



Original Research Article

Saving the parathyroid during thyroid surgery and its impact on quality of life: A surgical challenge

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Abstract

Background: Thyroidectomy which was once labelled as butchery (Samuel gross) and was banned in Europe has now come to be one of the most skillful of surgical procedures. There are 4 parathyroid glands lying in close association with the thyroid gland which are responsible for calcium homeostasis of the body. Post-operative hypo parathyroidism results from a reduction of functioning of these parathyroid parenchyma. This results in transient or delayed hypocalcemia which in some cases makes the patient dependent on lifetime of calcium supplement.

Materials and Methods: A prospective hospital based cross sectional study was done over 50 patients in a period of one year indicated for thyroidectomy and monitored for hypocalcemia and its impact on post-operative QOL. A successful attempt was made to start pre-operative oral calcium supplements for patient less than 8 mg /dl serum calcium levels.

Results: Out of 50 patients, 21 Patients showed consistent normocalcaemia. 5 of the patients showed severe hypocalcaemia. 28 patients required post-operative calcium supplement.

Conclusion: Visualization and saving of the parathyroid gland along with its vasculature by meticulous capsular dissection remain the most challenging yet effective way to prevent post-operative hypocalcaemia in thyroid surgery.

Keywords: Hypocalcemia, Iatrogenic Injury, Parathyroid, Thyroidectomy

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1. Introduction

The parathyroid glands are endocrine glands located in close association with the thyroid gland in most patients. There are normally four individual parathyroids, though supernumerary parathyroids have been found in up to 13% of autoperativesies.¹⁰ Normal Parathyroid glands are approximately 5-6 mm in greatest dimension, weigh 15-35 mg, and can be inconspicuous with their orange -tan color surrounded by yellow fatty tissue envelopativee. They are often confused with central compartment lymph nodes, fat globules etc.

Superior parathyroid glands which are derived from the fourth pharyngeal pouch are classically located near the

posterolateral aspect of the superior pole of the thyroid, 1cm superior to the junction of the recurrent laryngeal nerve (RLN), and the inferior thyroid artery.

The inferior parathyroid which are derived from third pharyngeal pouch are classically located near the inferior poles of the thyroid glands, within 1-2 cm of the insertion of the inferior thyroid artery to the inferior pole. They classically lie superficial to the plane of RLN. Its major blood supply is from Inferior thyroid artery. A recent review by the American association of clinical Endocrinologist (AACE) and American College of Endocrinology discussed definitions and management of post-surgical hypocalcemia.¹¹

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In term of post-surgical hypocalcemia a total serum calcium of less than 8.5 mg/dl (2.125 mmol/L) or ionized calcium less than 1.15 mmol/L were considered as cut off levels. According to an AI generated review of articles available in National Library of Medicine ; transient post-operative hypocalcemia occurs in 1 - 68% cases , permanent 0-13% cases, within 24 hrs 21.4%, on post-operative day1 29%, six months post-surgery 3.6%, Post-operative hypocalcemia results from a reduction of functioning parathyroid parenchyma which could be secondary to intraoperative damages caused by mechanical, thermal injuries , gland devascularization, or inadvertent parathyroid excision.¹

There are multiple studies to strategize ways to prevent parathyroid injury. One approach has been to see if there is any relationship between number of parathyroids identified intra operative and post-operative hypoparathyroidism.⁸

Identification of the PGs resulted in 90 % transient hypocalcemia but only 10 % permanent hypocalcemia, according to the data.⁷ Other strategies include: A) Surgical mapping of the PGs B) Intra operative identification of glands with auto fluorescence and indocyanine green angiography C) Sub Capsular saline Injection D) Preservation of vascularity.

Post-operative hypocalcemia causes a major setback to a patient's quality of life along with requirement of hospital admission in severe cases.

According to WHO guidelines all patients of total thyroidectomy/ thyroidectomy patient were started on Oral supplementation - Cal with Vit D (500mg CaCO₃ - 200IU VitD₃ per tab), 2 tabs (total of 1000mg CaCO₃) TID. For s. calcium levels less than 7 and with symptoms. Inject calcium gluconate is to be started.

