

A Clinical Study of Hypocalcemia Following Total Thyroidectomy in Tertiary Care Centre

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Abstract: ***Background:** Hypocalcemia has become a common complication following thyroid surgeries ever since the widespread use of total thyroidectomy for the treatment of thyroid disorders. This problem, although life threatening at times, can be adequately treated in the vast majority with no long term sequelae if recognized early in the post-operative period. Postoperative hypocalcemia is associated with morbidity and health care costs, but is rarely fatal. Therefore, it is important to identify and avoid high-risk surgical techniques and management practices that are associated with higher incidence of hypocalcemia. **Aim:** To estimate the incidence of hypocalcemia following total thyroidectomy and to correlate hypocalcemic features with ionized calcium level. **Materials and Methods:** The present study included 104 patients who underwent total or completion thyroidectomy in various surgical units from January 2020 to January 2022 in the Department of General Surgery, Thiruvannamalai Medical College Hospital, Thiruvannamalai. **Results:** This study was performed in a series of 104 patients of which 97 were females and 7 males. Most commonly middle age group (30-50 years) were affected by thyroid diseases. Majority of patients had non toxic multi nodular goiter. Incidence of hypocalcemia following total thyroidectomy was 37% Transient hypocalcemia-33.5%. Permanent hypocalcemia-1.9%. **Conclusion:** I concluded that transient hypocalcemia is the most common complication following total thyroidectomy. The incidence of post operative hypocalcemia is 36% [transient hypocalcemia 33.5% and permanent hypocalcemia 1.9%]. Proper planning and meticulous surgical techniques needed in localization and preserve blood supply to the parathyroids by ligating the branches of inferior thyroid artery individually without any compromise in parathyroid blood supply especially in thyroid malignancy, toxic goitre and Hashimoto's thyroiditis. Adequate and timely intervention is necessary in patients at risk for post operative hypocalcemia and for treatment of all symptomatic patients with calcium and vitamin D3 supplementation.*

Keywords: Hypocalcemia, Thyroidectomy.

1. Introduction

Total Thyroidectomy is one of the most common endocrine surgeries. It is the treatment of choice for the patients with malignant thyroid tumors as well as patients with multinodular goiters who experience compression symptoms. The most common complication of total thyroidectomy is post-operative hypocalcemia due to hypoparathyroidism. This complication is relatively common with an incidence of 20% to 30%, perhaps due to the sensitivity of parathyroid glands and their supplying arteries to trauma during surgery. However, most cases of post-operative hypocalcemia are transient, and the rate of permanent hypocalcemia persisting 12 months after the surgery is less than 2%. Postoperative hypocalcemia is associated with morbidity and health care costs, but is rarely fatal. Therefore, it is important to identify and avoid high-risk surgical techniques and management practices that are associated with higher incidence of hypocalcemia.

Surgical procedures on the thyroid gland are generally safe and well tolerated. Nonetheless the occasional complications that following surgery may be life threatening or permanently disabling. The complication arises from anatomical variations of many vital structures associated with thyroid gland in the neck.

Complication occurs infrequently due to the proximity of vital structures like recurrent laryngeal nerve and parathyroid glands. Despite high volume of surgery on the thyroid, no surgeon is likely to encounter a large experience with a particular complication.

A thorough knowledge of complications their prevention and the ability to recognise early and accordingly manage them has become more important because of the increased frequency of surgery on thyroid gland.

The exemplary work of Theodor Kocher during the last century in developing a safe technique for thyroidectomy resulted in a 'noble prize' and this allowed continuing progress in surgery by his successors.

The importance of safe operating technique can hardly be ever emphasised for it is far better to prevent a complication than to treat it.

Aim of the Study

To estimate the incidence of hypocalcemia following total thyroidectomy and to correlate hypocalcemic features with ionized calcium level.

2. Materials and Methods

The present study included 104 patients who underwent total or completion thyroidectomy in various surgical units from January 2020 to January 2022 in the Department of General Surgery, Thiruvannamalai Medical College Hospital, Thiruvannamalai

Inclusion Criteria: Age: all age groups from 14 to 75 years

Pathology: all benign, malignant, toxic and non toxic goitre cases who underwent total or completion thyroidectomy

Exclusion Criteria:

Age: less than 14 years.

