

**A DISSERTATION ON
“PROSPECTIVE ANALYSIS OF CLINICAL,
BIOCHEMICAL AND PEROPERATIVE FACTORS
PREDICTING HYPOCALCEMIA IN PATIENTS
UNDERGOING TOTAL THYROIDECTOMY”**

Dissertation submitted to

**THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERISTY
CHENNAI**

*With partial fulfilment of the regulations
For the Award of the degree*

**M.S. (GENERAL SURGERY)
BRANCH – I**



**MADRAS MEDICAL COLLEGE,
CHENNAI.**

APRIL-2017

BONAFIDE CERTIFICATE

Certified that this dissertation is the bonafide work of Dr. M.RAJESWARI on “**PROSPECTIVE ANALYSIS OF CLINICAL, BIOCHEMICAL AND PEROPERATIVE FACTORS PREDICTING HYPOCALCEMIA IN PATIENTS UNDERGOING TOTAL THYROIDECTOMY**” during her M.S. (General Surgery) course from Jan 2016 to june 2016 at the Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai – 600003.

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ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to the **DEAN**, Madras Medical College and **Prof.DR.P.RAGUMANI, MS** Director, Institute of General Surgery , MMC & RGGGH, for allowing me to undertake this study on **“PROSPECTIVE ANALYSIS OF CLINICAL, BIOCHEMICAL AND PEROPERATIVE FACTORS PREDICTING HYPOCALCEMIA IN PATIENTS UNDERGOING TOTAL THYROIDECTOMY”**

I was able to carry out my study to my fullest satisfaction, thanks to guidance, encouragement, motivation and constant supervision extended to me, by my beloved Unit Chief **Prof.Dr.G.MUTHUKUMARAN M.S.** Hence my profuse thanks are due for her.

I am bound by ties of gratitude to my respected Assistant Professors, **Dr.Krishnamoorthy M.S., Dr.Kalyankumar M.S., and Dr.Sivan M.S.**, in general, for placing and guiding me on the right track from the very beginning of my career in Surgery till this day. I would be failing in my duty if I don't place on record my sincere thanks to those patients who inspite of their sufferings extended their fullest co-operation.

I am fortunate to have my postgraduate colleagues, for their invaluable suggestions, relentless help for shouldering my responsibilities.

DECLARATION

I, certainly declare that this dissertation titled, “PROSPECTIVE ANALYSIS OF CLINICAL, BIOCHEMICAL AND PEROPERATIVE FACTORS PREDICTING HYPOCALCEMIA IN PATIENTS UNDERGOING TOTAL THYROIDECTOMY”, represent a genuine work of mine . The contributions of any supervisors to the research are consistent with normal supervisory practice, and are acknowledged.

I, also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other university board, neither in India or abroad. This is submitted to The Tamil Nadu Dr.MGR Medical University, Chennai in partial fulfillment of the rules and regulation for the award of Master of Surgery Degree Branch 1 (General Surgery).

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Date :

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INTRODUCTION

Surgical treatment of choice for most Thyroid diseases both benign and malignant is total Thyroidectomy, Provided that complication rates are low. Goiter is a latin word called GUTTER (THROAT). It is defined as an enlargement of the Thyroid gland. Hieronymus Fabricius ab Aquapendente recognised that goiters arose from the thyroid in 1619. By the contribution of Thomas Wharton the term Thyroid Gland (a greek word) was meant shield shaped gland.

In 1170 the first accounts of Thyroid Surgery for the treatment of Goiter was initiated by Roger Frugardi. The first standard technique of Thyroidectomy was described by Theodore Kocher in 1872. Later it was refined by Theodar Billroth and William S. Halsted, so as to decrease the postoperative mortality and morbidity after thyroid surgery to <1%.

Few important complications seen after Thyroid surgery are recurrent laryngeal nerve injury, haemorrhage and hypocalcemia. Among these the most important morbidity resulting from thyroid surgery is Hypocalcemia.

The incidence of hypocalcemia reported after Thyroid surgery was in the range of 2%-30%. Usual presentation of hypocalcemia seen on 2nd to 5th post operative day. Clinical presentation of hypocalcemia are circumoral paraesthesia and carpopedal spasm which may lead to Tetany. Two types are seen transient (or) Permanent. Ischemic damage

to the parathyroid glands during surgery have been thought to be responsible for post thyroidectomy hypocalcemia. Recurrent laryngeal nerve palsy and wound site hematoma could be diagnosed within first 8 hours after thyroid surgery. It has been thought that close monitoring of serum calcium level after thyroid surgery will decrease the morbidity following thyroid surgery.

