53. The inclusion criteria for the selection

includes any patient who underwent thyroid surgery in Bir Hospital, Kathmandu during 1 year study period. The patients presenting to the Department of ORL & HNS of NAMS , diagnosed as thyroid disease and planned for surgical procedure such as total/subtotal/near total/hemithyroidectomy was included in this study while patient having revision thyroid surgery was excluded. Structured questionnaire was used to identify socio demographic information and thyroid surgery related questionnaire were used to identify incidental parathyroidectomy. After getting ethical approval from Institutional Review Board of National Academy of Medical Science, permission to conduct the study was obtained from the head of department of the ORL and HNS. Specimen from thyroid surgery was sent to Department of pathology for histopathological examination. Meticulous examination of the tissue sample was done to detect presence of any parathyroid tissue in the sample. All variables were analyzed using frequency and percentage distribution using tables and figures. *p*-test was used to find out the association between incidental parathyroidectomy and selected variables like age, sex, nature of thyroid surgery, pathological conditions of thyroid gland and post operative calcium level.

P-value of the variables was set at 5% to be statistically significant.

In the study conducted by me, there was age group ranging from 20 years to 60 years and around 68% of the patients were from 31 to 50 years age group while others were from different age group. In a study conducted by Helme et al, the age group range of the studied cases were from 30 years to 66 years which was comparable with our study. In another study conducted by Prazenica et al a total number of 788 patients underwent total thyroidectomy in the study period with a mean age of 52.6 years (range, 19–87 years). This finding is quite unmatching from our study most probably due to large difference in geriatric extremes of ages in their study.

In our study, It explains that around 79% of the patients were female and only around 21% were male. This state that most of the patients under studied are females. In a study conducted by Campos et al, there were total of 442 patients who underwent thyroid surgery and out of which only 68 (15.38%) were male patients and remaining 374(84.61%) were female patients. This implies significantly more percentage of female patients in their study, which seems to be similar to our study. These data refers that thyroid disease are more common in female patients.

In our study, it shows that, 66.04% of the cases have benign conditions of thyroid gland, 32.08% malignant conditions 1.89% and have Graves diseases. In a study conducted by Sasson et al, there was total of 141 patients, out of which, 83 (59%) cases were benign conditions and 58 (41%) cases were malignant thyroid diseases. This shows the resemblance to our study in terms of more percentage of benign thyroid conditions.

In our study, there was 68% of benign thyroid diseases, out of which 56.6% of the patients were diagnosed with colloid cyst/goiter, 7.55% with multinodular goiter and 1.89% with hurthle-cell adenomas. Similarly, in cases of malignant conditions of thyroid gland, 28.3% of the patients are diagnosed with papillary carcinoma and 3.77% with follicular carcinoma. In a similar study conducted by Youssef et al, there were 92.8% of cases diagnosed as benign thyroid diseases and only 7.2% of cases diagnosed as malignant conditions of thyroid gland. This has got resemblance with our study in terms of being more percentage of benign cases in studied sample.

In a study conducted by Sasson et al, out of 141 patients who underwent thyroid surgery, 69(51%) cases underwent total thyroidectomy and 72(49%) underwent hemithyroidectomy. In our study, out of total 53 cases, 21 cases(39.62%) underwent total thyroidectomy whereas 32 cases (60.38%) underwent hemithyroidectomy. This finding dissimilarities might be due to more number benign cases and requiring hemithyroidectomy as their surgical modality of treatment.

In my study, the total number of cases who also had neck dissection as additional procedure during thyroid surgery was 11(20.75%) and in those 11 cases, 4 (36.66%) cases had evidence of incidental parathyroidectomy during thyroid surgery with modified radical neck dissection. In a study performed by Khairy et al, out of 54 cases who underwent modified radical neck dissection, 12 cases (22.2%) cases had evidence of incidental parathyroidectomy, which is comparatively a bit less than that of our study findings. Out of total 53 cases taken as study basis in our study, the number of incidental parathyroidectomy came out to be 5 (9.43%). This procedural data reflects that the incidental parathyroidectomy during thyroid surgery is not so common during thyroid surgery. In a study conducted by Khairy et al, out of 287 patients who underwent thyroid surgery between the year 2004 to 2008, 47 (16.4%) had evidence of incidental parathyroidectomy which seem to be quite approximate as our study.

