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# Predictors of Hypocalcaemia In Post Thyroidectomy Patients.

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**A B S T R A C T**

Thyroid disorders and surgical management for thyroid disorders are more common in any surgeons day to day life. In this modern medical era for every 3 hours one paper was presented about thyroid disorders. Post operative complications after thyroid surgery are variety and reported more frequently with budding and learning surgeons.

Hypocalcaemia after bilateral surgical resection of thyroid is a potential early complication. From 9.2% to 25% of transient hypocalcaemia are reported in literature and the incidence of permanent hypocalcaemia ranges from 0.5 to 2%. Even in experienced hands the incidence of early transient post thyroidectomy hypocalcaemia is quite significant, some studies shows up to 59%.



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## Introduction:

Post-operative hypocalcemia is a major concern following thyroid surgery.Decreased serum calcium, secondary to hypoparathyroidism, may present clinically with muscle cramps, perioral and peripheral paresthesias, carpopedal spasm or tetany, and/or confusion.

It often extends the duration of the hospital stay and the need for biochemical tests, when severe; it can lead to serious complications like laryngeal stridor and convulsions and require intravenous therapy to alleviate the clinical symptoms.

Depending on the extent of parathyroid gland damage following total thyroidectomy, hypocalcemia may be transient, resolving within a few months, or permanent, requiring lifelong oral calcium and vitamin D supplementation.

Many factors may be involved in the increased incidence of hypocalcemia and hypoparathyroidism after thyroidectomy, including total thyroidectomy, reoperation, neck dissection, preoperative hyperthyroidism and surgical procedure performed by inexperienced surgeons.

However, not all patients with these factors will develop such complication, probably because in order for it to happen, concur other causes, whose identification seems fundamental to its prevention. Rates of post total thyroidectomy hypocalcemia are approximately 5%; it resolves in 80% of cases in approximately 12 months.

A postoperative decrease of serum calcium is frequently observed within 2 to 5 days after a total or subtotal thyroidectomy, requiring exogenous replacement therapy to alleviate clinical symptoms.

To minimize complications and allow for early discharge, we must be able to identify cohort of patients who are likely to develop symptoms of hypocalcemia.

Those at risk would not be candidates for early discharge. Those identified at risk can be given Vitamin D and Calcium supplementation as needed.The purpose of this study is to evaluate calcium levels pre and post total thyroidectomy and provide a statistical analysis.

Thyroidectomy is one of the major and frequent operations performed in general surgical units. Dr. William Stewart Halsted said that "The extirpation of

thyroid gland typifies perhaps better than any operation the supreme triumph of the surgeon's art".

Thyroid disorders and surgical management for thyroid disorders are more common in any surgeons day to day life. In this modern medical era for every 3 hours one paper was presented about thyroid disorders. Post operative complications after thyroid surgery are variety and reported more frequently with budding and learning surgeons.

Hypocalcaemia after bilateral surgical resection of thyroid is a potential early complication. From 9.2% to 25% of transient hypocalcaemia are reported in literature and the incidence of permanent hypocalcaemia ranges from 0.5 to 2%.

Even in experienced hands the incidence of early transient post thyroidectomy hypocalcaemia is quite significant, some studies shows up to 59%.

Careful meticulous dissection to identify and sparing at least 2 parathyroid glands under direct vision is mandatory to avoid postoperative reduced calcium levels and its complications, some studies says that postoperative hypocalcaemia is more frequent following bilateral resection of lobes than unilateral 9% and 1.9% respectively.

Early recognition and prompt initial treatment of post thyroidectomy hypocalcaemia is crucial for successful outcome in the postoperative period following thyroidectomise.

There are many predictors are under study till now to establish an effective protocol to be followed in the postoperative period in the thyroidectomy surgeries to manage post thyroidectomy hypocalcaemia successfully.

But the availability of tests in small scale hospitals and the cost factor decides that serum calcium estimation post operatively is the most ideal tool for early diagnosis and management of post thyroidectomy hypocalcaemia.

**Objectives:**

1. To determine the incidence of hypocalcaemia following totalthyroidectomy - our institutional experience.
2. To study the prevalence of post thyroidectomy hypocalcaemia inresponse to age.
3. To study the various clinical presentations of post thyroidectomy hypocalcaemia.
4. Post thyroidectomy hypocalcaemia related to various pathological conditions of thyroid.
5. To correlate serum calcium level with clinical diagnosis.
6. To study the time of presentation of post thyroidectomy hypocalcaemia.

**Materials and Methods:**

**Source of data**:

- Prospective observational study.
- Cases for the present clinical study will be sourced from the patients aged 18-75 years admitted to the general surgical wards of Narayana Medical College &Hospital, Nellore during the period from December 2016 to October 2018 and undergoing total thyroidectomy procedure.

**Review of Literature:**

Overall incidence of hypocalcaemia after total thyroidectomy was 23.6% and that of permanent hypocalcaemia was 1.61%. Onset was delayed up to 3rd postoperative day in 13 % patients.

Hypocalcaemia was significantly associated with thyroidectomy for Grave's Disease, Hashimoto's thyroiditis, and with incidental parathyroidectomy.

8% of patients following thyroidectomy developed postoperative hypocalcaemia, of which 16.6% were considered permanent.If total thyroidectomy was the procedure 15.8% of the patients devoloped hypocalcaemia and the other 5.4% were after subtotal thyroidectomy.

The hypocalcaemia was 11.4% in toxic goitre, 12% were malignant goitre and 3.6% were simple multinodular goiter. When preservation of parathyroid glands and their blood supply is enforced during thyroidectomy, the incidence of postoperative hypocalcaemia and permanent hypoparathyroidism can be consistently decreased.

Randall L. Baldassarre et al. Studied 119,567 patients who underwent thyroidectomy of which 5.5% developed hypocalcemia. Total thyroidectomy resulted in a significantly higher increased incidence (9.0%) of hypocalcemia when compared with unilateral thyroid lobectomy.

Thyroidectomy with bilateral neck dissection, the strongest independent risk factor of postoperative hypocalcemia resulted in an incidence of 23.4%. Patients aged 45 years to 75 years were less likely to have postoperative hypocalcemia compared with their younger and older counterparts.

Additional factors independently associated with postoperative hypocalcemia included female gender, non teaching hospitals, and malignant neoplasms of thyroid gland.

Salem Nourledine et. al. retrospectively studied 304 patients who underwent total thyroidectomies of which mild and significant hypocalcemia occurred in 68 (22.4%) and 91 (29.9%) patients, respectively.

They concluded that low postoperative levels of intact parathyroid hormone (IPTH), female sex and the presence of malignant neoplasm appear to predict hypocalcemia after total thyroidectomy. The percentage of patients requiringcalcium treatment was: 24 h (15%),2–7 days (26%), 8–180 days (33%), >1 year (9%).

The extent of surgery to central and or lateral neck lymph nodes is responsible for a high rate of transient hypoparathyroidism owing to a high probability of

unplanned parathyroidectomy or parathyroid gland devascularization.

Routine supplementation therapy with oral calcium or vitamin D effectively prevents symptomatic hypocalcemia after total thyroidectomy and may allow for a safe early discharge. The combination of oral calcium and vitamin D may further reduce the rate of post operative hypocalcemia, without inhibiting parathyroid hormone secretion.

Inpatients receiving calcium and vitamin D supplements, the decrease in serum calcium was less, and symptoms of hypocalcemia were minimized and no patient experienced a hypocalcemic crisis. By contrast, hypocalcemic symptoms were more severe in patients who had undergone CND but did not receive supplements.

Oral administration of 1 µg of calcitriol twice per day and 500 mg of calcium salts 3 times per day after total thyroidectomy significantly decreases the risk of severe postoperative hypocalcemia.

In a study conducted by Sakouti et. al. regarding the incidence of transient and permanent hypocalcemia after total thyroidectomy for thyroid cancer reveals higher incidence of hypocalcemia after total thyroidectomy in malignant diseases of the thyroid. The incidence increases more with surgeries combined with radical neck dissection.

The incidence of post-thyroidectomy hypocalcemia is more in the toxic thyroid diseases than non-toxic diseases; this also attributes to the extensive surgical dissection in the toxic disorders to avoid recurrence of the disease.

**Surgical anatomy and embryology of the thyroid gland:**

Surgeons should have in-depth knowledge of the surgical anatomy andembryology of the thyroid and parathyroid glands to apply it during thyroidsurgeries to avoid potential complications like hypocalcaemia.

At third week of intrauterine life thyroid is derived from endoderm of the 4thpharyngeal pouch.

It develops as a midline diverticulum from the foramen caecum anddescends downwards in a complex pathway, crosses hyoid anteriorly encirclingthe lower border of hyoid and takes a curve after touching the posterior surfaceof hyoid then descend downwards.

By 6 weeks of intrauterine life the central column of cells got reabsorbed and becomes thyroglossal duct which bifurcates to form thyroid lobes.The pyramidal lobe is a remnant of the thyroglossal duct which extends from foramen caecum to the isthmus seen inn 55% of patients.