A priority in the current environment of cost containment and managed care is early safe postoperative hospital discharge. Some times it may extend the duration of hospital stay due to hypocalcemia and monitoring calcium level periodically may be useful, when the symptoms are severe it may require intravenous calcium therapy.

Several literature evaluated the factors responsible in the mechanism of post thyroidectomy hypocalcemia and its complications. Many studies have used post operative calcium level as a possible early predictor of post thyroidectomy hypocalcemia. But most of the patients showed rising trends in serum calcium levels after initial fall during first 1-2 days of post operative period. This type of calcium level fluctuation usually lead to normocalcemia in the later postoperative period. But the falling trend in serum calcium level in early post operative period is an indicator ,that the patients who falls in this group will develop postoperative hypocalcemia in later period.

Serial calcium measurement will help in the early prediction of hypocalcemia. The aim of the study is to assess early post thyroidectomy hypocalcemia and factors influencing in its occurrence.

AIMS AND OBJECTIVE

- ❖ Total thyroidectomy is most commonly performed surgery in which hypocalcemia is a well known complication. Incidence is 2 to 32%.
- ❖ The aim of the study is to identify predictors of transient and permanent hypocalcemia in patients undergoing total thyroidectomy which includes clinical, biochemical and peroperative factors.
 - Clinical parameters
 - Age & Sex of the Patient
 - Size of goiter
 - Histopathological types
 - Biochemical Parameters
 - Ionized Calcium
 - Parathyroid hormone
 - Albumin
 - Vitamin D Level
 - Peroperative Factors
 - No of parathyroid glands identified and preserved
 - Duration of surgery
- ❖ To establish the strength of association between the reported predictive factors with transient and permanent post thyroidectomy hypocalcemia.

REVIEW OF LITERATURE

Total thyroidectomy is a common surgical procedure which has well known complication and hypocalcemia is the important complication seen commonly. The incidence of post thyroidectomy hypocalcemia has been decreased because of advances in surgical techniques and technology. In the past the mortality rate after that thyroidectomy was as high as 35-40%. Now a days the mortality rates after surgery has significantly reduced to 1-2% .

Significant morbidity after total thyroidectomy is 3%-4%. The early complications of thyroid surgery are haemorrhage with tracheal compression, airway compromise and even death. Incidence of early hemorrhage is 1-2%. Respiratory embrocement can occur because of vocal cord paralysis (or) laryngeal edema. Incidence of life threatening respiratory obstruction occurs in about 0.5-1%,and it occur in immediate post opearative day.

Hypocalcemia is one of the serious complications of thyroid surgery. Incidence of hypocalcemia ranges from 2-30%(Edufe et al 2015). In early days the incidence was very high and due to the advancement in surgical technique the incidence has dropped significantly.

Occurrence of post thyroidectomy hypocalcemia is common several days after total thyroidectomy. This delay will challenge many clinician to monitor serum calcium level periodically.

Serious manifestation of hypocalcemia is Tetany which was established by Van Eisenberg in 1890. Erdheim advocated that these hypocalcemia symptoms were due to damage to parathyroid glands (or) functional hypoparathyroidism. Ligation of branches of inferior thyroid artery was responsible for hypocalcemia and it was suggested by Riddel. Hungry bone syndrome was suggested by Mitchie et al. Manipulation of thyroid gland results in release of calitonin which presents as hypocalcemia was suggested by Wilkin et al.

Extracellular calcium may account for only 1% of the body calcium stores, majority of which is sequestered in the skeletal system. It acts as a second messenger involved in muscular contraction and membrane repolarization. It has two form, Ionized form which is the active component approximately about 50%. The remainder will be bound to albumin (40%) and organic anions such as phosphate and citrate (10%)[Renzo2014]

Total serum calcium levels ranges from 8.5-10.5% mg/dl (2.1-2.6mmol) and Ionized calcium ranges from 4.7-5.2mg/dl (1.1-1.3mmol/L). the total serum calcium levels are variable with plasma protein levels especially serum albumin. For each gram per deciliter of

alteration in serum albumin level \pm 4mg/dl, there will be a 0.8mg/dl increase/ decrease in protein bound calcium.