2. Materials and Methods

This is prospective observational study, conducted over one year from October 2023 to October 2024, included 50 patients undergoing thyroidectomy at the department of otorhinolaryngology, TMCH.(Table 2)

The study population comprised all patients presenting with thyroid swelling indicated for surgery during this period. Informed consent was obtained from all participants after a thorough explanation of the study. Each patient underwent a detailed history and clinical assessment, followed by pre-operative investigations to ascertain their eligibility.

2.1. Inclusion criteria

Inclusion criteria encompassed all patients indicated for thyroidectomy and willing to provide consent for the study.

2.2. Exclusion criteria

Patients with pre-operative parathyroid dysfunction or systemic illnesses leading to deranged calcium homeostasis were excluded.

2.3. Surgical technique

The surgical technique involved meticulous capsular dissection of the thyroid gland with anatomical mapping of the parathyroid glands. Special attention was given to identifying and preserving the inferior thyroid artery and its branches, followed by close-to-gland ligation of the inferior thyroid artery, preserving a distal branch if it supplied the thyroid. Post-surgery, patients were followed up according to established protocols.

3. Results

Age and gender were taken into consideration due to decreased bone reserve in females beyond 3rd decade of life. There was female preponderance and age bias of 45-55 years. (Figure 1)

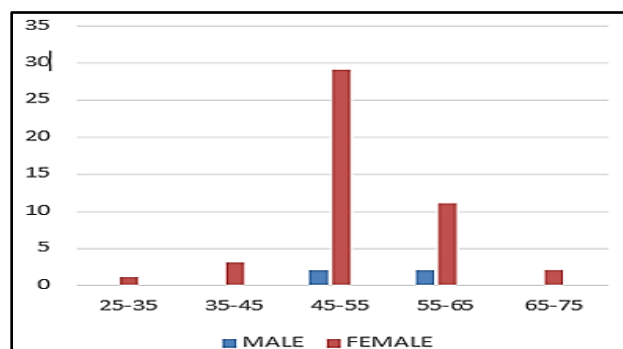


Figure 1: Age wise gender distribution Intra operative mapping of the parathyroid anatomy

Table 1: Identifying landmarks of right and left superior parathyroid glands

Landmarks	Right	Left
RLN	18	9
ITA and RLN	11	6
Cricothyroid junction	3	3
Tubercle of zuckerkindl	1	2
Total	33	20

Table 2: number of cases observed in different surgery

Type of surgery	Number of cases
Hemithyroidectomy	32
Total thyroidectomy	12
Total thyroidectomy with neck dissection	6
Total	50

Table 3: Identifying Landmarks for right and left inferior parathyroid glands

Landmarks	Right	Left
RLN	3	3
ITA and RLN	7	4
Lower pole	11	7
Tubercle of zuckerkindl	1	1
Total	22	15

Table 4: S. calcium levels monitored pre operatively and post operatively

S. Calcium levels	Pre-operative	Post-Operative Day 1	Post-Operative Day 4	Post-operative Day 14	Post-operative day 28
>8.5 mg/dl	6	6	4	4	6
8-8.5 mg/dl	28	20	20	26	21
7-8 mg /dl	16	14	14	12	18
<7 mg/dl	0	10	12	8	5

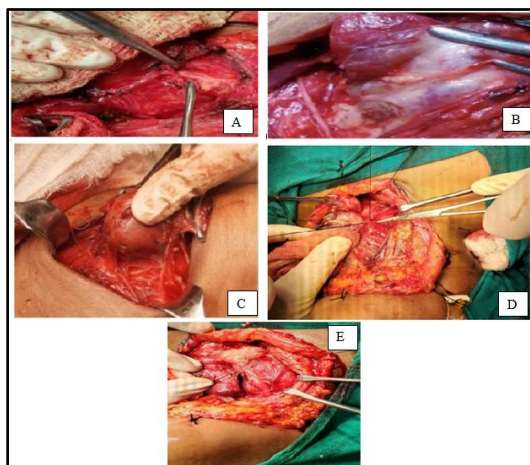


Figure 2: A) Left superior parathyroid gland lying posterior to left RLN, B) Identification of Superior parathyroid gland, C) Inferior parathyroid gland lying anterior to right RLN, D) Ligation of inferior thyroid artery and E) Inferior thyroid artery identification



Figure 3: 48 year old female case of large multinodular goitre.



Figure 4: Surgical specimen of total thyroidectomy of size 5.5 *4*3 cm3 approximately.