Para follicular C cells derived from ultimobranchial bodies/ neural crestcells from 4th and 5th branchial pouch, they are more numerous in the upperthyroid lobes.Parathyroid glands and thymus develop from 3rd and 4th pharyngealpouches.(16)

Thyroid glands weighs about 10 to 20 gms in adults highly vascularendocrine gland of the human body next to adrenals, thyroid gland consists of 2lobes and isthmus it is located in the anterior triangle of the neck deep to theinvesting layer of deep cervical fascia, lateral lobe was in relation to the tracheoesophageal groove medially and carotid sheath laterally, and sternocleidomastoid , sternohyoid, sternothyroid, superior belly of omohyoidwas in relation to the anterior and lateral surfaces, thyroid disorders such asmalignancy , thyroiditis, goitre, previous surgery in the neck, previous irradiation in the neck can considerably alter the normal anatomy of the gland.(17)

**Tubercle of Zuckerkandl:**

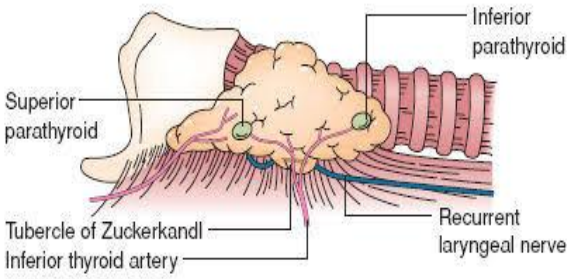



**Figure 1:** Tubercle of Zukercandl

It is an extension of thyroid gland on the posterior aspect of both lateralthyroid lobes, it is important due to recurrent laryngeal nerve is in posteriorrelation to this tubercle, surgeon can use this landmark to identify this nerve, insome studies this tubercle is in deep relation to recurrent laryngeal nerve, thisvariation may mislead surgeon and resultant injury to the nerve is disastrous.

**Blood supply:**

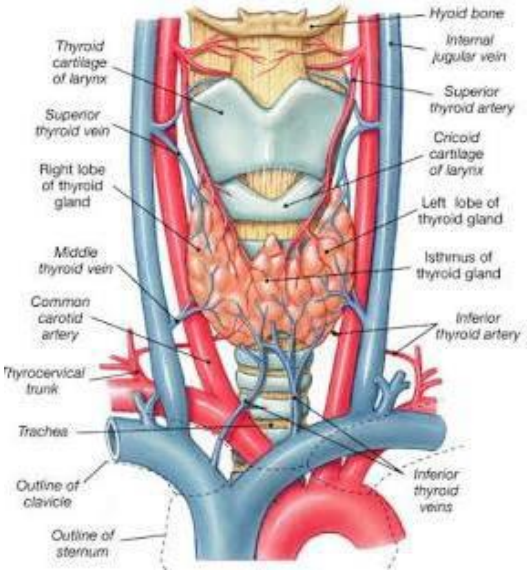



**Figure 2:** Blood supply of thyroid gland.

Arises from the external carotid artery. It is parallel to the course ofexternal laryngeal nerve. In order to avoid external laryngeal nerve injury,superior pedicle to be lIgated near the gland. The corresponding vein drains into the internal jugular or common facial vein. Terminal posterior branch ofsuperior thyroid artery contribute some blood supply to the parathyroid glands.In a study 67% of superior parathyroid supplied by single vessel, 33% suppliedby 2 or more vessels.

**Artery supplying to the inferior pole of thyroid:**

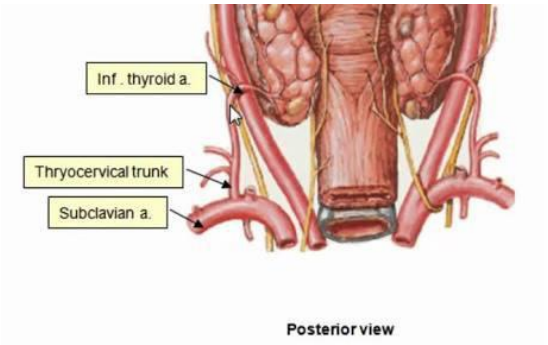



**Figure 3:** Inferior pole of thyroid.

Derived from the thyro cervical trunk, but in 15% arises from the subclavian artery. Multiple terminal branches of this vessel is in relation to therecurrent laryngeal nerve, in order to avoid injury to the vessel we should ligatethe inferior thyroid pedicle away from the gland, it is the major blood vessel toparathyroid glands. It supplies inferior and superior parathyroid glands. Ligationof the artery supplying inferior pole of thyroid bilaterally results in permanent hypoparathyroidism, hence studies suggested that identifiy and ligate these vessels seperately by 3 to 4 times near the capsule.

Thyroid ima artery arises from the brachiocephaic trunk or aorta supplying lower part of isthmus.Vein draining the inferior pole of thyroid is the largest, variable andasymmetric bilaterally and drains in to brachiocephalic vein on either side.

**Middle thyroid vein**

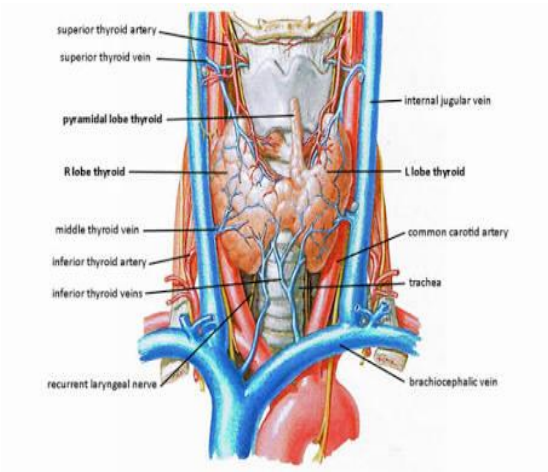


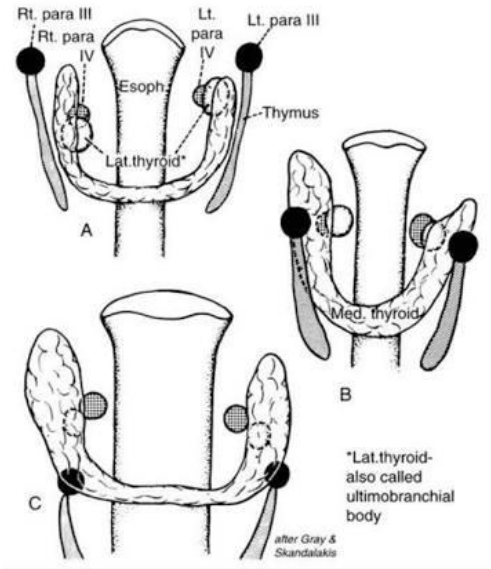

**Figure 4:** Veins of thyroid.

Middle thyroid veins are short and stubby and drains in to internal jugularvein.

Kochers vein is a rare variation found between middle and inferiorthyroid vein.

Variations of vessels supplying thyroid gland like double vessels, alteredcourse or absence may result in complications like post thyroidectomy ischemic necrosis of parathyroids, torrential bleeding or hematoma.

**Embryology and surgical anatomy of Parathyroid Glands:**



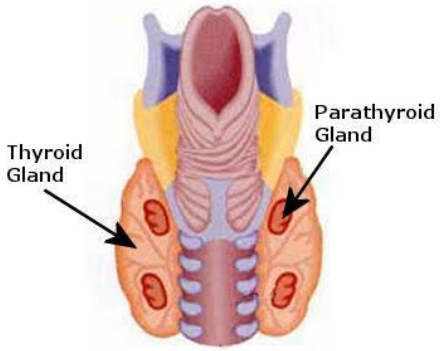




**Figure 5:** Development of Parathyroid glands.

Develops during the 5$^{th}$ and 6$^{th}$ week of intrauterine life. They developas epithelial thickening of the dorsal endoderm of 3rd and 4th bronchial pouches. The inferior parathyroid is derived from the 3$^{rd}$ pouch. Ondevelopment it subsequently migrates along with the thymus to the inferiorposition and becomes the inferior parathyroid gland. In some variants itdescends along with thymus into the mediastinum. So it's position is variable,developmental anomalies like variation in the location, number can be seen.

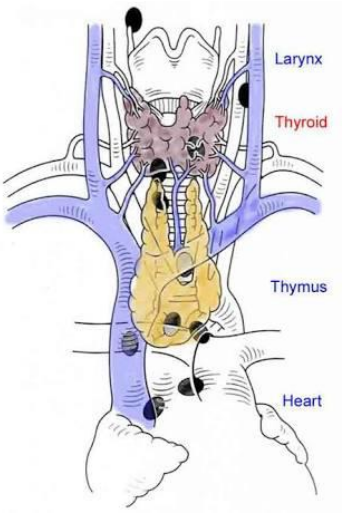



**Figure 6:** Variations of position of parathyroid.

They are seen in the posterior surface of thyroid gland having aconnective tissue capsule and having separate blood supply. It appears goldenyellow to light brown in colour, sometimes parathyroid may be seen within the capsule of thyroid.

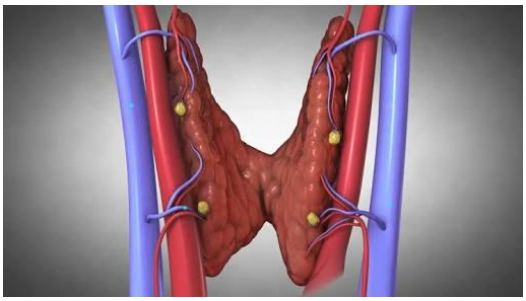


**Figure 7:** Parathyroids and its blood supply.

Libutti et al in his study reported that 7% incidence of intrathyroidal parathyroid gland and advised careful ultrasonographic location of parathyroids before proceeding for thyroidectomy. The surgeon should search superior parathyroids 2.5 cm above the junction of inferior thyroid artery and lower poleof thyroid gland and 2.5 cm below this point look for inferior parathyroids.

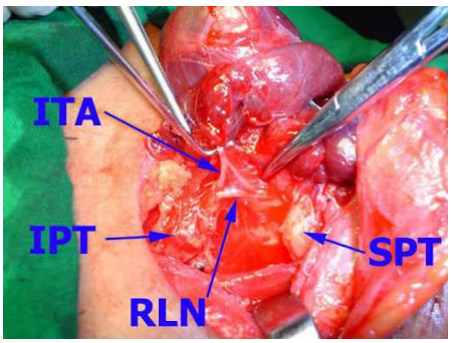



**Figure 8:** Parathyroid on surgical field.

Variations like absent parathyroids have been reported and such cases can result in hypoparathyroidism after thyroidectomy with even injuy to singlegland of parathyroid.