When the serum calcium level falls below 8.5mg/dl or ionized calcium less than 4.7mg/dl is defined as Hypocalcemia. Clinical features of Hypocalcemia will be manifested when the calcium levels falls below 7mg/dl (Total) or <4.7mg/dl (Ionized).

It exists in three form

- 1) Protein bound
- 2) Ionized (free)
- 3) Small amount as diffusible component. Ionized form of calcium is the active form and stays in equilibrium with the protein bound form. Hypoalbuminemia may result in reduction in Total calcium, although ionized calcium within normal limit. Each gram of serum albumin binds 0.8mg/dl of calcium. So the corrected calcium level in hypoalbuminemia is calculated by the following formula

Corrected calcium = $0.8(\text{serum albumin} - \text{patient albumin}) + \text{serum calcium level}$. Normal value-8.5 to 10.5 mg/dl.

About 250-500mg of calcium is absorbed from intestine per day. There is a balanced absorption and resorption of calcium per day. Urinary calcium excretion is about 100-400mg/day in a normal adult. Normal level of phosphorus is present in skeletal system about 85%.

Total amount of phosphorus is about 1kg in a healthy adult. Every day there is absorption of 0.5gm-1.4gm of phosphorus with a flux of 150mg to 300mg involved in absorption and resorption in bone.[Bove.A.2014]

The principal reason of hypocalcemia is hypoparathyroidism that is reduction in serum parathyroid hormone levels. It is a regulator of extracellular calcium concentration. It relay on a protein coupled membrane receptor, which is designated calcium sensing receptor and regulate calcium levels.

Parathyroid hormone secretion is stimulated by following factors such as low levels of 1, 25 dihydroxy Vitamin-D, catecholamines, and hypomagnesemia. Chromosome 11 is the location of Parathyroid hormone gene. Parathyroid hormone is synthesised from parathyroid gland as a precursor form preproPTH. This preproPTH is converted into proPTH and finally into 84 amino acid PTH. Half life of secreted PTH is 2-4 minutes, metabolism of PTH is conversion of PTH into active N terminal component and inactive C terminal fraction. This C terminal component is excreted by the kidney. This C terminal component gets accumulated in chronic renal failure. The receptor named calcium sensing receptor is expressed on the Parathyroid cell and regulate the concentration of extracellular calcium[R.Percario et al 2014].

PTH regulates serum calcium levels through its action on bone, intestine and kidney. It stimulates osteoclasts and increasing resorption of bone and promotes calcium and phosphate levels into the blood stream. In the kidney absorption of calcium is in concert with sodium in the proximal convoluted tubules. But PTH acts to control the calcium excretion at distal convoluted tubule through an active transport mechanism. Phosphate and Bicarbonate reabsorption are also inhibited by PTH mainly on proximal convoluted tubule. PTH also inhibits Na⁺/H⁺ antiporter result in metabolic acidosis. PTH enhances 1hydroxylation of 25 Hydroxy Vitamin-D and indirectly enhancing intestinal calcium absorption.

Vitamin D₂ & D₃ both are derived from Vitamin D produced by photolysis of naturally occurring precursors. 7 Dehydrocholesterol found in the skin which is metabolised and forms active form of Vitamin D as Vit. D₃. The primary circulatory form is 25 hydroxy Vitamin D which is produced in liver. In the kidney further hydroxylation results in 1, 25-dihydroxy Vit. D. It regulates calcium homeostasis by stimulating the absorption of calcium and phosphates from gut and resorption of calcium from bone and maintain the serum levels.

Calcitonin which has opposite action produces hypocalcemia. It increases phosphate excretion thereby inhibiting its absorption in the

kidney. Used as a marker in medullary thyroid carcinoma and in treating hypercalcemia.

Hypocalcemia

- 1) Transient
- 2) Permanent

Hypocalcemia can occur based on parathyroid glands function, parathyroid gland may be congenitally absent in diGeorge syndrome as lack of thymic development. Most common cause of hypoparathyroidism is total thyroidectomy.

Transient hypocalcemia

It is the condition where serum calcium level is less than normal which reaches the normal level within 3-6 months of thyroid surgery. Other causes are calcitonin release and hungry bone syndrome.