Table 4 shows Serum calcium levels were monitored pre operatively and post operatively. A level of less than 8.5 mg /dl was considered abnormal. Out of 50 patients, (21) 42 percent showed consistent normocalcaemia. One percent (5) of the patients showed severe hypocalcaemia and had to be re admitted on follow up.

All were cases of total thyroidectomy indicated for malignancy, 2 out of which had undergone CND. 28% (14) required post-operative oral calcium supplements of calcium 500mcg plus vitamin D3(.025mg) , 2 TABS thrice daily for 3 weeks tapered to BD followed by OD continued until normal level is reached . Out of which 8 patients showed signs of hypocalcaemia and were managed as acute hypocalcaemia with injection calcium gluconate 5 amp in 500 ml normal saline.

4. Discussion

Prevention of hypo parathyroidism following thyroid surgery starts with pre-operative assessment of serum Vitamin D , serum calcium, s. albumin , s. magnesium , parathyroid hormone levels (PTH levels) in patients at higher risk of hypo

parathyroidism. A meta-analysis of pre-operative risk factors for hypo parathyroidism included female sex, graves' disease, , larger thyroid glands, retrosternal goiter , need for bilateral central neck dissection, re operative thyroid surgery , advanced malignant disease.¹

In our present study, location of parathyroid glands had been identified in relation to CT joint, RLN, ITA and RLN junction and tubercle of Zukerkandl for superior parathyroid glands and ITA and RLN junction was found to be the common identifying landmark for inferior parathyroids along with inferior thyroid pole. (Table 1, Table 3, Figure 2)

An approach was attempted for patients with serum calcium levels less than 8 mg /dl pre operatively by starting on calcium plus vitamin D3, 500mg twice daily 4-5 days prior. There was evidence of decreased transient post-operative day 1 hypocalcemia in those patients.

The most common symptoms presented were tingling and numbness while some patients were trousseau's and Chvostek sign positive. Patients on follow up (2 weeks then one month) were checked for twitching of muscles, perioral and peripheral tingling or numbness, muscle cramps, fatigue, chest pain, altered mental state. Apart from the one percent of patients under the study all were enjoying a healthy life on one monthly follow up. The one percent said cases were managed with oral supplements and injectable calcium gluconate.

A study revealed a co-relation of female sex, age beyond 3rd decade with decreased post-operative calcium levels. A proper estimation with BMD test could provide fruitful in such cases.

There was also evidence proving that all four parathyroid glands were necessary for optimum calcium levels as patients undergoing hemithyroidectomy also developed hypocalcemia, thereby making saving the parathyroid a norm in all thyroid surgeries.

A clearly ischemic and probable non -viable parathyroid mostly occurring in large multinodular goiter or malignant disease with distorted anatomy could be confirmed by frozen section and considered for auto transplantation in sternocleidomastoid muscle.¹²

A patient presented with a pre-operative calcium level of 8.6 mg/dL. By post-operative day 1, the calcium level decreased to 7.9 mg/dL, further dropping to 6.8 mg/dL by day 4, at which point the patient became symptomatic. The patient was discharged on day 11 but required readmission on day 27 due to signs and symptoms of hypocalcemia. Treatment involved both oral and injectable calcium gluconate, leading to stabilization and a favorable follow-up.(Figure 3, Figure 4) Conclusion

There was clear evidence of post-operative hypo parathyroidism resulting from a reduction of functioning parathyroid parenchyma, which could be secondary to

intraoperative damages caused by mechanical or thermal trauma, obstruction to venous outflow, gland devascularization, and inadvertent parathyroid excision. Its occurrence was associated with severe clinical symptoms, requiring the need for calcium supplementation, at times prolonged and recurrent emergency hospitalization.

The blood flow of the final branch to the parathyroid gland is mostly in the lateral-to-medial direction; therefore, mobilization and preservation of the vessels lateral to the gland is essential to prevent devascularization of the parathyroid gland. Visualization and saving of the parathyroid gland along with its vasculature remain the most challenging yet the most effective way to prevent post-operative hypocalcemia in thyroid surgery.

Thyroidectomy is now considered as a surgical triumph and a skillful craftsmanship among surgical procedures. Therefore practice and discussing newer techniques of identifying the parathyroid glands in difficult cases could open a new horizon for safe thyroid surgery.

5. Source of Funding

None.

6. Conflict of Interest

None.

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