Risk Factors of Hypoparathyroidism After Total Thyroidectomy

Sonia Rani,[1*] Saba Ramzan, [1] Zahid Mehmood [1]

ABSTRACT

Objective *To find the frequency and risk factors of postoperative hypoparathyroidism in patients after total thyroidectomy.*

Study design *Cross sectional study.*

Place & Duration of study *Department of General Surgery, Jinnah Postgraduate Medical Center Karachi, from September 2022 to May 2023.*

Methods *A prospective observational cross sectional study was conducted on patients in whom total thyroidectomy was contemplated. Information related to demography, personal habits, presence of co morbid conditions, indications of total thyroidectomy and postoperative hypoparathyroidism were collected on a pre designed form. SPSS version 20 was used to analyze the data and post stratification Chi square test/ Fischer exact test was applied and p value less than 0.05 was considered significant.*

Results *One hundred and sixteen patients were enrolled in this study. There were 62 (53.4%) males and 54 (46.6%) female patients. The mean age, body mass index, height and weight of the study population were 44.89±10.56 years, 27.45±3.58 Kg/m^2, 156.5±8.58 cm and 76.8±10.69 Kg respectively. Seventy-two (62.06%) patients were operated for non-toxic multinodular goiter, 23(19.8%) for papillary carcinoma of thyroid, 12 (10.34%) for Graves' disease, 8 (6.8%) for toxic multinodular goiter and 1 (0.08%) for anaplastic carcinoma. Twenty (17.2%) patients developed postoperative hypoparathyroidism. It was transient in nature and improved within three months.*

Conclusion *High prevalence of postoperative hypoparathyroidism was seen in patients undergoing total thyroidectomy.*

Key words *Hypoparathyroidism, Total thyroidectomy, Goiter, Calcium metabolism, Neck surgery.*

INTRODUCTION:

The parathyroid glands are four in number. Each gland is a small oval-shaped endocrine structure about 0.5 cm in size. They have brown to tan color, located in close relation with the thyroid gland and supplied by the inferior thyroid artery. The parathyroid glands secrete parathyroid hormone which is responsible for calcium metabolism. This hormone has a very short half-life. In case of injury to this gland symptoms of hypoparathyroidism appear immediately.[1]

Hypoparathyroidism is a known complication of neck surgeries particularly of anterior triangle. This is because of the removal or injury to the parathyroid gland or damage to its blood supply.[1,2] The majority of patients with hypoparathyroidism recover within three months, if injury is partial. In order to label chronic hypoparathyroidism, symptoms should be present for at least six months.[3,4] The most common surgery that causes hypoparathyroidism is total thyroidectomy. Hungry bone syndrome is another

[1] Department of General Surgery JPMC Karachi

Correspondence:
Dr. Sonia Rani [1*]
Department of General Surgery
Jinnah Postgraduate Medical Center
Karachi
E mail: sonia_channar@yahoo.com

important cause of hypocalcemia after parathyroid surgery.[5] The clinical features of hypoparathyroidism range from mild symptoms like abnormal tingling sensations of lips, fingers, and toes, paresthesia, muscle cramps, to tetany, seizures, abnormal cardiac rhythm, cardiac failure and laryngospasm.[6]. These symptoms may take weeks to resolve and patients may need hospitalization in severe cases.[7]

The incidence of hypoparathyroidism is significantly decreased due to a better understanding of anatomy and dedicated endocrine units that have a high volume of cases and experienced endocrine surgeons. The incidence of permanent hypoparathyroidism after thyroid surgery is 0.9%-1.6%.[8] Iatrogenic injury to the parathyroid gland or its blood supply is avoidable in experienced hands. The use of indocyanine green (ICG) angiography helps in the identification of parathyroid glands.[9] This study was conducted to find the frequency of postoperative hypoparathyroidism and associated risk factors in patients who underwent total thyroidectomy.

METHODS:

Study design, place & duration: This cross sectional study was conducted in Surgical Unit 1, Jinnah Postgraduate Medical Center Karachi, from September 2022 to May 2023.

Ethical considerations: It is a dissertation-based article. Synopsis approval was obtained from the College of Physicians & Surgeons Pakistan (REU: 51897). All the patients gave consent for the surgery and using their clinical data for this study.

Inclusion criteria: Patients aged 20 years - 60 years, either gender who underwent total thyroidectomy were included.

Exclusion criteria: Patients who had hyperparathyroidism, preoperative hypocalcemia, neck radiotherapy, and recent blood transfusion (within a week), were excluded.

Sample size estimation: WHO software was used to calculate the sample size by keeping the prevalence of hypoparathyroidism at 18% after total thyroidectomy,[10] the confidence level 95% and the margin of error 7%, a sample size of 116 was obtained.

Sampling technique: A non-probability convenience sampling technique was used for the study.