HUNGRY BONE SYNDROME

When the patient with preoperative hyperthyroidism, they have increased bone breakdown. After total thyroidectomy the thyroid hormone levels drop, bone resorption (or) breakdown will be ceased. The bones are hungry for calcium and try to absorb calcium from plasma and hypocalcemia is the result.

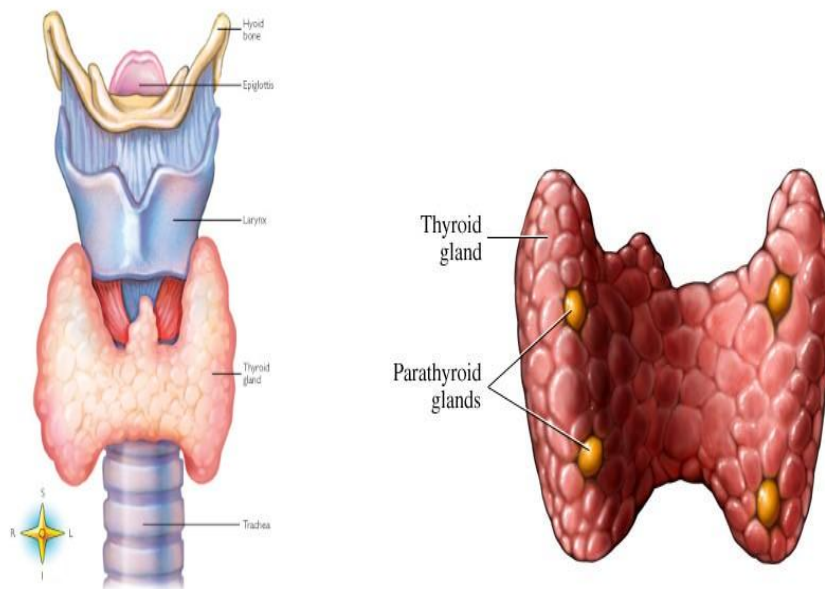
PERMANENT HYPOCALCEMIA

Persistent hypocalcemia is a rare condition in which serum calcium level do not come back to normal upto 6 months of post thyroidectomy and it was explained by Murakani T et al 2000. when persistent low calcium level less than 8mg/dl along with serum phosphate level less than 4mg/dl or serum calcium only if less than 7.5mg/dl for more than one year after total thyroidectomy is defined as permanent hypocalcemia. It may result from irreversible damage to parathyroid glands.

O Edade et al 2000 defined when direct injury (or) devascularisation of parathyroid gland is accepted as most common cause of hypocalcemia which has occurred post operatively.

BRIEF IDEA ABOUT THYROID GLAND

SITE = ANTEROINFERIOR PART OF NECK (INFRAHYOID)
TWO LOBES ON EITHER SIDE OF TRACHEA
ISTHMUS IN THE MIDLINE OVER ANTERIOR TRACHEAL WALL.
CAROTID ARTERIES AND JUGULAR VEINS LATERALLY



Between trachea and esophages medially, carotid sheaths laterally, rights and left lateral lobes located in a space (Thyroid fossa) extends from middle of thyroid cartilage to 6th tracheal ring. Isthmus is located between two lateral lobes in midline extending from 2nd to 4th tracheal rings. Pyramid lobe is between isthmus and left lateral lobe. Thyroid gland is supplied by (i) superior thyroid artery branch of

external carotid artery, (ii) Inferior thyroid artery branch of thyrocervical trunk (iii) Thyroid ima artery branch of aorta.

Fall in ionized calcium in the blood can lead to tetany. The superior and inferior parathyroid glands are supplied by inferior thyroid artery. Although superior glands are getting nutrition from superior thyroid artery it may not be adequate, so that careful dissection should be attempted to save the parathyroid glands. Within the thyroid glands, lymphatic channels are present immediately beneath the capsule and communicate between between lobe through the isthmus. Most of the thyroid malignancies are drained directly to central nodal basins level 6, except the superior 1/3 of gland which drain into lateral compartment. Immediately superior to isthmus drain into pretracheal, and paratracheal nodes, tracheoesophageal groove lymph nodes, mediastinal nodes in the anterior and superior position. In case of widespread thyroid cancer have Level-II, III and IV lymph node involvement may involve posterior triangle. So while doing MRND/ Central lymph node dissection injury to parathyroid gland are expected. So while doing dissection careful attempt to make out and avoid injury to the glands to prevent the incidence of hypocalcemia.

