



ORIGINAL RESEARCH PAPER

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ESTIMATION OF INCIDENCE OF POSTOPERATIVE HYPOCALEMIA AMONG PATIENTS UNDERGOING TOTAL THYROIDECTOMY IN A TERTIARY CARE HOSPITAL IN KASHMIR – A PROSPECTIVE OBSERVATIONAL STUDY

KEY WORDS: Postoperative, Hypocalcemia, Incidence, Kashmir

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ABSTRACT

INTRODUCTION: The thyroid gland is one of the main regulators of metabolism. The parathyroid glands produce parathyroid hormone (PTH), which regulates blood calcium levels. One of the serious complications of thyroidectomy is hypocalcemia secondary to damage to parathyroid glands. **OBJECTIVES:** To estimate the incidence of hypocalcemic symptoms during first three post-operative days of total thyroidectomy with or without neck dissection. **METHODS:** A Hospital-based Prospective Observational Study was conducted in the Department of Otorhinolaryngology and Head and Neck surgery, Government SMHS Hospital Srinagar, among the patients undergoing total thyroidectomy. **RESULTS:** Out of 37 participants more than fourth-fifths (81%) were females. Majority of patients were Pappillary Carcinoma Thyroid (78.4%) & Neck dissection was performed in 62% of cases. Majority of cases were in the age-group of 21 to 30 years. 54 % patients developed symptoms of hypocalcemia within one of the first three postoperative days with majority of them developing it on first postoperative day.

INTRODUCTION

The thyroid gland is a ductless alveolar gland found in the anterior neck just below the laryngeal prominence. It is roughly butterfly-shaped, with two lobes wrapping around the trachea & connected in the middle by an isthmus. The thyroid gland is an essential organ of our body which manages multiple metabolic processes in the body. The thyroid gland is one of the main regulators of metabolism. Tri-iodothyronine (T3) and Tetra-iodothyronine (T4) hormones, produced by thyroid gland, typically act via nuclear receptors in the target tissues and initiate a variety of metabolic pathways. High levels of them typically cause these processes to occur faster and more frequently. Metabolic processes increased by thyroid hormones include Basal Metabolic Rate (BMR), Gluconeogenesis, Glycogenolysis, Protein synthesis, Lipogenesis and Thermogenesis.

There are usually four parathyroid glands two on each side, one superior and another inferior. Once the dissection of the posterior aspect of the thyroid lobe begins, the surgeon and assistants should be vigilant in identifying the parathyroid glands. The superior parathyroid gland can often be found above the tubercle of zuckerkanndl and can also be found adjacent to the superior pole. The inferior parathyroid gland is usually located in a 1cm radius around the inferior pole of the thyroid gland and almost always anterior to the plane of the recurrent laryngeal nerve. After identifying the glands, they should be carefully dissected from the thyroid and left in the thyroid bed. The parathyroid glands produce parathyroid hormone (PTH), which regulates blood calcium levels. Low blood calcium levels cause the production and secretion of PTH. Parathyroid hormone (PTH) has three main actions, all of which act to **increase calcium** levels in the body;

- **Increased bone resorption:**- PTH acts directly on bone to increase bone resorption. It induces cytokine secretion from osteoblasts that act on osteoclast cells to increase their activity. Osteoclasts are responsible for the breakdown of bone and thus an increase in their activity leads to increased bone break down. This leads to an increase in calcium in the extracellular fluid.
- **Increased reabsorption in the kidney:**- PTH increases the amount of calcium absorbed from the Loop of Henle and distal tubules. Additionally, PTH increases the rate of phosphate excretion which is very important to prevent to formation of calcium phosphate kidney stones.

- **Vitamin D synthesis:**- Although PTH does not actively increase the absorption of calcium from the gut it stimulates the formation of vitamin D, which subsequently increases absorption from the gut.