For locating parathyroid glands in operating table we can use methyleneblue. On table measurement of parathormone levels can be used as predictor of hypocalcaemia after surgery.

**Histology:**

Principle cells or chief cells secretes parathormone, neoplastic glands may show water clear cells.

**Calcium metabolism:**

Few words about calcium levels in various organs of body and how theyare regulated.

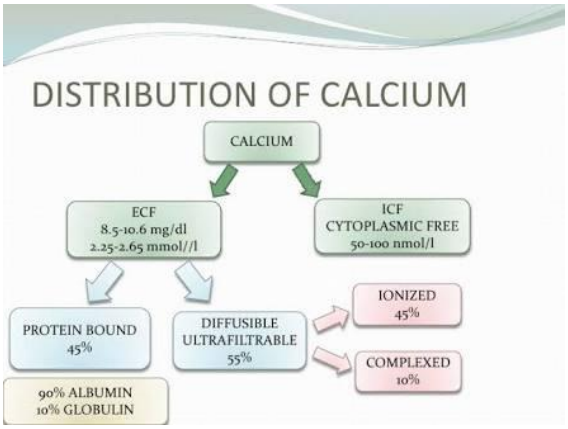



**Figure 9:** Calcium distribution.

Blood plasma calcium levels are maintained in very narrow limits. Slightchanges can result in hypo or hyper calcaemia.

An average adult human contains about 1 kilogram of calcium of whichmajority is in the form of skeletal calcium phosphate.

ECF contains 23 mmol of calcium of which 9 to 11 mmol are in theplasma.

ICF contains very minimal or negligible calcium.

It is on regular feedback control involving two major hormones parathormone secreted by parathyroid glands and calcitonin secreted by parafollicular C cells of thyroid and Vitamin D.

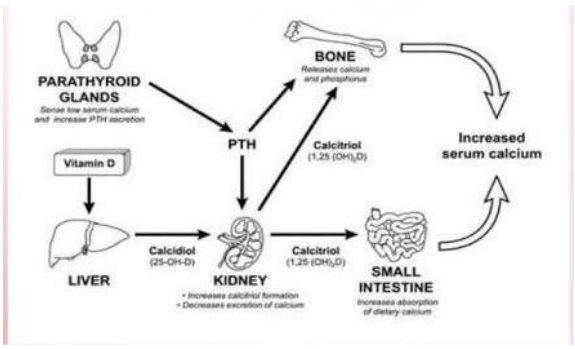



**Figure 10:** Calcium metabolism.

**Parathyroid hormone:**

Parathormone is a peptide containing 84 aminoacids. It's secretion isregulated by serum calcium and magnesium. Parathormone secretion is notunder the control of pituitary gland. Stimulating factors are hypercalcemia and hypomagnesemia.

**Action of Parathormone:**

1. It causes mobilisation of calcium out of the bone.
2. It causes increased absorption of calcium from the kidney.
3. It causes increased excretion of phosphate in the kidney.
4. It increases absorption of calcium from the GIT.

In overall Parathormone cause increase in serum calcium level.

Parathormone action is balanced by calcitonin.

**Few important functions of calcium:**

1. For optimal functioning of clotting factors.
2. Neurotransmission regulation by preventing the leaking of sodium into theneural axons.
3. Major supporting material in skeletal system.
4. Act as a effective 2nd messenger in muscle contraction.
5. 2nd messenger in releasing insulin from pancreas.

**Normal range of calcium:**

Total calcium 2.2 to 2.6 mmol/lit (9 to 10.5mg/dl). Ionised calcium 1.3 to 1.5 mmol/lit( 4.5 to 5.6mg/dl).

Amount of total calcium altered with serum albumin levels.

Ionised calcium is not associated with serum albumin level. So estimation of ionised calcium is more precious than total calcium in hypocalcaemia. But in normal serum albumin levels total calcium level will also reflect biological effects of calcium.

**For calculation of corrected calcium:**

Corrected calcium (mg/dl) = measured total calcium in mg/dl+ 0.8(4.0-serum albumin in gm/dl)

**Absorbtion of calcium:**

Calcium is absorbed in intestine and bound to calbindin. It is transferred into endoplasmic reticulum of intestinal epithelial cell. From there PMCA1calcium pump transport it into the body. Active transport and major transport occurs in the duodenum. Passive occurs in the jejunum and ileum, Absorptionof calcium is regulated by calcitriol in the blood(vit-D).

Due to the parathyroid stimulation cholicalciferol converted into 1-25dihydroxycholicalciferol in kidney which regulates absorption of calcium in the gut.

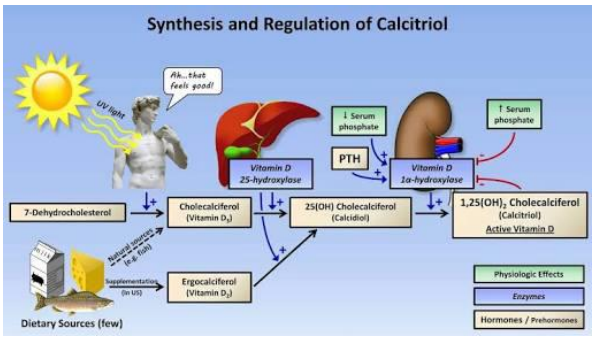



**Figure 11:** Action of Vitamin D.

**Hypocalcaemia:**

Acute hypocalcaemia may endanger the life, so close monitoring in the post operative period, early identification of signs and symptoms of hypocalcaemia and effective replacement management is crucial in the management of post thyroidectomy hypocalcaemia

**Definition of hypocalcaemia**

- Serum calcium level lower than 8.2 mg/dl (2.05mmol/lit)
- Ionised calcium level lower than 4.4mg/dl (1.1mmol/lit)

**Signs and symptoms of hypocalcaemia:**

**1. Neurological disturbances:**

- Seizures
- Dementia
- Emotional problems like
- anxiety/depression.
- Chovestek sign- Tapping at the angle of jaw over the course of facial nerveproduces twitching of facial muscles which are supplied by it.

**Figure 12:** Elicitation of Chovestek sign.

- Trousseaus sign- Induced carpopedal spasm by increasing thepressurein blood pressure cuff wrapped around the arm.


**Figure 13:** Elicitation of Trousseaus sign.

- Parasthesia over extremities.
- Parasthesia in the perioral region.
- Myalgias and muscle spasms.
- Tetany-or carpopedal spasm
- Thumb in palm deformity or obstetricians hand.

**Figure 14:** Carpopedal spasm.

**2. Cardiovascular disturbances:**

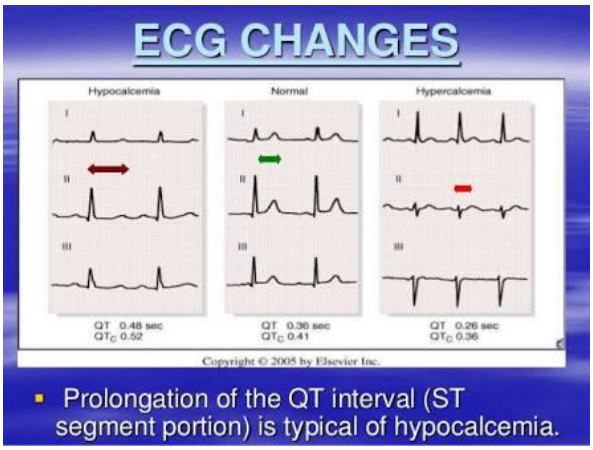



**Figure 15:** ECG changes of hypocalcaemia.

- Pprolonged QT interval.
- Hypotension.
- Cardiac failure.

**3. Autonomic disturbances:**

- Biliary colic.
- Bronchospasm.
- Diaphoresis.

**Classification of hypocalcemia:**

**Based on symptoms:**

1. Asymptomatic
2. Moderate hypocalcemia with numbness, tetany, chovestek sign, trousseau sign
3. Severe hypocalcemia with ecg,changes U waves, QT prolongation or bronchospasm.[24]

**Based on duration:**

1. Temporary hypocalcaemia - Less than 6 months duration.
2. Permanant Hypocalcaemia- More than 6 months.

**Management of Hypocalcaemia:**

For asymptomatic hypocalcaemia per oral replacement of calciumstarting with the low dose and titrate according to 24 hours serum calciumassessment.

For moderate hypocalcaemia, patient can be treated in general ward withinitial high dose of oral calcium along with calcitriol supplementation 0.5microgram daily.

For severe hypocalcaemia, patient treated in Intensive care unit with intravenous calcium gluconate 10ml diluted in 100ml normal saline over15mins slow iv and frequent monitoring of serum calcium levels and continuous cardiac monitoring. Once normocalcaemia level reached then with over to oral calcium supplementation with Vit D.

**Thyroidectomy:**

After putting the patient in semi fowler position with hyperextension ofneck with a sandbag and head support with a ring.

Prepare the patients neck with betadine and spirit as per the institutional protocol.

Mark the incision line by 2-0 silk in the lower skin crease.

By lower collar skin crease incision or kochers incision skin, subcutaneous tissue and platysma is divided in the same line.

After establishing good control of bleeding superior and inferior flaps areraised.

Superior flap raised up to superior border of thyroid cartilage and inferiorflap raised up to sternal notch for exposing the field adequately. Small incisions and inadequate raising of flaps and inadequate exposure of field may result in difficult dissection or bleeding and disturbance toparathyroid blood supply.

Open the deep fascia in the midline vertically, retract the strap muscleslaterally, in some cases with huge thyroid swelling may need division of strapmuscles for better exposure.

To avoid injury to the ansacervicalis always divide the strap muscles on its upper half.

After thorough examination of the pathology of the thyroid gland, and parathyroid glands position retract the lobe of the thyroid medially and above in order to taut the middle thyroid vein, careful dissection should be made toligate this vein.

