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ASSESSMENT OF INTRA OPERATIVE PARATHYROID HORMONE LEVEL: AS AN INDICATOR FOR POST-OPERTIVE CALCIUM THERAPY IN A PATIENT UNDERGOING NEAR TOTAL AND TOTAL THYROIDECTOMY

General Surgery

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ABSTRACT

Thyroid and parathyroid are anatomically close to each other. Blood supply to parathyroid may get cut off inadvertently or all parathyroid tissue may get removed removed during near total or total thyroidectomy.As a result of near total and total thyroidectomy it may lead to hypocalcemia crisis post-operatively causing tingling, numbness, tetany, neuro-muscular dysfunction.Hypocalcemia is the most common etiological factor for prolonged hospitalization in patients undergoing total thyroidectomy.Recent studies concludes that, hypocalcemia can be prevented by assessing S. PTH levels pre-operatively and intra-operatively one hour after removing the gland.This study includes 30 patients, who underwent near total and total thyroidectomy from August 2018-July2020 with thyroid swelling where indicated for surgery.Patients who underwent total thyroidectomy for malignancy (10 out of 30) developed hypocalcemia, this attributed to the extensive surgical dissection performed in malignant disorders in order to obtain tumour clearance.For the Stratification of thyroidectomy patients who may develop hypocalcemia into low and high risk category, a single 1-hour post-thyroidectomy PTH level is very useful.

KEYWORDS

Thyroid, Thyroidectomy, Hypocalcemia, Parathyroid hormone(PTH)

INTRODUCTION:

Thyroid and parathyroid are anatomically close to each other. Blood supply to parathyroid may get cut off inadvertently or all parathyroid tissue may get removed removed during near total or total thyroidectomy.As a result of near total and total thyroidectomy it may lead to hypocalcemia crisis post-operatively causing tingling, numbness, tetany, neuro-muscular dysfunction.

Thyroidectomy is an age old process and is presented with very high mortality rates. By 1912, Theodore Kocher recognized the need to preserve parathyroid glands. This high mortality possibly reflected a lack of knowledge concerning the parathyroid glands and their influence on calcium metabolism[1]

Near total and total thyroidectomy is a preferred surgical technique for benign as well as malignant pathologies.Hypocalcemia is the most common etiological factor for prolonged hospitalization in patients undergoing total thyroidectomy[2].Initially to assess or to detect hypocalcemia in the post operative period frequently we investigate about total and ionized calcium and clinical features of hypocalcemia. These methods will take approximately 24 hrs to detect hypocalcemia[2].

The normal range of S.PTH is 10-65 pg/ml or 10-65ng/l and S.Calcium is 8.5-10.3mg/dl. Hypocalcemia occurs when the S. PTH level is less than 10 pg/ml or 10 ng/l or S. Calcium level is less than 8.5 mg/dl.

Recent studies concludes that, hypocalcemia can be prevented by assessing S. PTH levels pre-operatively and intra-operatively one hour after removing the gland[3]. Intra-operative S. PTH level one hour after removing the gland can give more accurate results when compared to other samples. The clinical features outcome will appear less than 1day to 3-4 days to detect, which unnecessarily increases the hospital stay of the patient and it causes financial burden to the patient.

AIMS AND OBJECTIVES

AIM: Assessment of Intra-operative PARATHYROID HORMONE level predicting need of post-operative calcium therapy in a patient undergoing near total and total thyroidectomy.

OBJECTIVES:

1. To evaluate Pre-operative S. PTH and S. Calcium
2. To evaluate Intra-operative S. PTH and S. Calcium
3. As a predictor of hypocalcemia and its complications in post-operative period.

MATERIALS AND METHODS:

Study design: Prospective observational study.

Inclusion criteria: Patient who are undergoing near total and total thyroidectomy are included in this study irrespective of indication for surgery(either benign or malignant).

Exclusion criteria: Those who are undergoing hemi-thyroidectomy and sub total thyroidectomy.

OBSERVATION AND RESULTS

This study has been carried out in Bharati Vidyapeeth deemed to be university Medical college and hospital, Pune. This study includes 30 patients, who underwent near total and total thyroidectomy from August 2018-July2020 with thyroid swelling where indicated for surgery.

A. Distribution of samples as per sex:

In this study group, 80%(24 out of 30) were female patients and 20%(6 out of 30) were male patients.