Patient undergoing hemithyroidectomy Primary parathyroid pathology. Patient already on calcium supplementation.

In this study post operative hypocalcemia was observed for 4 cases in the age group of <30years, 14 cases in the age group of 31–40 years, 8 cases from 41-50 years and 11 cases aged > 50years.

Chi square= P=

3. Results

Table 1: Incidence of Post Operative Hypocalcemia in Relation to age Group

Age in Years	Hypocalcemia	
	Present	Absent
< 30	4	6
31-40	14	22
41-50	8	26
> 50	11	13

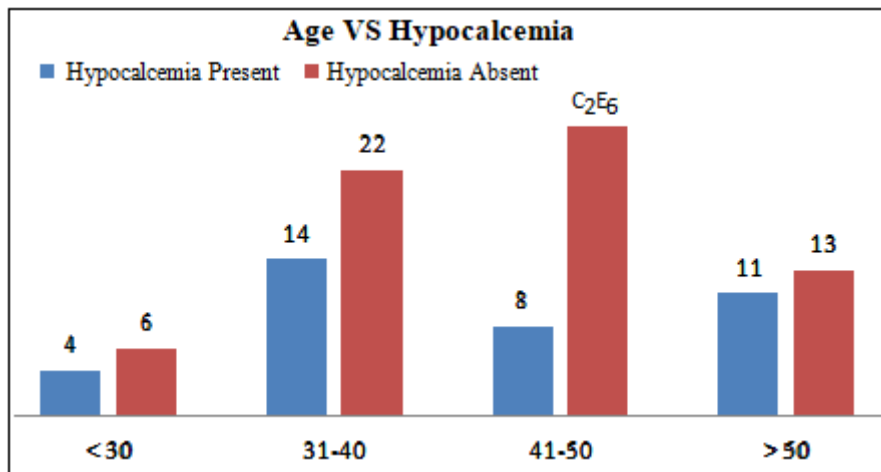


Figure 1: Incidence of Hypocalcemia Related to Age Group

Table 2: Incidence of Post Operative Hypocalcemia Type of Hypocalcemia

Hypocalcemia	No of Patients	Percentage
Transient	35	33.5%
Permanent	2	1.9%

In this study, 33.5% cases developed transient hypocalcemia and 1.9% cases developed permanent hypocalcemia.

Table 3: Incidence of Post OP Hypocalcemia in Relation to Type of Surgery

Type of Surgery	No. of Patients	Hypocalcemia Present
Total Thyroidectomy	101	35
Completion Thyroidectomy	3	2

In this study, out of 101 cases who underwent total thyroidectomy, 35cases developed post operative hypocalcemia and out of 3 cases who underwent completion thyroidectomy, 2 developed post operative hypocalcemia.

Table 4: Incidence of Post OP Hypocalcemia in Relation to Risk Factors

Risk Factors	Total Cases	Hypocalcemia Present
Huge Goitre	9	7
Neck Node Dissection	1	1
Short Neck/Obesity	6	3
Previous Thyroid Surgery	2	2

• In this study, out of 9 cases with huge goitre, 7

developed post operative hypocalcemia

- Out of 6 cases with short neck / obesity, 3 developed post operative hypocalcemia.
- Out of 2 cases with history of previous thyroid surgery, both developed post operative hypocalcemia.
- 1 case operated for neck dissection, developed post operative hypocalcemia

Table 5: Pre OP Distribution of Thyroid Diseases

Pre OP Indication	No. of Patients	Percentage
Multi Nodular Goitre	81	78%
Papillary CA	10	9%
Toxic MNG	8	8%
Grave's Disease	2	2%
Recurrent Thyroid Nodule	3	3%

In this study, 78 % of MNG cases, 9% of Papillary carcinoma cases, 10 % of Toxic goitre cases underwent total thyroidectomy and 3 % recurrent thyroid nodule cases underwent completion thyroidectomy

Table 6: Distribution of Post OP HPE Reports

Post OP HPE	No. of Patients	Percentage
Nodular/ Colloid Goitre	40	39%
Carcinoma	25	24%
Graves Disease	3	3%
Toxic MNG	4	4%
Adenoma	15	14%
Hashimoto Thyroiditis	17	16%

In this study, post op HPE of 39 % cases showed Nodular / Colloid Goitre, 24 % showed Papillary carcinoma thyroid, 3 % showed Graves disease, 4% showed Toxic MNG, 14% showed thyroid adenoma, 16% showed Hashimoto's / Lymphocytic Thyroiditis.