Identify and protect the parathyroids intraoperatively by its typical colour.

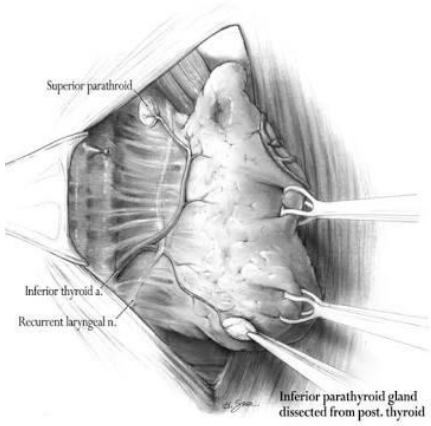



**Figure 16:** Exposing Parathyroids during surgery.

Ligate the inferior thyroid artery branches after identifying the recurrentlaryngeal nerve using 3 to 4 separate clamps close to the capsule leaving behind the vessels supplying parathyroids.

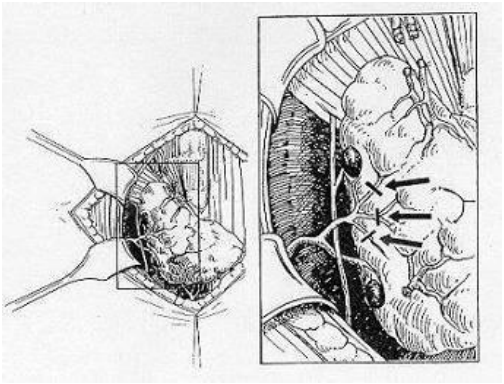


**Figure 17:** Ligation of inferior thyroid artery.

Carefully ligate the vessels supplying the upper pole after carefuldissection near the gland.

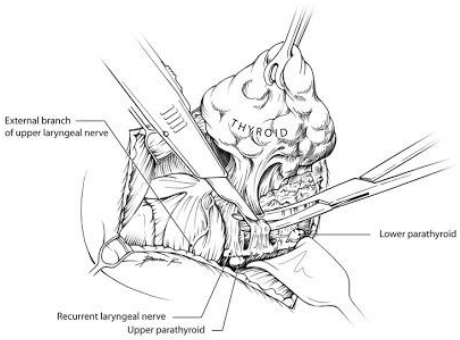



**Figure 18:** Dissection in the field.

Blunt dissection made to separate the lobe from trachea, andunderlying ligaments and vessels ligated and divided.The same procedure to be repeated on the opposite side.

Carefully divide the attachments between the isthmus and tracheaand don't forget to look for pyramidal lobe or aberrant thyroids to avoid resurgeries which may be a high risk for post operative hypocalcaemia, After achieving complete haemostasis wound should be closed in layers leavinga glove drain in situ as per the institutional protocol.

**Complications of Total Thyroidectomy:**

1. Wound hematoma
   - Early life threatening complication.
   - Resulting in airway obstruction.
   - May need immediate surgical intervention.
2. Hypocalcemia
   - May be temporary or permanent.
   - Need early diagnosis and prompt treatment.
3. Seroma collection.
4. Infection.
5. Hypertrophic scar or keloid.
6. Recurrent laryngeal nerve palsy.
7. Superior laryngeal nerve palsy.
8. Horners syndrome.
9. Chyle leak.
10. Loss of voice.
11. Tracheomalacia.
12. Hypothyroidism.
13. Airway obstruction.

**Post thyroidectomy complications incidence are increased with:**

1. Extent of the disease (large size).
2. Extent of the surgery (long duration and difficult recovery from anaesthesia).
3. Reoperative surgeries done for recurrent diseases.
4. Extra thyroidal extension of diseases.
5. Surgeries combined with neck dissection.
6. Reexploration for post operativehematoma

**Some Predictors of Post Thyroidectomy Hypocalcemia:**

1. Regular preoperative and post operative serum calcium estimation.
2. Intraoperative and postoperative parathyroid hormone level estimation.

**Parathormone as a predictor:**

Perioperative and peroperative estimation of parathyroid hormone level inblood is a well documented predictor of post thyroidectomy hypocalcaemia inliterature (fewins J et al).

For that parathormone estimation was done intra operatively and 1 hour and 24 hours after surgery.

A fall in parathormone level immediately after surgery that is 1 hour and continuing fall in 24 hours is strongly associated with hypocalcaemia (lam and ker et al).

Parathormone level 8 picogram/ml associated with hypocalcaemia and more than 9 picogram/ml does not produce hypocalcaemia. But the availability of this test and the cost are the limiting factors in low scale hospital setups.

**Calcium as predictor:**

Various studies regarding serial calcium estimation and analysis postoperatively and the prediction value of post thyroidectomy hypocalcaemiashows varying results.

But the cost factor of the parathormone estimation may necessitate theuse of calcium estimation even in small health care delivery systems.In a study conducted by (ancutaleahu et al) shows patient with positivecalcium trend such that, rise of postoperative calcium levels on serial estimation shows normocalcaemic pattern and excludes hypocalcaemia successfully in 96.2% of patients.

The same study shows the patients with negative calcium trend like that aserial fall in serum calcium level after thyroid surgeries may result inhypocalcaemia in 51.6% of patients.

From this pattern of results he concluded, positive calcium trend patientscan be discharged earlier without the fear of hypocalcaemia and patients withnegative calcium trends should be monitored some more days forhypocalcaemia or starting oral supplementation of calcium.

**Prevention of post thyroidectomy hypocalcemia:**

In order to prevent Post Thyroidectomy Hypocalcaemia, the surgeon must have adequate knowledge about surgical anatomy and embryology of thyroid and parathyroid glands.

The surgeon and anaesthetist team should have a good rapport in order to give pleasant and smooth anaesthesia during surgery and during recovery. Cuff of endotracheal tube must be smaller in size in order to avoidlaryngeal edema.

The surgeon must ensure good exposure of the operating field with good light source. Perfect haemostasis to be maintained for identification of parathyroids in the operating field with naked eyes.

Meticulous dissection to be done throughout the procedure. Prompt recognition of parathyroids by its size, colour and location or some other protocols according to the institution like methylene blue dyedetection in the field.

Carefully identify and protect the blood supply to the parathyroids. To preserve the blood supply of parathyroids the surgeon should ligateinferior thyroid artery at its terminal branch level.

Avoid parathyroid hematoma.

Avoid excessive suction in the field.

In case of accidental injury to parathyroid glands or its blood supply resulting in colour change, do immediate parathyroid auto transplantation in thesame side sternocleidomastoid.

In case of accidental parathyroid hematoma noted by its bulge and congested appearance, don't hesitate to open the capsule of parathyroid by smallincision and note the perfusion of the gland by its colour change. If the perfusion of the gland is doubtful don't hesitate to do parathyroidauto transplantation. Close postoperative follow up and early diagnosis and management also play a crucial role in post thyroidectomy hypocalcaemia.

**Parathyroid Auto Transplantation:**

Accidental removal of parathyroid glands during thyroid surgery may result in temporary or permanent hypocalcemia. In order to prevent this potential life threatening complication, somestudies suggested that immediate auto transplantation of parathyroid glands onthe operating table in the sternocleidomastoid muscle is recommended (TestinyM et al).

It is performed on table whenever a surgeon identifies a devascularised parathyroid gland. Parathyroid auto transplantation was described by F.H. Lahey in 1926.Delayed auto transplantation surgeries can be done after cryopreservation of parathyroid gland in the post operative period.

It can be preserved up to two years. But the success rate of immediate auto transplantation is higher than delayed transplantation 85 to 99% in immediate to 71% in delayed respectively. Parathyroid auto transplantation is highly recommended in completion thyroidectomies, huge nodular goitre, radical head and neck surgeries, totalthyroidectomy with radical neck dissection (testini M et al).Parathyroid auto transplantation reduces the risk of permanent hypocalcaemia.

So inadvertently removed parathyroid glands during complicated necksurgeries should be auto transplanted in the ipsilateral sternocleidomastoid.

The operating surgeon must carefully examine the resected thyroid on table to identify any accidentally removed parathyroid gland as a routine procedure for parathyroid auto transplantation.

Specimen examination on table may show congested or ischemicparathyroids is treated with incision of the capsule of the parathyroid to preventnecrosis.

If the colour is satisfying after this procedure leave it as such or transplant it to the same side sternocleidomastoid.

Some surgeons prefer routine parathyroid auto transplantation in all totalthyroidectomy patients to avoid lifelong replacement of calcium.

**Method of collection of data:**

Consecutive cases undergoing total thyroidectomy in Narayana Medical College &Hospital, Nellore will be selected for the study.

a. Direct interview with the patient and obtaining a detailed history regarding age, sex, symptoms and thorough clinical examination.
b. Pre operative investigations: Serum calcium, Thyroid profile, FNAC, USG of neck, serum albumin levels.
c. Post operative investigations including serum calcium, albumin levels at day 1, day 2 and day 5 post-op & Histopathological examination of the specimen.
d. Following parameters considered for statistical analysis: age, gender, final diagnosis, HPE (benign or malignant), principal procedure, presence and number of parathyroid glands in surgical specimen sent for histopathological examination if detected.
e. All the cases will be followed upto discharge.
f. Hypocalcaemia diagnosed when serum corrected calcium level dropped below 8mg/dL.
g. Corrected Calcium level = [0.8 X (normal albumin - patient's albumin)] + serum Calcium level. (Normal albumin: 4 g/dl )

**Inclusion criteria:**

Patients aged more than 18 (18-75) years of age including both genders admitted and positively diagnosed as having thyroid swellings requiring total thyroidectomy and willing for surgery.

**Exclusion criteria:**

- Previous thyroid operation or irradiation.
- Concomitant parathyroid diseases.
- Complications which cannot be attributed to surgery due to natural course of the disease.
- Thyroid lobectomy, isthmectomy and hemithyroidectomy.
- Patient already on calcium supplementation.