Table 1. Distribution of samples as per sex:

Sex	No. of samples	Percentage distribution
Male	6	20%
Female	24	80%
Total	30	100%

B. Distribution of samples as per age:

In this study, study population are divided into three age groups. Of them 33.3%(10 out of 30) are in the age group between 20-39 years, 46.7%(14 out of 30) are in the age group between 40-59 years and rest 20%(6 out of 30) are more than 60 years of age.

Table 2. Distribution of samples as per age groups

Age group (in years)	No. of samples	Percentage distribution
20-39	10	33.3%
40-59	14	46.7%
>60	6	20%
Total	30	100%

C. Distribution of samples as per indication for surgery:

According to pre-operative indications, 36.7%(11 out of 30) were having malignancy, 26.7%(8 out of 30) are diagnosed to have multinodular goitre and 36.7%(11 out of 30) were having other conditions like benign lesion, suspicion of malignancy etc.,

Table 3. Distribution as indication for surgery:

Indication for surgery	No. Of samples	Percentage distribution
Malignancy	11	36.7%
Multinodular goitre	8	26.6%
Other(Benign lesions, suspicious of neoplasm)	11	36.7%
Total	30	100%

D. Distribution as per type of thyroidectomy:

Out of total number of thyroidectomies, 80%(25 out of 30) underwent total thyroidectomy, 16.7%(5 out of 30) underwent completion thyroidectomy and 3.3%(1 out of 30) underwent near total thyroidectomy.

Table 4. Distribution as per type of thyroidectomy:

Thyroidectomy type	No. Of samples	Percentage distribution
Total	24	80%
Completion	5	16.7%
Near total	1	3.3%
Total	30	100%

E. Presenting feature of hypocalcemia:

Table 5. Presenting of hypocalcemia:

Presenting feature	Percentage
Peri-oral numbness or tingling sensation	40%
Carpopedal spasm	33.3%
Chvostek's sign	16.7%
Trosseau's sign	20%
No symptoms	36.7%

F. Incidence of hypocalcemia as per sex:

Out of 30 patients who underwent thyroidectomy, 19 patients developed hypocalcemia. Among 19 patients who developed hypocalcemia, 73.7%(14 out of 19) are females and 26.3%(5 out of 19) were males.

Table 6. Incidence of hypocalcemia as per sex:

Sex	No. Of cases	Percentage
Male	5	26.3%
Female	14	73.7%
Total	19	100%

H. Incidence of hypocalcemia as per age:

Table 7. Incidence of hypocalcemia as per age:

Age group	No. Of Cases	Percentage
20-39 years	6	31.6%
40-59 years	7	36.8%
>60 years	6	31.6%
Total	19	100%

I. Incidence of hypocalcemia as per type of thyroidectomy:

19 out of 30 patients who developed hypocalcemia following thyroidectomy, of them 89.5%(17 out of 19) underwent total thyroidectomy and 10.5%(2 out of 19) underwent completion thyroidectomy.

Table 8. Incidence of hypocalcemia as per type of thyroidectomy:

Thyroidectomy type	No. Of cases	Percentage
Total	17	89.5%
Completion	2	10.5%
Near total	0	0%
Total	19	100%

J. Incidence of hypocalcemia as per type of malignancy:

In this study of 30 patients who underwent thyroidectomy, 19 patients developed hypocalcemia. Out of 19 patients who developed hypocalcemia, 10 patients are having malignancy.

Table 9. Incidence of hypocalcemia as per type of malignancy:

Type of malignancy	No. Of cases	Percentage
Papillary ca	4	40%
Follicular ca	2	20%
Medullary ca	2	20%
Others	2	20%
Total	10	100%

K. Severity of hypocalcemia based on post-operative (1 hour after removing the gland) PTH:

Based on the post operative PTH values and clinical features developed by patients who underwent thyroidectomy, patients are divided into three groups as shown in the below table and graph.

Table 10.

Severity(PTH values)	Post op PTH values	Percentage
No/mild(>30 pg/ml)	16	53.3%
Moderate(10-30 pg/ml)	7	23.3%
Severe(<10 pg/ml)	7	23.3%
Total	30	100%

L. Severity of hypocalcemia based on post-operative calcium levels:

Samples in this study are divided into 3 categories based on their post-operative calcium levels. These includes;

Table 11.

Severity	Calcium levels(Post-op)	Percentage
No(8.6-10.5 mg/dl)	28	93.3%
Mild/moderate(7.5-8.5 mg/dl)	2	6.7%
Severe(<7.5 mg/dl)	0	0%
Total	30	100%

DISCUSSION

Post-operative hypocalcemia is one of the most common complication after near total and total thyroidectomy. It is the most common etiological factor for prolonged hospitalization in patients undergoing near total and total thyroidectomy. Our study has emphasized that, early detection of post-operative hypocalcemia and to prevent prolonged hospitalization, Intra-operative PTH analysis can be helpful.