In our study, post operative calcium level on second post operative day was assessed and on findings that normal level of calcium was found to be in 69.81% and hypocalcemia was seen in 30.19% following thyroid surgery. In case of benign cases and Graves disease, no patients had hypocalcemia after thyroid surgery. However, among those patients, those who underwent total thyroidectomy, 16 out of total 21, ie 76.19% cases had evidence of hypocalcemia. Furthermore, out of 5 patients who had incidental parathyroidectomy, all patients had hypocalcemia. Therefore our study reflects the significant association of hypocalcemia with incidental parathyroidectomy. In a study conducted by Khairy et al, the incidence of biochemical hypocalcemia on the was seen in 23.3%, and hypocalcemia was significantly higher among patients with incidental parathyroidectomy (38.3%) (18 of 47) than in those without incidental parathyroidectomy (20%) (48 of 240 patients) (P=.0123)

After analyzing the association of incidental thyroidectomy with different variables, following discussions can be made: p-value for variable sex came to be 0.068 which is more than 0.05 which shows that there is no relation with variable sex, p-value for variable age came to be 0.59 which is more than 0.05 which shows that there is no correlation with age. The univariate analysis did not identify age or gender as risk factors for IPT as per Manatakis et al. which matched with our result. But according to Neagoe et al, female patients favour IP which is different from our study. Age and sex were not risk factors for incidental parathyroidectomy.” This also matches with our result. In our study, all the cases who had inadvertent parathyroidectomy had undergone total thyroidectomy as surgical procedure and has significant relation with it (p value – 0.00371). In a study conducted by Binglong Ba et al in 2018, 35 studies were included in the analysis after an exhaustive literature review. Pathology data demonstrate that incidental parathyroidectomy occurred in various locations:

intrathyroidal (2.2– 50.0%), intracapsular (16.7–40.0%) and extracapsular (15.7–81.1%) regions. Overall, the analysis found that malignancy (RR = 1.60, 95% CI: 1.27 to 2.02; $p < 0.0001$), central neck dissection (RR = 2.35, 95% CI: 1.47 to 3.75; $p = 0.0004$), total thyroidectomy (RR 1.42, 95% CI: 1.20 to 1.67; $p < 0.0001$) were significant risk factors associated with incidental parathyroidectomy. The above mentioned study also showed resemblance of association of total thyroidectomy with that of the incidental thyroidectomy. Similarly in our study, the malignant conditions of thyroid gland who underwent thyroidectomy were associated with incidental parathyroidectomy, that means all 5 cases of incidental parathyroidectomy were of malignant conditions of thyroid gland. Similarly in our study, the prevalence of incidental parathyroidectomy seem to be more in malignant conditions of thyroid gland with a p-value of 0.0028, Also the association of incidental parathyroidectomy with hypocalcemia came out to be statistically significant with a p-value of 0.00035.

Iatrogenic hypoparathyroidism is a well recognized complication following thyroid surgery. Its incidence varies greatly (up to 15%), but with a meticulous surgical technique it can be minimized to 0.5% to 4.0%. The incidence and the clinical significance of incidental parathyroidectomy during thyroid surgery are somehow obscure. In the literature, the incidence of incidental parathyroidectomy during thyroid surgery ranges from 8% to 19%. In this study, we observed incidental parathyroidectomy in 9.43% of our patients. Most authors agree that identifying parathyroid glands during thyroid surgery can result in a lower incidence of incidental parathyroidectomy. On the other hand, dissection in search of all parathyroid glands during thyroid surgery is unwarranted and may be hazardous. However, it is not unusual, even for the experienced thyroid surgeon, to see a histopathology report revealing the presence of parathyroid tissue along with the resected thyroid specimen. Familiarity with the anatomy of parathyroid glands and their blood supply is necessary to prevent inadvertent injury/devascularization or resection of the parathyroid parenchyma. The variable location of the parathyroid glands (particularly the intracapsular or intrathyroid location in some cases) contributes to the risk of incidental parathyroidectomy, however, incidentally excised parathyroids have been reported to be in an intrathyroid location in upto 40% to 50% of cases. Obviously, in cases of intrathyroidal parathyroids, improvements in surgical technique cannot eliminate the risk of incidental parathyroidectomy; therefore, incidental parathyroidectomy may occur even in the hands of the more experienced thyroid surgeons.

Theoretically, the risk of incidental parathyroidectomy may be increased in some cases, such as in patients who are undergoing extensive surgery for malignant thyroid disease, in the presence of extra thyroid extension or in the presence of bulky lymph node metastases. Modified radical neck dissection has been recognized

as a risk factor for unintentional parathyroidectomy. In our study, out of 5 cases of incidental parathyroidectomy, 4 patients had undergone neck dissection. Increased awareness when dissecting the central compartment may reduce the risk of unintentional parathyroidectomy, oncologic safety should not be compromised. Interestingly, in this study, there was significant correlation between the type of thyroid disease (i.e., malignant versus benign) or the extent of thyroid surgery and the incidence of accidental parathyroid resection; this is the experience of other investigators as well. In the literature, completion thyroidectomy/reoperations have been correlated with an increased risk for unintentional parathyroidectomy, probably resulting from the formation of scar tissue and fibrosis, which may cause operative difficulty. In this study, however, patients who underwent reoperation for recurrent or persisted thyroid disease were excluded. It therefore appears that the risk of incidental parathyroidectomy may be related to anatomic factors rather than underlying disease.