**Results:**

In this study we followed 51 patients who were undergone totalthyroidectomies on various indications.

These patients are selected from, patients undergoing total thyroidectomies in 1st surgical unit, Narayana medical college and hospital from the period of December 2016 to October 2018, after meticulous history taking and fulfilling the inclusion and exclusion criterias mentioned in this study proposal. After thorough history taking we excluded patients undergoing surgeries other than total thyroidectomies like hemithyroidectomy near total and sub total thyroidectomies, in the age group of above 18 years.

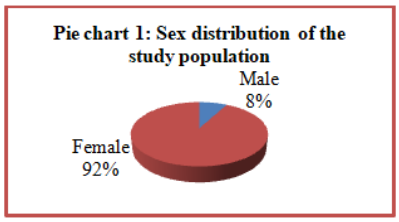
We excluded patients with preoperative altered calcium levels in order to avoid previous altered parathyroid functions and excluded patients with previous history of radiation and also excluded patients already on calcium supplementation.

We followed all patients met our study criteria with serial estimation of serum calcium levels post operatively by day 1, day 2 and day 5 and also records history about various presentations of postoperative hypocalcaemia like perioral numbness, carpopedal spasm, trousseau sign, chovestek's sign, ECG changes of hypocalcaemia and other neurological symptoms.

**Description of study population:**

**Table 1:** Sex distribution of the study population

| Sex of the study population | No of patient |
|---|---|
| Male | 04 |
| Female | 47 |
| **Total** | **51** |



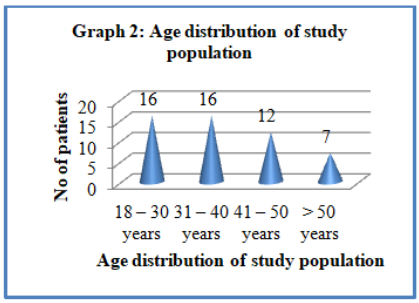

In this study we followed 47 female patients and 4 male patients underwent total thyroidectomy.

**Age distribution of study population:**

We categories the study population according to the distribution of age in to four groups.

**Table 2:** Age distribution of the study population

| Age distribution of study population | No of patients |
|---|---|
| 18 – 30 years | 16 |
| 31 – 40 years | 16 |
| 41 – 50 years | 12 |
| > 50 years | 07 |
| **Total** | **51** |

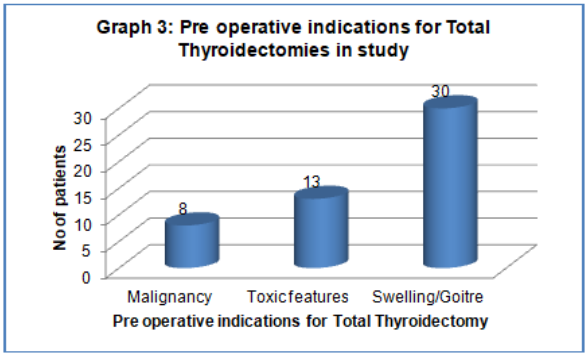



16 patients fall in the group 1, 16 patients fall in the group 2, 12 patients fall in the group 3 and 4 patients fall in the group 4.

**Table 3:** Pre operative indications for total thyroidectomy in study population

| Pre operative indications for Total Thyoidectomy | No of patients |
|---|---|
| Malignancy | 08 |
| Toxic features | 13 |

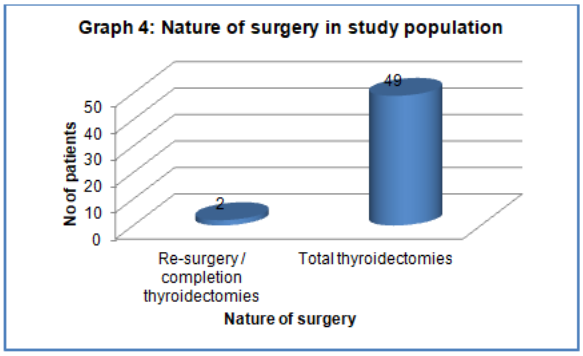
| | |
|---|---|
| Swelling/Goitre | 30 |
| **Total** | **51** |




According to preoperative indicators of thyroidectomy of these 51 patients, 8 patients are posted for thyroidectomy for suspecting malignancy, 13 patients are posted for thyroidectomy for toxic features after controlling toxicity, 30 patients are posted for thyroidectomy for complaints like swelling or goiter or pressure effects.

**Table 4:** Nature of surgery in study population

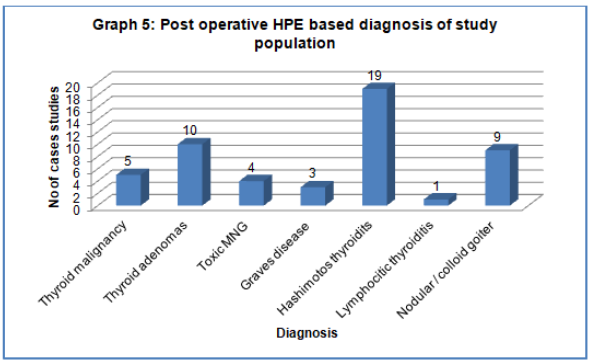
| Nature of surgery | No of patients |
|---|---|
| Re-surgery / completion thyroidectomies | 02 |
| Total thyroidectomies | 49 |
| **Total** | **51** |




Of these 51 total thyroidectomies 2 patients are posted for completion thyroidectomy (re surgery) followed after previous hemithyroidectomy or subtotal thyroidectomy with preoperative benign FNAC report and postoperative histopathological finding shows papillary malignancy for one patient, and recurrent toxicity for another patient.

**Table 5:** Post operative HPE based diagnosis of study population

| Diagnosis | No of cases studies |
|---|---|
| Thyroid malignancy | 05 |
| Thyroid adenomas | 10 |
| Toxic MNG | 04 |
| Graves disease | 03 |
| Hashimotosthyroidits | 19 |
| Lymphocitic thyroiditis | 01 |
| Nodular / colloid goiter | 09 |
| **Total no of cases** | **51** |




Of the 51 total thyroidecomised patients, post operative follow up shows the following HPE reports.

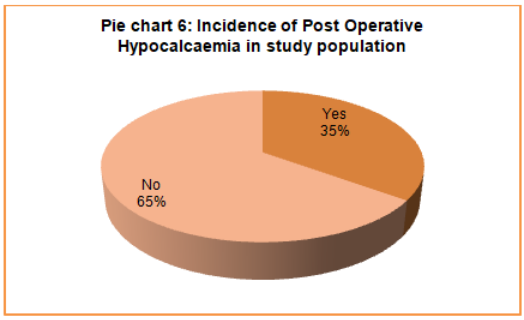
5 patients underwent total thyroidectomy shows papillary thyroid carcinoma in their specimen, 10 patients showing thyroid adenoma, 4 patients HPE report reveals toxic Multinodular goiter and 3 patients specimen shows Graves disease. Hashimotosthyroidits reported in post thyroidectomy specimens of 19 patients and lymphocytic thyroiditis in 1 patient and 9 patients with nodular or colloid goiter.

**Post thyroidectomy Hypocalcimia in the study population:**

In our study we documented 18 patients out of 51 patients of study population had experienced signs and symptoms of hypocalcemia in their post operative period.

**Table 6:** Incidence of Post Thyroidectomy Hypocalcemia in study population

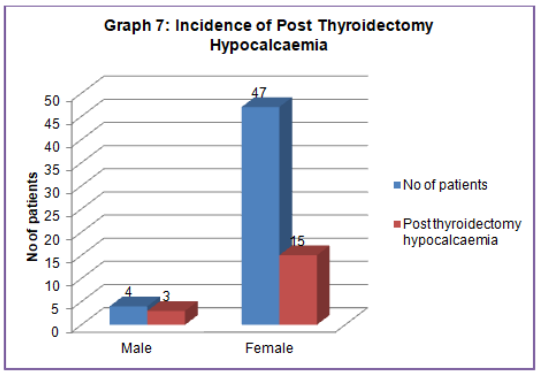
| Post operative Hypocalcemia in study | No of patients | Percentage |
|---|---|---|
| Yes | 18 | 35% |
| No | 33 | 65% |




In denotes approximately 35% of study population experienced hypocalcemia in their post operative period.

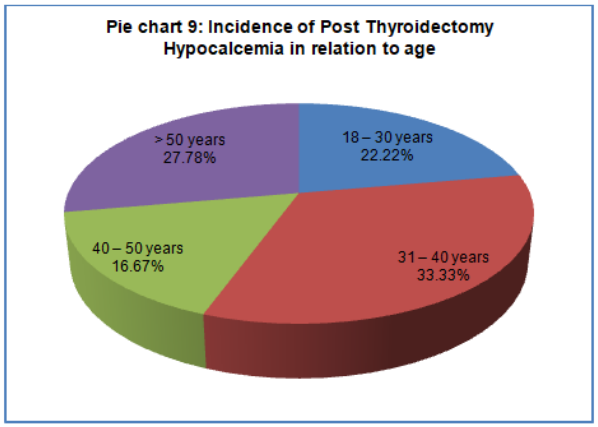
**Table 7:** Incidence of Post Thyroidectomy Hypocalcaemia in relation to sex in study population

| Sex of study population | No of patients | Post thyroidectomy hypocalcaemia |
|---|---|---|
| Male | 04 | 03 |
| Female | 47 | 15 |




Of these 3 males out of 4 male patient experienced hypycalcaemia in their post operative period, this approximates 75%.