Table 7: Distribution of Pre Operative Serum Calcium Level

HPE Diagnosis	Pre OP Serum Calcium Level	
	MEAN	SD
Nodular/Colloid Goitre	10.27	0.87
Carcinoma	9.62	0.7
Graves Disease	9.33	0.38
TOXIC MNG	9.82	0.61
Adenoma	9.87	0.76
Hashimoto Thyroiditis	9.56	0.82

In this study, Mean Pre operative Serum Calcium levels were normal for all cases.

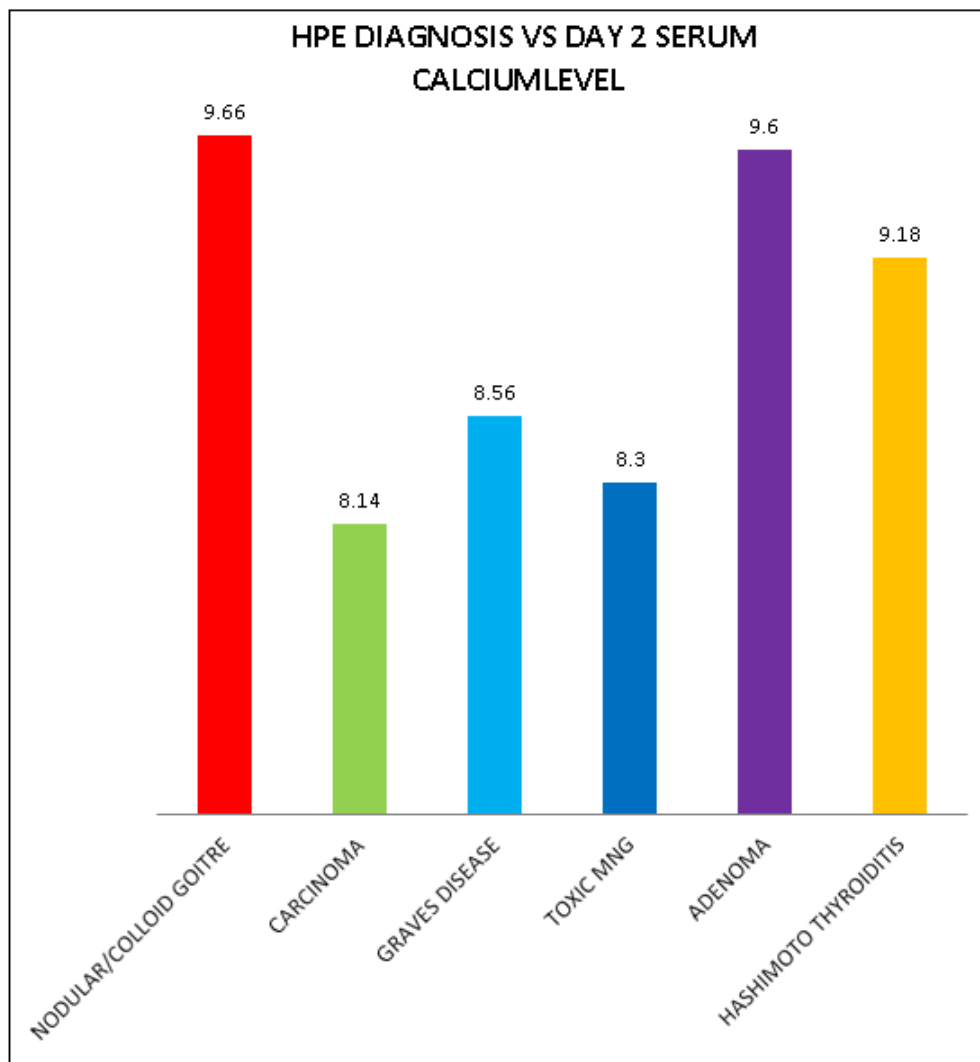
Table 8: Correlation of Day 1 Serum Calcium Level and Post OP HPE

HPE Diagnosis	DAY 1 Serum Calcium Level	
	Mean	SD
Nodular/Colloid Goitre	9.78	0.6
Carcinoma	9	0.73
Graves Disease	9.03	0.75
Toxic MNG	8.82	0.95
Adenoma	9.47	0.59
Hashimoto Thyroiditis	9.37	0.61
P VALUE - 0.001 Significant		

In this study, mean serum calcium level in 1st POD were found to be normal in all the cases. P value is 0.001 statistically significant.