One of the major indications for thyroidectomy is a diagnosis of thyroid cancer.¹ Thyroidectomy is also a viable option for patients with symptomatic thyroid masses or goiters. Patients who have compressive symptoms including dysphagia, dyspnea, shortness of breath, and/or hoarseness of voice due to a large goiter should undergo a thyroidectomy. Aesthetic concerns due to a goiter may be an indication for thyroidectomy. Another indication includes patients with medically refractory Graves disease or hyperthyroidism.²

There are certain complications of total thyroidectomy which include the following:

- Hypocalcemia secondary to hypoparathyroidism,
- Injury to the recurrent laryngeal nerve,
- Injury to the superior laryngeal nerve,
- Neck hematoma,
- Infection,
- Thyrotoxic storm.

Hypocalcemia secondary to hypoparathyroidism is one of the common complications after total thyroidectomy, which may cause uncomfortable symptoms that result in longer hospital stays and ongoing laboratory symptoms.³ Immediate postoperative course reported rates of transient hypocalcemia vary in the literature from between 5-50%, but the rate of permanent hypocalcemia secondary to hypo parathyroidism (i.e., lasting more than 6 months) is between 0.5-2%. The pathophysiology behind transient hypoparathyroidism and hypocalcemia is not well understood but is thought to be related to a transient ischemia to the parathyroid glands or perhaps an increased release of the acute phase reactant endothelin-1.³

Patients may initially be asymptomatic. The classic presenting symptoms of hypocalcemia include numbness and tingling of the digits or perioral area, carpopedal spasm, or the presence of a Chvostek sign or a Trousseau sign. In severe cases, patients may also experience tetany, EKG changes (QT prolongation), seizures, mental status changes, or cardiac arrest secondary to hypocalcemia. The Chvostek sign can be reproduced by tapping on the face just anterior to

the ear, causing contraction of the ipsilateral facial muscles. A patient with a positive Trousseau sign will have spasm of the wrist, fingers, or thumb with inflation of a sphygmomanometer above the systolic blood pressure. Either sign is indicative of neuromuscular excitability associated with hypocalcemia.

Patients who are noted to have postoperative hypocalcemia can be managed with calcium supplementation. By following the trend of serum calcium levels, oral calcium supplementation can be titrated accordingly. If patients are receiving 2 grams of elemental calcium and continue to have decreasing or low serum calcium, calcitriol supplementation between 0.25-1mcg per day can be considered. Additionally, intravenous calcium replacement may be necessary for patients refractory to oral management or those with severe symptomatic hypocalcemia. Patients who develop hypocalcemia can be discharged with calcium and vitamin D supplementation and if necessary calcitriol supplementation. After a few months, weaning from the calcium supplementation can be considered.

AIMS AND OBJECTIVES

AIM:

- To study the post-operative hypocalcemia after total thyroidectomy.

OBJECTIVES:

- To estimate the incidence of hypocalcemic symptoms during first three post-operative days of total thyroidectomy with or without neck dissection.

MATERIALS AND METHODS

Study Design: A Hospital-based Prospective Observational Study was undertaken in the Department of Otorhinolaryngology and Head and Neck surgery, Government SMHS Hospital Srinagar, which caters patients from whole of Kashmir division.

Study Period: The study was done for a period of 18 months from May 2019 up to October 2020.

Study participants: All the patients undergoing total thyroidectomy in the Department during the study period.

Inclusion Criteria:

- All the patients undergoing total thyroidectomy for various causes with or without neck dissection.

Exclusion criteria:

- Patients having hypocalcemia prior to thyroidectomy.
- Patient with such co-morbidities which might influence the serum calcium level.

Sample size estimation: No predetermined sample size was planned. All the participants who fulfilled the inclusion & exclusion criteria and underwent total thyroidectomy within the said period were included.

Selection of sample and data collection: All the patients who were scheduled for total thyroidectomy during the study period were assessed for inclusion & exclusion criteria and those found eligible were included in the study. Written and Informed consent was obtained from patients before enrolling them into the study. A clearance from the ethical committee of Government Medical College Srinagar was obtained prior to the start of study. The participants were assessed at base-line before surgery, during surgery and during first 3 days of post-operative period.