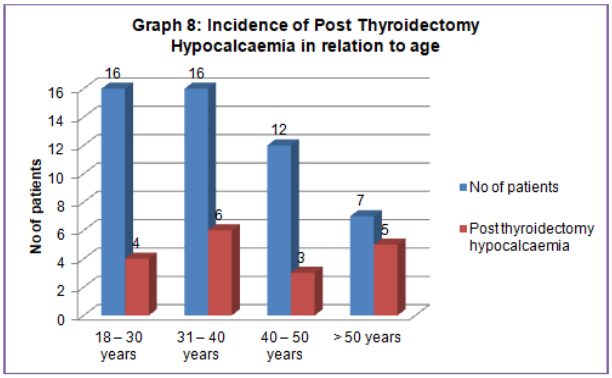
Out of 47 female patients 15 patients shows signs and symptoms of hypocalcemia, this approximates 32%.




22.22% of 18 to 30 years patients experienced post operative hypocalcaemia, 33.33% of 31 to 40 years experienced hypocalcaemia, 16.67% of 41 to 50 years experienced hypocalcaemia and 27.78% of more than 50 years experienced post operative hypocalcemia.

**Table 8:** Incidence of Post thyroidectomy Hypocalcaemia in relation to age in study population

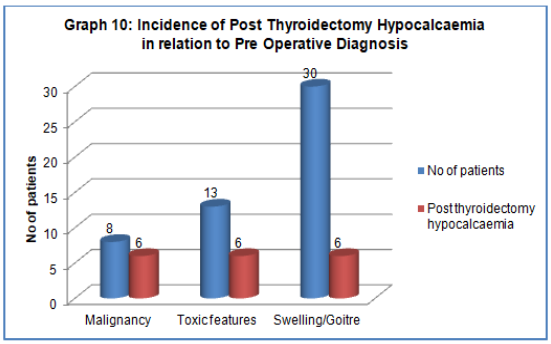
| Age distribution of study population | No of patients | Post thyroidectomy hypocalcaemia | Percentage |
|---|---|---|---|
| 18 – 30 years | 16 | 4 | 22.22% |
| 31 – 40 years | 16 | 6 | 33.33% |
| 40 – 50 years | 12 | 3 | 16.67% |
| > 50 years | 07 | 5 | 27.78% |
| **Total** | **51** | **18** | **100%** |



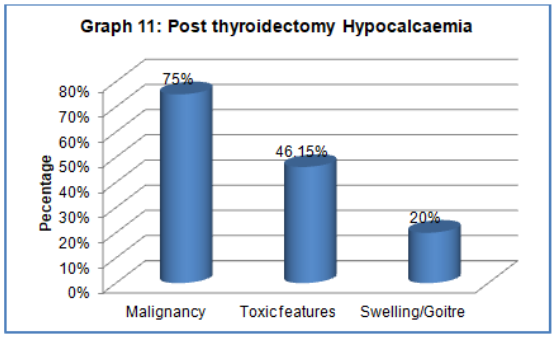

According to age distribution 4 patients in the age group of 12 to 30 years and 6 patients in the age group of 31 to 40 years, and 3 patients in the age group of 41 to 50 years and 5 patients in the age group of more than 50 years are affected by post operative hypocalcaemia.

**Table 9:** Incidence of Post Thyroidectomy Hypocalcaemia in relation to Pre OP indicators in study population

| Pre operative indications for thyroidectomy | No of patients | Post thyroidectomy hypocalcaemia | Percentage |
|---|---|---|---|
| Malignancy | 08 | 6 | 75% |
| Toxic features | 13 | 6 | 46.15% |
| Swelling/Goitre | 30 | 6 | 20% |



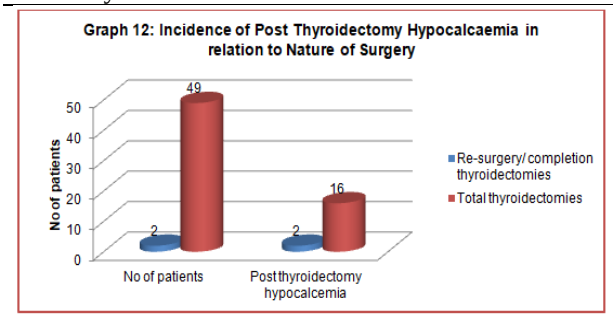

Patients underwent total thyroidectomy with pre operative diagnosis of malignancy experienced 75% of post operative hypocalcaemia and approximately 46% of patients with toxic features experienced post operative hypocalcaemia, only 20% of patients with swelling or goiter are reported with post operative hypocalcaemia.




Patients who underwent resurgeries like completion thyroidectomy shows 100% incidence of post thyroidectomy hypocalcaemia

**Table 10:** Incidence of post thyroidectomy hypocalcaemia in relation to nature of surgery

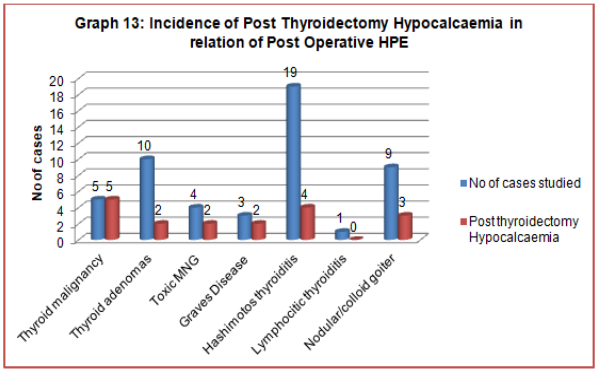
| Nature of surgery | No of patients | Post thyroidectomy hypocalcemia | Percentage |
|---|---|---|---|
| Re-surgery/ Completion thyroidectomies | 02 | 02 | 100% |
| Total thyroidectomies | 49 | 16 | 32.65% |




According to final post operative HPE based diagnosis, the incidence of post thyroidectomy hypocalcaemia experience in our study was 5 out of 5 thyroid malignant patients experienced post thyroidectomy hypocalcaemia and 20% of thyroid adenomas, and 50% of toxic Multinodular goiter patients, 67% of Graves disease patients and 21% of hashimotos thyroiditis patients and 33% of nodular or colloid goiter patient experienced post operative hypcalacaemia.

**Table 11:** Indidecne of Post Thyroidectoy Hypocalcaemia in relation to Post Operative HPE

| Diagnosis | No of cases studied | Post thyroidectomy Hypocalcaemia | Percentage of hypocalcaemia |
|---|---|---|---|
| Thyroid malignancy | 05 | 05 | 100% |
| Thyroid adenomas | 10 | 02 | 20% |
| Toxic MNG | 04 | 02 | 50% |
| Graves Disease | 03 | 02 | 66.67% |
| Hashimotos thyroiditis | 19 | 04 | 21.05% |
| Lymphocitic thyroiditis | 01 | 00 | 0% |
| Nodular/colloid goiter | 09 | 03 | 33.33% |




In our study 18 patients out of 51 patients experienced post operative hypcalcaemia, majority of them manifested the symptoms on post operative day 2 such that 61%, remaining patients presented on post operative day 1.

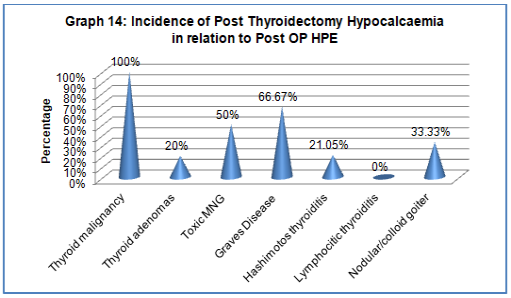



**Table 12:** Time of presentation of post thyroidectomy hypocalcaemia in study population

| Day of presentation of hypocalcemia | No of patients | Percentage |
|---|---|---|
| Post operative day 1 | 7 | 38.89% |
| Post operative day 2 | 11 | 61.11% |

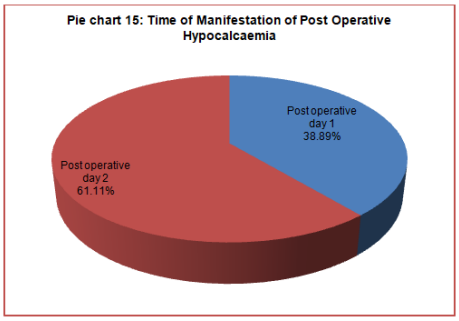
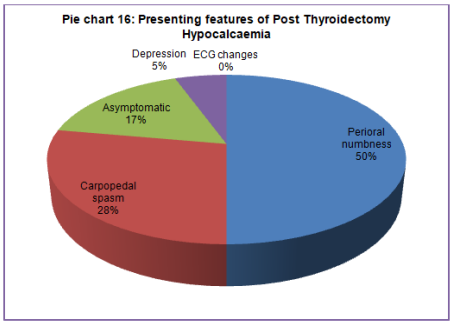



**Table 13:** Presenting feature of post thyroidectomy hypocalacaemia in study population

| Presenting symptom of post thyroidectomy hypocalcaemia | No of patients |
|---|---|

| | |
|---|---|
| Perioral numbness | 9 |
| Carpopedal spasm | 5 |
| Asymptomatic | 3 |
| Depression | 1 |
| ECG changes | 0 |




Most common presenting features in our study was perioral numbness. About 50% patient's first complaint during hypocalcaemia is perioral numbness.

**Discussion:**

Thyroid diseases are more common in females, as in many literature. Ourstudy population also reflects the same .male 7.8% and female contributes 92.15% ofthyroid disorders.

**Table 14:** Sex distribution

| Sex of study population | No of patients | Post thyroidectomy hypocalcaemia |
|---|---|---|
| Male | 04 | 03 |
| Female | 47 | 15 |

In our study, results show that thyroid diseases that may need thyroidsurgeries are frequent in the middle age group between 30 to 40 years. But the post thyroidectomy hypocalcaemia incidence is more common inthe advancing age group i.e more than 50 years. A study conducted by Erbil Yet al named the impact of age, vit D level and incidental parathyroidectomy on postoperative hypocalcemia after total or near total thyroidectomy reveals thatin advancing ages the level of vit D fall postoperatively increases tremendously. So the incidence 25 times greater for the patients of more than 50 years of age.