Table 9: Correlation of Day 2 Serum Calcium Level and Post OP HPE

HPE Diagnosis	DAY 2 Serum Calcium Level	
	Mean	SD
Nodular/Colloid Goitre	9.66	0.84
Carcinoma	8.14	0.9
Graves Disease	8.56	0.73
Toxic MNG	8.3	0.87
Adenoma	9.6	0.81
Hashimoto Thyroiditis	9.18	0.9
P VALUE - 0.001 SIGNIFICANT		



In this study, Toxic goitre cases and Malignancy cases on 2nd POD showed decreasing mean Serum Calcium levels. P value is 0.001 statistically significant.

Table 10: Correlation of Post OP Day 3 Serum Calcium Level and Post OP HPE

HPE Diagnosis	DAY 3 Serum Calcium Level	
	Mean	SD
Nodular/Colloid Goitre	9.54	1.15
Carcinoma	7.96	1.21
Graves Disease	8.13	0.41
Toxic MNG	7.65	0.57
Adenoma	9.52	0.96
Hashimoto Thyroiditis	8.95	1.21
P VALUE - 0.001 Significant		

In this study, on 3rd POD, Graves disease cases, Toxic MNG cases and thyroid malignancy cases showed significant decrease in Mean Serum Calcium Levels. P value is 0.001 statistically significant.

4. Discussion

- In my study of 104 patients who with various thyroid pathology underwent total thyroidectomy or completion thyroidectomy consecutively during the period from January 2020– January 2022
- Most of our cases who underwent total thyroidectomy were female [female-97,male-7] most of them in the age group of 30-50 years.
- Colloid goitre or multi nodular goitre is the most common indication for surgery in mystudy.
- Risk factors like huge goitre, short neck, obesity, previous thyroid surgery, associated neck node dissection which increases the incidence of post operative hypocalcemia observed in my study. **Sakouti et al⁽¹⁰⁾,2010** was noted thyroid malignancy combined with neck node dissection increases the incidence of post operative hypocalcemia where as in **Nourelidine et al⁽¹¹⁾, 2014** there is no association between neck node dissection and hypocalcemia but randomized controlled trial showed that patients who undergone neck node dissection along with thyroidectomy were at high risk of developing post operative hypocalcemia.
- Incidence of post operative hypocalcemia [serum ca<8.5mg/dl].

According to various study

Study	Transient	Permanent
Thomusch et al ⁽¹⁴⁾ (2003)	7.3%	1.5%
Ganecalvesseries(2010)	25.5%	5.1%
Fahmy et al ⁽¹⁵⁾ (2004)	5.4-26%	0.5-24%
Karamanakos et al ⁽¹⁶⁾ (2010)	6.9-46%	0.4- 33%
Present Study	33.5%	1.9%

In my study thyroid malignancy and toxic goitre which were increases the incidence of postoperative hypocalcemia whereas **Burge et al⁽¹⁷⁾, 1998** in his study he also found that permanent post operative hypocalcemia common in thyroid malignancy and the patients with graves disease had transient hypocalcemia following total thyroidectomy.

Wingert et al⁽¹⁸⁾, 1986 noted post op hypocalcemia in thyroid malignancy patients was 25%, toxic goitre -11.4%, multi nodular goitre - 3.6%.

Present study – the incidence of hypocalcemia in thyroid malignancy -60%, toxic goitre -85%, hashimoto's thyroiditis -41%, nodulargoitre -15%.

Identification of parathyroid glands and its preservation of blood supply by meticulous dissection and auto transplantation of parathyroid gland while accidental removal which may decreases the incidence of post operative hypocalcemia.

Gavilan et al⁽²¹⁾, 1986 used intravenous methylene blue , **Sofola et al⁽²⁾,2001** used polarized spectra imaging, **Pederson et al⁽²²⁾, 2003** used portal gamma camera with setstambi radio tracer used for identification of parathyroid glands.