Study protocol: One hundred sixteen patients who fulfilled the inclusion criteria underwent total thyroidectomy and enrolled in this study. All patients were interviewed and investigated for diabetes mellitus type II, use of anti-diabetic medications for at least six months and HbA1c level, BMI to assess for presence of obesity, and postoperative hypoparathyroidism. Estimation of parathyroid hormone (PTH) levels were done on first postoperative day and PTH level of <10 pg/mL within 2 days of surgery was considered as postoperative hypoparathyroidism

Statistical analysis: IBM SPSS version 20 was used to analyze the statistical data. Frequencies and percentages were determined for the qualitative variables like age, gender, BMI, diabetes mellitus type II, and postoperative hypoparathyroidism. Effect modifiers were controlled through stratification of qualitative variables. Post stratification Fisher exact test and Chi-square test were applied. A 95% confidence interval was used to calculate the odds ratio. A p value of <0.05 was taken as significant.

RESULTS:

One hundred sixteen patients were admitted for total thyroidectomy. Seventy-two (62.06%) patients were operated for non-toxic multinodular goiter, 23 (19.8%) for papillary carcinoma of thyroid, 12 (10.34%) for Graves' disease, 8 (6.8%) for toxic multinodular goiter and 1 (0.08%) for anaplastic carcinoma. The age of the patients was from 30 years to 60 years with the mean age of 44.89±10.56 years. The mean BMI, height and weight were 27.45±3.58 Kg/m^2, 156.5±8.58 cm, and 76.8±10.69 Kg respectively.

Twenty (17.2%) patients developed hypoparathyroidism that was transient in nature and improved within three months. No patient developed permanent hypoparathyroidism in this study. Stratification for age and postoperative hypoparathyroidism is shown in table I. Out of 20 patients who developed hypoparathyroidism 11 (55%) were operated for non-toxic multinodular goiter, 6 (30%) for papillary carcinoma, 2 (10%) for Graves' disease and 1 (5%) for anaplastic carcinoma of thyroid. Grave's disease and 1(100%) patient operated for Anaplastic carcinoma.

Stratification of postoperative hypoparathyroidism according to the age and pathology is given in table I. Ten patients of either gender developed postoperative hypoparathyroidism (p=0.73). Patients with diabetes mellitus had a higher frequency of hypoparathyroidism (5 out of 20 patients – p =0.31). Stratification with the BMI showed that postoperative hypoparathyroidism occurred in 12 out of 56 obese

Table I: Postoperative Hypoparathyroidism According to the Age

Age (Years)	Postoperative Hypoparathyroidism		Total
	Yes	No	
20-40	12 (30%)	28 (70%)	40 (100%)
41-60	08 (10.5%)	68 (89.5%)	76 (100%)
Total	20 (17.2%)	96 (82.8%)	116(100%)
P value	0.01*		

patients and in 8 out of 60 non obese patients with p=0.24.

DISCUSSION:

In this study of 116 patients, 20 (17.2%) developed transient postoperative hypoparathyroidism. All of these patients recovered within three months. Thyroid surgery is associated with two life-threatening complications, parathyroid insufficiency and recurrent laryngeal nerve injury. These two conditions can result in poor quality of life with additional burden on limited healthcare resources. The incidence of postoperative hypoparathyroidism is low in hospitals where dedicated thyroid units are present. It is more often reported in females of older age group.[11,12] Hypoparathyroidism may be transient that usually resolve within three months with an incidence of 19 - 38% or permanent if persists for more than six months and reported in 1.5-6.4%.

In a study it was found that 35.16% cases of postoperative hypoparathyroidism were due to the resection of parathyroid glands while 64.94% due to damage to the blood supply.[11] Surgeons must be skilled to prevent such a disaster by knowing the anatomy of the parathyroid glands with variations of blood supply as well use loupes to clearly identify all the structures. In a study almost similar results to our, a total of 18% patients developed hypoparathyroidism. Of these 70% patients recovered within two months and 5% in 12-months. They used one-year time to label permanent hypoparathyroidism if recovery does not occur. The incidence of this was 1.9% in their series.[8] Serum magnesium, phosphorus and PTH concentrations are important influencing factors and effective predictors of short-term postoperative parathyroid function recovery to normal.[13]

Yazicioglu et al reported comparable results to index study. They recorded postoperative hypoparathyroidism in 16.48 % patients. In three patients, it was permanent. They observed that if the PTH level after surgery was 5.95 pmol/L then there is a high risk for permanent hypoparathyroidism.[14] Teshima et al documented high incidence of transit hypoparathyroidism in 68% and permanent hypoparathyroidism in 18% patients. They also mentioned that hypoparathyroidism is directly related to the number of auto-transplantation of the parathyroid glands.[15]

Limitations of the study: This is a single center study with transient postoperative hypoparathyroidism in all the patients who developed this complication. This is in contrast to high incidence of both transient and permanent hypoparathyroidism reported in literature.

CONCLUSION:

Post-surgery hypoparathyroidism in our study observed in number of patients. However, all instances were transient in nature and recovered over period of time. Identification of parathyroid glands and preservation of their blood supply are the key factors to prevent hypoparathyroidism.

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