In the present study total number of patients aged above were 07 out of which 5 patients developed post thyroidectomy hypocalcemia.

**Table 15:** Age distribution

| Age distribution of study population | No of patients | Post thyroidectomy hypocalcaemia | Percentage |
|---|---|---|---|
| 18 – 30 years | 16 | 4 | 25% |
| 31 – 40 years | 16 | 6 | 37.5% |
| 40 – 50 years | 12 | 3 | 25% |
| > 50 years | 07 | 5 | 71.4% |

Benign diseases shows less incidence of post thyroidectomyhypocalcaemia than the malignant diseases, this attribute to the extensive surgical dissection performed in malignant disorders in order to obtain tumour clearance. In a study conducted by sokouti M et al, regarding the incidence of transient and permanent hypocalcemia after total thyroidectomy for thyroidcancer reveals higher incidence of hypocalcemia after total thyroidectomy inmalignant diseases of thyroid. The incidence increases more with surgeries combined with radical neck dissection.

The incidence of post thyroidectomy hypocalcaemia is more in the toxicthyroid diseases than non toxic diseases, this also attributes to the extensive surgical dissection in the toxic disorders in order to avoid recurrence of thedisease.

The same reason can explain the 100% incidence of post thyroidectomy hypocalcaemia in the resurgeries in our study, and in resurgeries some literatures postulates that extensive fibrosis can be a reason for vascularcompromise that results in hypo parathyroidism. Indications for total thyroidectomy in our study population shows majority of them are resected for thyroid mass or goiter.

In our study period we concentrated mainly on immediate postoperativehypocalcaemia and due to the poor compliance of patients permanent hypocalcaemia was not analysed.

Our study shows the incidence of postoperative hypocalcaemia was approximately 35%, In literature it was reported from 27% to 80%. During the study period we did parathyroid auto transplantation for 4patients who are found to be with accidental injury to the parathyroid glands found on table and post thyroidectomy hypocalcaemia didn't manifest in thatpatients.

In a study conducted by Low and lam et al, where their team followroutine parathyroid auto transplantation incidence of hypocalcemia was less, patients presenting with hypocalcaemia are whom parathyroid auto transplantation was not done zendenius et al reported in his study that he did 100 case series with totalthyroidectomy and parathyroid auto transplantation and concluded there was nopermanent hypocalcaemia in his study group.

For prevention of post thyroidectomy hypocalcaemia many authors followed identification of parathyroid intra operatively by various methods. Some of them are Esselstyn CB used parathyroid blush on table, Silverberg usedmethylene blue staining of parathyroids, Ramao used iv methylene blue for identification of parathyroids, Sofola et al used polarised spectral imaging, Pederson et al used portable gamma camera with sestamibi radio tracer, Yao etal touching print preparations, still the studies are going on. A higher

incidence of hypocalcaemia was noted in nontoxic nodular goiters but was associated with incidental parathyroidectomy. But we noticed that incidental removal of the gland was significantly associated with hypocalcaemia. This feature was interestingly noted along with nontoxic nodular goiters without risk factors. So we feel that a refinement in the surgical technique could have improved the outcome. The capsular dissection technique of mobilization ensures intact parathyroid glands with vascular pedicles. Thomusch ***et al***. noted lateral ligation of inferior thyroid arteries (ITA) as a strong determinant of hypocalcaemia. But in one observational study, lateral ligation of the trunk of ITA did not cause significant hypocalcaemia following subtotal thyroidectomy for Grave's disease. This observation indicates an additional blood supply apart from the branches of ITA, possibly from thyroid gland itself.

In a study conducted by Nair C.G et al, Randall L. Baldassarre et al, Salem L Noureldine et al, Sakouti M hypocalcemia noticed were 23.6%, 5.5%, 29.9% and 28%, in our study out of 51 patients 18 patients developed hypocalcemia which is approximately corresponds to 35.5%.

**Table 16:** Comparision of studies

| Study | % of hypocalcemia |
|---|---|
| Nair C.G et al | 23.6% |
| Randall L Baldassarre et al | 5.5% |
| Salem L Noureldine et al | 29.9% |
| Sakouti M | 28.7% |
| Present study | 35.9% |

In a study conducted by Randall L. Baldassarre, Thyroidectomy with bilateral neck dissection, the strongest independent risk factor of postoperative hypocalcemia resulted in an incidence of 23.4%. Additional factors independently associated with postoperative hypocalcemia included female gender, nonteaching hospitals, and malignant neoplasms of thyroid gland.

In this present study all the malignant thyroid swellings developed hypocalcemia after thyroidectomy this attribute to the extensive surgical dissection performed in malignant disorders in order to obtain tumour clearance.

In a study conducted by C. Gopalakrishna Nair et al 806 patients were analyse and the incidence of hypocalcaemia was 23.6% (n = 190) and that of permanent hypocalcaemia was 1.61% (n = 13). Onset was delayed up to 3rd postoperative day in 13 patients. Hypocalcaemia was significantly associated with thyroidectomy for Grave's Disease, Hashimoto's thyroiditis, and with incidental parathyroidectomy.

**Table 17:** Percentage of patients developed hypocalcemia

| Study | Within 6 hours | 1st POD | 2nd POD | 3rd POD |
|---|---|---|---|---|
| CG Nair (n = 806) | 21 (11.05%) | 110 (57.88%) | 46 (24.22%) | 13 (6.84%) |
| Present study (n = 51) | --- | 7 (38.89%) | 11 (61.11%) | ---- |

**Conclusion & Summary:**

- From our study we concluded that post thyroidectomy transient hypocalcaemia is a frequent complication which can be prevented with preoperative preparation of patients with extreme caution and preoperative meticulous dissection, prompt identification of parathyroids and postoperative frequent monitoring of serum calcium and early treatment can prevent significant morbidity.
- Parathyroid auto transplantation should be considered in accidental injury to parathyroids during the procedure.
- Resurgeries of thyroid should be done with extreme caution.
- For treating patients more than 50 years surgeon should careful in preventing hypocalcaemia.
- While doing surgeries for malignant and toxic lesions for thyroid, the surgeon should consider total thyroidectomy as not only a thyroid removing surgery but also a surgery done to preserve parathyroids.
- For small scale hospitals serial monitoring of serum calcium levels preoperatively and postoperatively combined with careful monitoring of signs and symptoms of hypocalcemia is a efficient and cost effective tool to detect post thyroidectomy hypocalcemia.

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**PROFORMA**

| | | |
|---|---|---|
| Name : | Age : | Sex : |
| Address : | Occupation : | |
| Date of admission : | Date of discharge : | |
| Date of surgery : | | |

- Chief complaints :
- H/O present illness :
- H/O past illness :
- General examination :
- Local examination of thyroid swelling :
- Provisional diagnosis :

**Investigations :**

- Preoperative FNAC
- TFT
- Preoperative Serum Calcium
- RBS
- Blood urea
- Serum Creatinine
- LFT
- USG NECK
- CXR PA VIEW
- X Ray Neck AP Lateral
- Indication for surgery

- Surgery done
- Surgical notes
- PTAT Y/N
- Post operative serum calcium
- POD-1-
- POD-2-
- POD-5-
- Perioral numbness
- Carpopedal spasm
- Mood changes
- ECG changes
- Treated with