In my study Parathyroid auto trasplantation which decreases the incidence of post operative hypocalcemia. **Zedenius et al⁽²³⁾, 1999** and **Lo and lam⁽⁴⁾,1998** concluded that after routinely transplanting atleast one parathyroid gland into sternocleidomastoid muscle , there is no permanent hypoparathyroidism in 100 consecutive cases undergoing total thyroidectomy.

Postoperative monitoring of serum calcium and parathormone level is essential for treating hypocalcemia. **Asari et al⁽⁷⁾, 2008** and **O Edate et al⁽²⁴⁾,2014** noted parathormone level **Terries et al⁽²⁵⁾, 2009** estimation of serum calcium level are effective predictor for monitoring and correcting postop hypocalcemia.

Adequate and timely intervention and finally proper follow up is necessary in patients at risk and developing transient or permanent hypocalcemia following total thyroidectomy. **Kanis et al⁽²⁶⁾, 2012** recommended the duration of oral calcium supplementation with or without vitamin D3for 3-6 months in correcting severe hypocalcemia [seruca <7.5mg/dl].**Moore et al⁽²⁷⁾, 2001** recommended that routine calcium supplementation prior to discharge for all total thyroidectomy patients.

5. Conclusion

- 1) I concluded that transient hypocalcemia is the most common complication following total thyroidectomy.
- 2) The incidence of post operative hypocalcemia is 36% [transient hypocalcemia 33.5% and permanent hypocalcemia1.9%].
- 3) Proper planning and meticulous surgical techniques needed in localization and preserve blood supply to the parathyroids by ligating the branches of inferior thyroid artery individually without any compromise in parathyroid blood supply especially in thyroid malignancy, toxic goitre and Hashimoto'sthyroiditis.
- 4) Incidence of postoperative hypocalcemiamore in thyroid malignancy and toxic goitre.
- 5) The risk factors like huge goitre, short neck, obesity, previous thyroid surgery and associated neck node

dissection increases the incidence of post op hypocalcemia.

- 6) To implement the newer techniques like parathyroid auto transplantation, use of ultrasonic enhanced bipolar diathermy which may help in decreasing the incidence of post op hypocalcemia.
- 7) Pre and postop monitoring of serum calcium levels is essential for diagnosis , treatment and follow up of patients with hypocalcemia.
- 8) Adequate and timely intervention is necessary in patients at risk for post operative hypocalcemia and for treatment of all symptomatic patients with calcium and vitamin D3 supplementation.
- 9) Finally a proper follow up schedule is mandatory in all patients undergoing total thyroidectomy who developed hypocalcemia in their post operative period.

References

- [1] Esselstyn CB Jr. The parathyroid blush in the identification of parathyroid glands. *Am JSurg*
- [2] Sofola IO, Pazos GA, Buttolph TB, Casler JD, Leonard DW. The cytoscanmodelE-II in intra operative parathyroid gland identification in a rabbit model. *Otolaryngol Head Neck Surg*2001;125:635-9
- [3] Yao DX, Hoda SA, Yin DY, Kuhel WI, Harigopal M, Resetkova E, *et al.* Interpretative problems and preparative technique influence reliability of intraoperative parathyroid touch imprints. *Arch Pathol Lab Med*2003;127:6
- [4] Lo CY, Lam KY. Postoperative hypocalcemia in patients who did or did not undergo parathyroid autotransplantation during thyroidectomy: A comparative study. *Surgery*1998;124:1081-6
- [5] Fewins J, Simpson CB, Miller FR. Complications of thyroid and parathyroid surgery *OtolaryngolClin North Am*36:189-206.
- [6] K Mcleod MP Hier, MJ Black, PD Kerr *journal of the American...*,2007
- [7] R Asari, C Passler, K Kaezirek., *ofsurgery.*,2008
- [8] Reza asan et al (1995) combined measurement of PTH and serum calcium..., prediction of post operative hypocalcaemia.
- [9] A Leahu , V.Carroni,GBiliotti *J de chirurgie*2009
- [10] Sakouti M, Montazeri V , Golzari S, The incidence of transient and permanent hypocalcemia after total thyroidectomy for thyroid cancer *Int J Endocrinal metabolism*2010;1;7-12