As per many other studies, Thyroid diseases are more common in females. Like other studies, our study has confirmed that thyroid diseases is more predominant in females than males (i.e.,80% female cases and 20% contributed by males)[4].

In our study, majority of the samples are in the age group between 40 and 60 yrs(I.e., middle age group). They constitute 46.7%(14 out of 30) among the samples, who underwent surgery for thyroid diseases. As per literature, incidence of hypocalcemia Post-thyroidectomy increases with increasing age I.e., more than 50 yrs. Erbil Y et al in his study, has revealed that with advancing age there is a tremendous fall in Vit-D levels following thyroidectomy. His study is based on Age, Vit-D level and incidental para thyroidectomy following near total or total thyroidectomy. As per this study, there is 25 times more incidence of hypocalcemia if the age is above 50 yrs[59].

Patients who underwent total thyroidectomy for malignancy (10 out of 30) developed hypocalcemia, this attributed to the extensive surgical dissection performed in malignant disorders in order to obtain tumour clearance. Sokouti et, al,. in his study he concluded that, post operative hypocalcemia following total thyroidectomy in malignancies is due to extensive dissection and the incidence increases when the procedure combined with neck dissection[6].

In our study, 5 patients underwent completion thyroidectomy, of them 2 patients developed hypocalcemia. The reason for this, because of fibrosis and adhesions developed following previous surgery. In re-surgeries some literatures postulates that extensive fibrosis can be a reason for vascular compromise that results in hypo parathyroidism. In 2012, Mehmet Ali Et al., in his study , he concluded that, complications like temporary and permanent hypocalcemia following thyroidectomy are 20.7% and 4.4% respectively. These complications occur while dissecting scar tissue around RLN or parathyroid vascular pedicle[7].

Our study mainly concentrated on post operative parathyroid hormone level(sample sent 1 hour after removing the gland) and probability of having hypocalcemia. In our study, we found that 7 patients are having post-operative PTH level below 10 pg/ml(<10 pg/ml) and they had severe hypocalcemic features and 7 patients are having transient hypocalcemia. In their study,Michael G White et al.,has reported that PTH measured post-operatively at 1 hr was equalent to PTH measured 24 hrs post thyroidectomy[8].

Perioperative and per-operative estimation of parathyroid hormone

level in blood is a well documented predictor of post thyroidectomy hypocalcaemia in literature.For that parathormone estimation was done intra-operatively and 1 hour and 24 hours after surgery[9].A fall in parathormone level immediately after surgery that is 1 hour and continuing fall in 24 hours is strongly associated with hypocalcaemia[9].

Chung Yau Lo et al, in his study he concluded that, if Post-thyroidectomy PTH level is normal or reduction of < 75% can detect patient who is normocalcemic while thyroidectomy rather than monitoring 24 hrs Sr. Ca^{2+}[10].

Jong-Lyel Roh et al,. Compared intra-operative PTH level with normal PTH level inside 8 hrs post-thyroidectomy.Prediction of post-thyroidectomy tetany, if intra-operative PTH level is less than 15pg/ml has 85% sensitivity and 84% specificity. Patients who are normocalcemic or requiring close monitoring and to start Ca^{2+} can be identified ,if intra-operative PTH level is >15 pg/ml and/or decline of <70% with pre-operative PTH level[11].

Michael G White et al., hypothesized that increased risk of symptomatic hypocalcemia might be due to increased manipulation of parathyroid glands during central node dissection or parathyroid auto transplantation[8].

Trung N Le et al., based on his study, he stratified patients as to their level of risk for developing hypocalcemia based on a single 1-hour post-operative PTH level. He concluded that, patients who are at high risk should be started immediately on prophylactic supplementation and considered safely for 23-hr discharge. Patients who are low risk can be discharged without any supplementation[12].

As per as post operative calcium levels are taken into consideration, only 2(out of 30) patients will develop hypocalcemia. Jumaily JS, et al., in his study has summarized that 1 to 6 hrs PTH assay post-thyroidectomy has excellent accuracy and in determining patients who will become hypocalcemic. Thus PTH helps in early detection of hypocalcemia than calcium levels where early calcium levels are normal[13].