## MASTER CHART

| Sl. NO. | Reg. No. | Name of the patient | Age | Sex | Pre OP Indication | Procedure Done | Date of Surgery | Post OP HPE | Pre OP serum calcium in mg/dl | Serum calcium in 1st POD | Serum Calcium in 2nd POD | Serum Calcium in POD 4 | Prenting symptom | Treatment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20170366653 | S. Indiramma | 65 | F | Recurrent Papillary Carcinoma | Completion Thyroidectomy | 05-03-2017 | Papillary Carcinoma | 8.5 | 7.5 | 7.8 | 8.5 | Peri oral numbness | Oral |
| 2 | 20170461793 | Sujana T | 70 | F | MNG | Total Thyroidecomy | 02-05-2017 | Nodular goitre with cystic degeneration | 9 | 8.5 | 8.5 | 8.5 | | |
| 3 | 20170505132 | K. Nagamma | 37 | F | MNG | Total Thyroidecomy | 07-05-2017 | Graves disease | 8.7 | 7 | 7.5 | 8.4 | Carpopedal Spasm | IV |
| 4 | 20170645544 | Sukumaramma | 57 | F | Papillary Carcinoma | Total Thyroidecomy | 20-06-2017 | Papillary Carcinoma | 9 | 8.5 | 8 | 9 | Asymptomatic | Oral |
| 5 | 20170707175 | A. Gangadevi | 28 | F | Papillary Carcinoma | Total Thyroidecomy | 10-07-2017 | Follicular Adenoma | 9 | 9 | 8.5 | 8.5 | | |
| 6 | 20170737818 | Roshini | 30 | F | MNG | Total Thyroidecomy | 18-07-2017 | Adenomatous Hyperplasia | 8.8 | 8.5 | 9 | 9 | | |
| 7 | 20170831125 | Anitha N | 27 | F | Papillary Carcinoma | Total Thyroidecomy | 14-08-2017 | Papillary Carcinoma | 8.8 | 8.5 | 7.5 | 8.5 | Peri oral numbness | Oral |
| 8 | 20170974345 | Shakeela Bhanu | 38 | F | Diffuse Goitre | Total Thyroidecomy | 02-10-2017 | Hashimotos Throidits | 9.5 | 9 | 9 | 9 | | |
| 9 | 20170311868 | Najuma SD | 28 | F | MNG | Total Thyroidecomy | 12-03-2017 | Hashimotos Throidits | 9.5 | 9.5 | 9 | 9 | | |
| 10 | 20160647236 | Ramanamma | 42 | F | Toxic MNG | Total Thyroidecomy | 12-03-2017 | Hashimotos Throidits | 8.5 | 9 | 7.8 | 8.8 | Peri oral numbness | Oral |
| 11 | 20170313937 | Najunni SK | 42 | F | MNG | Total Thyroidecomy | 10-03-2017 | Adenomatous Hyperplasia | 9 | 9 | 8.5 | 9 | | |
| 12 | 20170360626 | Venkatamma D | 50 | F | Papillary Carcinoma | Total Thyroidecomy | 04-04-2017 | Papillary Carcinoma | 9 | 8.5 | 8 | 9 | Asymptomatic | Oral |
| 13 | 20170372267 | Prabhavathi M | 40 | F | Papillary Carcinoma | Total Thyroidecomy | 15-04-2017 | Adenomatous Hyperplasia | 8.5 | 8.5 | 8.5 | 9 | | |
| 14 | 20170443146 | G. Guramma | 35 | F | MNG | Total Thyroidecomy | 21-05-2017 | Hashimotos Throidits | 9.5 | 9 | 8.5 | 9 | | |
| 15 | 20170663364 | V. Sukumaramma | 30 | F | Toxic MNG | Total Thyroidecomy | 24-06-2017 | Microfollicular Adenoma | 10 | 9 | 9 | 9 | | |
| 16 | 20170737552 | P. Munemma | 35 | F | Recurrent Toxic MNG | Total Thyroidecomy | 16-07-2017 | Hashimotos Throidits | 9 | 7.5 | 7.8 | 8.5 | Carpopedal Spasm | IV |
| 17 | 20170737818 | SK. Roshini | 44 | F | Toxic Goitre | Total Thyroidecomy | 18-07-2017 | Lymphocytic Thyroiditis | 10 | 9.5 | 9 | 8.5 | | |
| 18 | 20170808386 | V. Polamma | 39 | F | MNG | Total Thyroidecomy | 06-08-2017 | Hashimotos Throidits | 9 | 9 | 9 | 8.5 | | |
| 19 | 20170808607 | V. Narasamma | 28 | F | MNG | Total Thyroidecomy | 05-08-2017 | Hashimotos Throidits | 9 | 8.5 | 9 | 8.8 | | |
| 20 | 20170827734 | Hymavathi | 50 | F | MNG | Total Thyroidecomy | 14-08-2017 | Hashimotos Throidits | 8.5 | 85 | 8.8 | 8.8 | | |
| 21 | 20170861825 | Venkateswaralu Y | 55 | M | Papillary Carcinoma | Total Thyroidecomy | 04-08-2017 | Papillary Carcinoma | 8.5 | 7.5 | 8 | 8.5 | Peri oral numbness | Oral |
| 22 | 20170861922 | P. Rajamma | 30 | F | Diffuse Goitre | Total Thyroidecomy | 28-08-2017 | Hashimotos Throidits | 8.8 | 8.5 | 9 | 9 | | |
| 23 | 20170870932 | G. Subbamma | 24 | F | Diffuse Goitre | Total Thyroidecomy | 04-09-2017 | Hashimotos Throidits | 9.2 | 9 | 9 | 9 | | |
| 24 | 20170934621 | G. Padma | 30 | F | MNG | Total Thyroidecomy | 10-09-2017 | Colloid Goitre | 9 | 9 | 8.8 | 9 | | |
| 25 | 20170934563 | C. Rathnamma | 49 | F | MNG | Total Thyroidecomy | 14-09-2017 | Colloid Goitre | 9 | 8.5 | 7.8 | 8.8 | Peri oral numbness | Oral |

## MASTER CHART

| Sl. NO. | Reg. No. | Name of the patient | Age | Sex | Pre OP Indication | Procedure Done | Date of Surgery | Post OP HPE | Pre OP serum calcium in mg/dl | Serum calcium in 1st POD | Serum Calcium in 2nd POD | Serum Calcium in POD 4 | Prenting symptom | Treatment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 20171252867 | K. Sailaja | 48 | F | MNG | Total Thyroidecomy | 21-12-2017 | Colloid Goitre | 9.5 | 9.5 | 9 | 9 | | |
| 27 | 20171245347 | K. Chinamma | 41 | F | MNG | Total Thyroidecomy | 26-12-2017 | Microfollicular Adenoma | 9.6 | 9 | 9 | 9 | | |
| 28 | 20171269925 | V. Aggemma | 26 | F | Primary Thyrotoxicosis | Total Thyroidecomy | 29-12-2017 | Colloid Goitre | 9.8 | 8.8 | 8 | 9 | Asymptomatic | Oral |
| 29 | 20161208291 | Subbarathnamma D | 30 | F | Diffuse Goitre | Total Thyroidecomy | 10-12-2018 | Hashimotos Throidits | 8.8 | 8.5 | 8.8 | 9 | | |
| 30 | 20161208072 | Narayanamma R | 55 | F | Diffuse Goitre | Total Thyroidecomy | 14-12-2016 | Colloid Goitre | 8.5 | 8.5 | 8.5 | 8.5 | | |
| 31 | 20161142606 | Nagamma Y | 37 | F | MNG | Total Thyroidecomy | 13-11-2016 | Colloid Goitre | 8.2 | 8.5 | 8.5 | 8.5 | | |
| 32 | 20170608994 | Ankamma P | 60 | F | MNG | Total Thyroidecomy | 05-06-2017 | Hashimotos Throidits | 8.4 | 8.5 | 8.5 | 9 | | |
| 33 | 20170639397 | Jyothi K | 40 | F | MNG | Total Thyroidecomy | 16-06-2017 | Hashimotos Throidits | 9 | 9 | 8.8 | 9 | | |
| 34 | 20170557089 | Venkata Ramanamma B | 65 | F | MNG | Total Thyroidecomy | 04-05-2017 | Colloid Goitre | 8.5 | 7 | 7.8 | 8.5 | Carpopedal Spasm | IV |
| 35 | 20170639233 | Vani U | 35 | F | Toxic Goitre | Total Thyroidecomy | 10-06-2017 | Toxic MNG | 9 | 7 | 7.5 | 8 | Carpopedal Spasm | IV |
| 36 | 20180614758 | Sujatha T | 31 | F | Solitary Thyroid Nodule Left | Total Thyroidecomy | 05-06-2018 | Follicular Adenoma | 9.5 | 8.5 | 7.2 | 8.5 | Peri oral numbness | Oral |
| 37 | 20180615092 | Guravamma Y | 35 | F | Toxic MNG | Total Thyroidecomy | 11-06-2018 | Toxic MNG | 10 | 10 | 9 | 9 | | |
| 38 | 20180553353 | Lalithamma D | 26 | F | Diffuse Goitre | Total Thyroidecomy | 13-05-2018 | Hashimotos Throidits | 10.5 | 10 | 9.5 | 9 | | |
| 39 | 20180582492 | Sankaramma G | 40 | F | Toxic MNG | Total Thyroidecomy | 18-05-2018 | Hashimotos Throidits | 9 | 9 | 9 | 8.5 | | |
| 40 | 20180614906 | Naramadha K | 46 | F | MNG | Total Thyroidecomy | 04-06-2018 | Hashimotos Throidits | 9.5 | 9 | 7.5 | 8.5 | Carpopedal Spasm | IV |
| 41 | 20180614819 | Sukuna Kumari G | 34 | F | MNG | Total Thyroidecomy | 20-06-2018 | Hashimotos Throidits | 8.5 | 8.5 | 8.8 | 8.5 | | |
| 42 | 20180614750 | Kanakadurga N | 48 | F | Toxic MNG | Total Thyroidecomy | 29-06-2018 | Toxic MNG | 8.8 | 8 | 8.5 | 8.5 | | |
| 43 | 20180614927 | Ramanamma C | 39 | F | MNG | Total Thyroidecomy | 29-06-2018 | Hashimotos Throidits | 9 | 8.5 | 9 | 9 | | |
| 44 | 20180380407 | Suselamma P | 30 | F | MNG | Total Thyroidecomy | 09-03-2018 | Hashimotos Throidits | 9.5 | 9 | 8 | 9.5 | Peri oral numbness | Oral |
| 45 | 20180543524 | Kathyani G | 30 | F | MNG | Total Thyroidecomy | 11-05-2018 | Microfollicular Adenoma | 10 | 10 | 9.5 | 9.5 | | |
| 46 | 20160734281 | Rama Krishnaiah P | 29 | M | Primary Thyrotoxicosis | Total Thyroidecomy | 10-07-2016 | Follicular Adenoma | 10.5 | 8.5 | 7.8 | 8.5 | Peri oral numbness | Oral |
| 47 | 20161210861 | Venkataiah B | 39 | M | Toxic MNG | Total Thyroidecomy | 14-12-2016 | Toxic MNG | 9 | 7.5 | 8 | 8.5 | Depression | IV |
| 48 | 20161208495 | Madhan K | 22 | M | Primary Thyrotoxicosis | Total Thyroidecomy | 20-12-2016 | Adenomatous Hyperplasia | 9 | 9 | 9 | 8.5 | | |
| 49 | 20180802162 | Kanthamma B | 37 | F | Primary Thyrotoxicosis | Total Thyroidecomy | 10-08-2018 | Graves disease | 9.5 | 9 | 9 | 9 | | |
| 50 | 20180762964 | Vijaya Kumari A | 36 | F | MNG | Total Thyroidecomy | 19-07-2018 | Colloid Goitre | 8.5 | 8.5 | 9 | 9.2 | | |
| 51 | 20180669344 | Polamma K | 50 | F | MNG | Total Thyroidecomy | 22-06-2018 | Colloid Goitre | 8.8 | 8.5 | 7.8 | 8.8 | Peri oral numbness | Oral |