Careful inspection of the resected thyroid/neck dissection specimens for the presence of normal parathyroid tissue, anticipating possible autotransplantation, is prudent. Autotransplantation should be strongly considered, especially when more than two parathyroid glands are identified in the specimen following thyroid resection, particularly if the operative dissection has been tedious and the vascularity of the remaining parathyroid(s) is in doubt. Routine parathyroid autotransplantation during thyroid surgery resulted in less than 1% incidence of permanent hypoparathyroidism.

The parathyroid glands should be identified whenever possible. The position of the glands can be variable and 25% of the glands may not be in the position that the surgeon expects them to be. When the thyroid gland has been mobilized, the superior parathyroid gland should fall in a posterior position from the nerve and the inferior parathyroid gland in an anterior one. Once identified, the tissue handling needs to be very precise and delicate so the glands can be dissected with their blood supply preserved. Parathyroid glands rely on their blood supply to function, and it is critical that their nutrient vessels are preserved. The glands should be gently dissected from the thyroid, taking care not to cause traction or diathermy injury to their blood supply. Surgical procedure should be performed close to the gland, in the event that a parathyroid is excised, or is considered non-viable, a sample should be sent for frozen section analysis and, on confirmation, the gland should be divided into around 12 pieces for implantation into a muscle. Often the sternomastoid muscle is used due to its convenience, although this view has recently been challenged.

Assessing all the parameters associated with incidental parathyroidectomy, the major two factors seem to be malignant conditions of thyroid gland and nature of thyroid surgery. Furthermore, if the total thyroidectomy is associated with additional

surgical interventions like neck dissection, there seemed to be significant percentage of incidental parathyroidectomy. The more occurrence of incidental parathyroidectomy in case of malignant conditions may be due to the presence of adhesions and fibrosis of the gland near by adjacent structures where there might be presence of parathyroid gland. In relevance to total thyroidectomy, there is high percentage of incidental parathyroidectomy due to removal of bulk amount of tissues which causes inadvertent removal of parathyroid gland. Furthermore, the more prevalence of incidental parathyroidectomy which may be due to extensive nature of surgery in neck dissection. Other factor which may enhance incidental removal of parathyroid gland in neck dissection may be due to tumor adhesions. Also, while maintaining a safety oncological clearance, the adjacent parathyroid tissue may get injured and inadvertently removed. According to the study done by Hakan et al, it states that there is the possibility of parathyroid tissue extraction along with adipose tissue while performing the neck dissection. The boundaries of the central compartment are often an area to cover the parathyroid glands. Therefore, it is very difficult for surgeons to reveal these glands during surgery and even to do central neck dissection without disturbing their blood supply.

Limitations

Small size of the study sample as well as racial variation and other intrinsic factor not taken into consideration. Similarly Surgical expertise of the involved surgeon for safe identification of Parathyroid glands was not uniform. Also multiple surgeons were involved. Serum Parathyroid Hormone Level was not monitored and temporary hypocalcemia was only addressed. Permanent hypocalcemia was not included in the study and duration of medications was not been mentioned.

Conclusion

Incidental parathyroidectomy is a frequently encountered complication in thyroid surgery. In this study, approximately 9.43% of the total cases had evidence of incidental parathyroidectomy.

The major factors associated with incidental parathyroidectomy seem to be more in case of malignant conditions of thyroid and total thyroidectomy procedures. Additional surgical procedures like neck dissection further added risk for inadvertent parathyroidectomy. From the general study, we determined various values of variables associated with incidental parathyroidectomy. For that, we conducted p-value test to determine whether the variables have correlation with incidental thyroidectomy and came in conclusion that it has association with total thyroidectomy done in malignant conditions. The preservation of parathyroid glands during thyroid surgery carries paramount importance. Therefore it is possible that these parathyroid glands may be identified and preserved with more meticulous inspection of the thyroid capsule during thyroidectomy to decrease the incidence of unintentional parathyroidectomy during thyroidectomy in the future.

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References

1. Khairy GA, Al-Saif A (2011) Incidental parathyroidectomy during thyroid resection: incidence, risk factors, and outcome. *Annals of Saudi medicine* 31: 274-278.
2. Clark OH (2000) Surgical anatomy. In: Braverman LE, Utiger RD (eds). *Werner and Ingbar's The thyroid*. 8th ed. Philadelphia: Lippincott William & Wilkins 2000: 455-461.
3. Langer P (1999) Minireview: discussion about the limit between normal thyroid goiter. *Endocr Regul* 33: 39-45.
4. Watkinson JC, Clarke R (2018) editors. *Scott-Brown's otorhinolaryngology and head and neck surgery: basic sciences, endocrine surgery, rhinology*. Eighth edition. Boca Raton: CRC Press 2018.
5. Braverman LE, Utiger RD (eds). *Werner and Ingbar's The thyroid*, 8th ed. Philadelphia: Lippincott William & Wilkins 2000.