Algarni M et al., in his study, he summarized that absolute PTH levels and percentage decline can anticipate hypocalcemia risk but it lacks 100% accuracy. Regular PTH level is improbable for grave hypocalcemia. For early and safe discharge, PTH can be tested discreetly. To prevent the frequency and grade of hypocalcemic morbidity and to start Ca^{2+}/Cholecalciferol(Vit-D) PTH level can be helpful[14].

Limitations of the study:

Our study group includes small sample size. High individual biologic variability of PTH level. The availability of this test and the cost are the limiting factors in low scale hospital setups.This test cant be useful for followup cases of hypocalcemia due to high cost and unavailability of tests in low scale centers.

CONCLUSION:

Hypocalcemia is one of the most common complication following total and near total thyroidectomy. This can be prevented with thorough knowledge of anatomy, pre-operative preparation of the patient, per-operative meticulous dissection and identification of parathyroids. During procedure, accidental injury or removal of parathyroid should be auto-transplanted. For the Stratification of thyroidectomy patients who may develop hypocalcemia into minimum and maximum risk category, a single 1-hour post-thyroidectomy PTH level is very useful. A single measurement one hour after surgery is slightly more accurate and more cost-effective, since only one measurement is required.However, a larger, multi-institutional study is required to further strengthen and establish its accuracy to detect and treat hypocalcemia in time.

REFERENCES

1. Vanderlei FA, Vieira JG, Hojaij FC, Cervantes O, Kunii IS, Ohe MN, Santos RO, Abrahão M. Parathyroid hormone: an early predictor of symptomatic hypocalcemia after total thyroidectomy. Arquivos Brasileiros de Endocrinologia & Metabologia. 2012 Apr;56(3):168-72.
2. Kim, J.P., et al., Effectiveness of an i-PTH measurement in predicting post thyroidectomy hypocalcemia: prospective controlled study. Yonsei Med J, 2013. 54(3): p. 637-42.
3. AlQahtani A, Parsyan A, Payne R, Tabah R. Parathyroid hormone levels 1 hour after thyroidectomy: an early predictor of postoperative hypocalcemia. Canadian Journal of Surgery. 2014 Aug;57(4):237.
4. Bailey and Love 26th edition, short practice of surgery
5. Erbil, Y., et al., Predictive factors for recurrent laryngeal nerve palsy and .hypoparathyroidism after thyroid surgery. Clin Otolaryngol, 2007. 32(1): p. 32-7.
6. 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.
7. Gulcelik MA, Kuru B, Dincer H, Camlibel M, Yuksel UM, Yenidogan E, Reis E. Complications of completion versus total thyroidectomy. Asian Pac J Cancer Prev. 2012 Jan 1;13(10):5225-8.
8. Michael G White, James BC, Nocon C, Nagar S, Kaplan EL, Angelos P, Grogan RH. One-hour PTH after thyroidectomy predicts symptomatic hypocalcemia. Journal of Surgical Research. 2016 Apr 1;201(2):473-9.
9. Soon PS, Magarey CJ, Campbell P, Jalaludin B,Serum intact parathyroid hormone as predictor of hypocalcemia after total thyroidectomy. ANZ J Surg 2005; 75 (11); 977-80.
10. Di Fabio F, Casella C, Bugari G, Iacobello C, Salerni B. Identification of patients at low risk for thyroidectomy-related hypocalcemia by intraoperative quick PTH. World J Surg. 2006;30(8):1428-1433.
11. Roh JL, Park CI. Intraoperative parathyroid hormone assay for management of patients undergoing total thyroidectomy. Head Neck. 2006;28(11):990-997.
12. Trung N Le, Kerr PD, Sutherland DE, Lambert P. Validation of 1-hour post-thyroidectomy parathyroid hormone level in predicting hypocalcemia. Journal of Otolaryngology-Head & Neck Surgery. 2014 Dec;43(1):1-5.
13. Jumaily JS, Noordzij JP, Dukas AG, Lee SL, Bernet VJ, Payne RJ, McLeod IK, Hier MP, Black MJ, Kerr PD, Raffaelli M. Prediction of hypocalcemia after using 1.to 6.hour postoperative parathyroid hormone and calcium levels: An analysis of pooled individual patient data from 3 observational studies. Head & Neck: Journal for the Sciences and Specialties of the Head and Neck. 2010 Apr;32(4):427-34.
14. Algarni M, Alzahrani R, Dionigi G, Hadi AH, AlSubayea H. Parathyroid hormone and serum calcium levels measurements as predictors of postoperative hypocalcemia in total thyroidectomy. Gland surgery. 2017 Oct;6(5):428.