Statistical Analysis: The data was entered in the Microsoft excel 2007 and analyzed using SPSS v23. Categorical variables were described as Frequencies & Percentages while as continuous variables were described as Mean & Standard Deviation. Appropriate statistical tests were used when required. A p Value of less than 0.05 % was considered to be statistically significant.

OBSERVATIONS & RESULTS

Table 1. Distribution of study participants according to gender:

Gender	Frequency	Percent
Male	7	18.9
Female	30	81.1
Total	37	100.0

More than fourth-fifth of study participants were females.

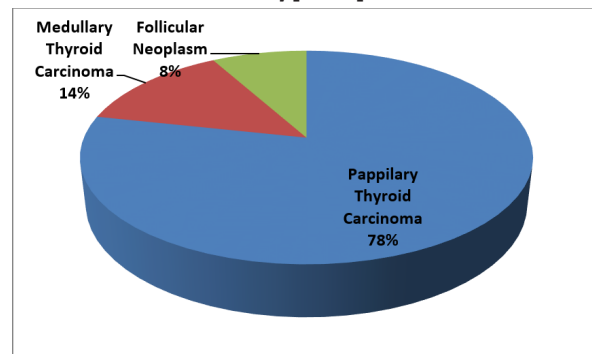


Figure 1. Pie chart showing distribution of different types of cancers among study participants.

Table 2. Distribution of type of surgery among study participants:

Type of surgery	Frequency	Percent
Total thyroidectomy	14	37.8
Total thyroidectomy with Neck dissection	23	62.2
Total	37	100.0

Table 3. Distribution of study subjects according to age group:

Age Group	Frequency	Percent
<20 Years	7	18.9
21 to 30 Years	9	24.3
31 to 40 Years	8	21.6
41 to 50 Years	6	16.2
51 to 60 Years	5	13.5
> 60 Years	2	5.4
Total	37	100.0

Table 4. Distribution of study subjects according development of symptoms of hypocalcemia:

Symptoms of Hypocalcemia	Frequency	Percent
No symptom	17	45.9
Symptoms developed	20	54.1
Total	37	100.0

54 % patients developed Symptoms of Hypocalcemia within three postoperative days.

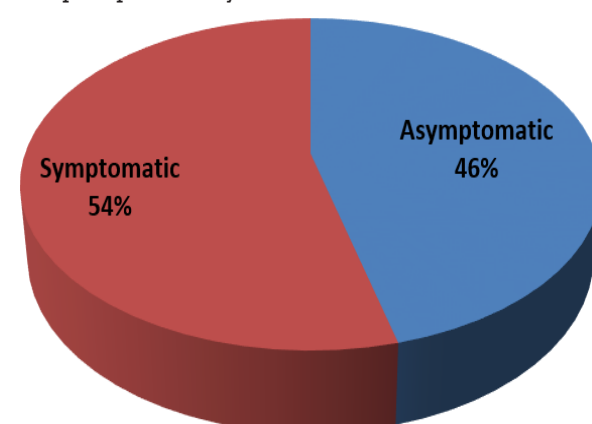


Figure 2. Pie chart showing distribution of study subjects according development of symptoms of hypocalcemia.

Table 5. Distribution of study subjects according development of symptoms of hypocalcemia at different Post-operative days:

Symptoms of Hypocalcemia a	At 1st Post-operative Day		At 2nd Post-operative Day		At 3rd Post-operative Day	
	Freque ncy	Percent	Freque ncy	Percent	Freque ncy	Percent
Asymptomatic	27	73.0	29	78.4	31	83.8
Symptomatic	10	27.0	8	21.6	6	16.2
Total	37	100.0	37	100.0	37	100.0

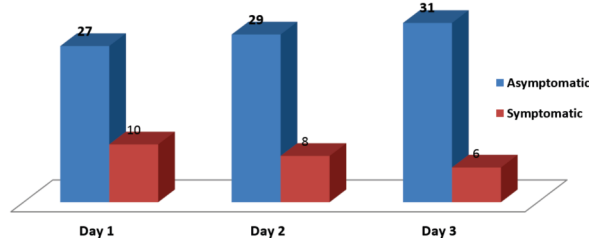


Figure 3. Bar chart showing symptoms of hypocalcemia at different Post-operative days.

DISCUSSION

The thyroid gland is one of the main regulators of metabolism. The parathyroid glands are small structures located on the posterior aspects of thyroid gland lobes. These glands produce parathyroid hormone (PTH), which regulates blood calcium levels. Parathyroid hormone (PTH) has three main actions, all of which act to **increase calcium** levels in the body. **These actions include Increased bone resorption, Increased reabsorption in the kidney & Vitamin D synthesis.** One of the serious complications of thyroidectomy is hypocalcemia secondary to damage to parathyroid glands. This prospective observational study was conducted to assess the incidence of symptomatic hypocalcemia after total thyroidectomy.

A total of 37 eligible participants were included & followed in the study. More than fourth-fifths (81%) of study participants were females. Majority of patients were Pappillary Carcinoma Thyroid (78.4%) followed by Medullary Carcinoma Thyroid (13.5%). Neck dissection was performed in 62% of cases. Majority of cases were in the age-group of 21 to 30 years followed by 31 to 40 years (24.3% & 21.6% respectively). The Serum Calcium level at first, second & third post-operative day was 8.18±0.84, 7.88±1.03 & 7.97±0.95 mg/dl respectively. 54 % patients developed symptoms of hypocalcemia within one of the first three postoperative days with majority of them developing it on first postoperative day. In our study 81% of study participants were females. Many similar studies showed similar female preponderance among patients undergoing total thyroidectomy.^{4,5} Chowdury AK etal¹ had 70% of patients undergoing total thyroidectomy in their study as females. Randall L etal² had 81% of patients undergoing total thyroidectomy in their study as females in a total sample of 119567 thyroidectomies.

The most common indication for total thyroidectomy among the study participants was Pappillary Carcinoma Thyroid (78.4%) followed by Medullary Carcinoma Thyroid (13.5%). It is quite expected as the Pappillary Carcinoma Thyroid is the most common thyroid malignancy.

The incidence of hypocalcemic symptoms during first three post-operative days of total thyroidectomy with or without neck dissection was estimated to be 54%. 27% participants developed symptoms of hypocalcemia on first postoperative day, 21.6% developed symptoms on second postoperative day and 16.2% developed symptoms on third postoperative day. Many studies including Chowdury AK etal have demonstrated highest incidence of hypocalcemic symptoms

within first 24 hours after total thyroidectomy. It is proposed that during surgeries of thyroid gland there is partial compromise in the blood supply to parathyroid glands resulting into transient hypoparathyroidism & subsequent transient hypocalcemia. Immediate postoperative rates of transient hypocalcemia vary in the literature from between 5-50%.^{6,7,8,9,10,11,12}

The serum Calcium levels at first, second & third post-operative days were 8.18±0.84, 7.88±1.03 & 7.97±0.95 mg/dl respectively. As evident the mean serum Calcium level was less than the normal range during all the three days.

STRENGTHS AND LIMITATIONS OF THE STUDY

- In order to estimate the incidence of a disease we have to follow up the participants and look for the development of disease. Most of the studies conducted across the country were cross-sectional studies and would not give the actual incidence of the hypocalcemic symptoms. Our study is a longitudinal (follow up) study and will give the true incidence of hypocalcemic symptoms.
- There is no chance of selection bias in our study because we had no role in the admission of patients to the SMHS Hospital for thyroidectomy, and patients belonging to all strata of socio-economic status from all over the Kashmir get thyroidectomy at Department of Otorhinolaryngology and Head and Neck surgery, Government SMHS Hospital Srinagar.
- Our study has less power due to a small sample size. We could not take a bigger sample size because of the fact that due to the Pandemic of Covid-19 & some local law & order issues, lesser number of patients than expected were operated for Thyroidectomy during the study period.

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