Hypocalcemia following thyroid surgery results from damage to the parathyroid end artery or parathyroid gland itself or due to accidental removal or manipulation of parathyroid gland during surgery. Unintentional parathyroidectomy will make an issue

IDENTIFICATION OF PARATHYROID GLANDSDURING SURGERY

There are 4 parathyroid gland in a normal healthy adult. 2 superior and 2 inferior gland. Superior glands are dorsal to

recurrent laryngeal nerve at the level of cricoid cartilage. Conversely inferior glands are ventral to RLN. Parathyroid glands are identified by its colour during preoperatively as golden yellow to light brown in adult. Its colour depends on cellularity, fat content and blood supply. They are ovoid in shape and embedded in loose tissue or fat, weight about 40-50mg each gland. O Edafe et al defined that identification of fewer than two parathyroid gland during surgery may produce hypocalcemia post operatively.

PARATHYROID GLAND INJURY DURING SURGERY

Injury to parathyroid gland is one of the important cause of post operative hypocalcemia. It is caused by several mechanism. Inadvertent excision of parathyroid gland may occur in a difficult thyroidectomy may cause post operative hypocalcemia. Its incidence could be clarified by examining the thyroidectomy specimen for the parathyroid. It is confirmed by serial sectioning of the surgical specimen dipped in to saline, parathyroid glands will sink but fatty tissue will float. O Edafe and colleagues stated that inadvertent excision of >2 parathyroid gland during thyroidectomy has association with transient hypocalcemia with odd ratio 1.90, 95% confident interval (1.31-2.74). Other causes are

subcapsular hematoma (or) bruising of the gland may produce trauma to parathyroid gland causes temporary (or) permanent damage.

VASCULAR COMPROMISE TO PARATHYROID GLAND

Parathyroid glands acquire their blood supply from a branch of the inferior thyroid artery, part from superior thyroid artery which supply 20% upper gland. Minor contributions from thyroidea ima. Vessels to the trachea, esophagus, larynx and mediastinum may have a role. Venous drainage by superior, middle and inferior thyroid vein drained into external and internal jugular veins. Because of anastomosis with the arteries parathyroid glands are unlikely to undergo ischemic insults unless there is direct interference with its arterial supply and producing temporary post operative hypocalcemia. It can occur in a variety of ways. In case of difficult thyroidectomy or extensive dissection in the region of Tracheoesophageal groove and inability to achieve good hemostasis at the time of surgery. Injury can occur while suturing the thyroid remnant to the pretracheal fascia may accidentally injure the parathyroid glands and vascularity.

Several studies have been analysed to assess the superior technique of vascular control during thyroidectomy to prevent vascular damage to parathyroid glands and reduce the incidence of post operative hypocalcemia. When division of main trunk of both principle thyroid vessels (or) to do microsurgical capsular dissection to direct out parathyroid blood supply and produces hypocalcemia.

Wingert et al 1986 suggested the technique of capsular dissection in their study design in which 221 patients who had been operated for total thyroidectomy, they ligated the superior and inferior thyroid arteries close to the glands thus preventing the main trunks of inferior thyroid arteries. The rate of hypocalcemia of only 4% that too occurred temporarily, because of rough handling which damages the vascular supply of parathyroid results in transient hypocalcemia. Even main trunk of inferior thyroid artery into trouble, superior thyroid artery may supply both the parathyroid and reduce the incidence of permanent post thyroidectomy hypocalcemia.

VENOUS COMPONENT

Venous drainage usually via venous channel right under the capsule of the gland and the vein that along the arterial branches of parathyroid glands. It has anastomosis with the veins on the surface of the thyroid or vein near the thyroid gland. So transient hypocalcemia can occur because of ligation of the venous drainage of the thyroid and postoperative local venous congestion and edema of the thyroid tissues. Symptoms will be settled once congestion and edema got relieved.

IDENTIFICATION OF RECURRENT LARYNGEAL NERVE

The practice of routine identification of recurrent laryngeal nerve necessitates an excessive amount of dissection on posterior surface of the thyroid. So that it reflexly increase the risk of damage to blood supply of the Parathyroid gland.

Identification of recurrent laryngeal nerve on both sides during thyroidectomy on 100 patients, 4 of them develop hypoparathyroidism at 1 year following the surgery. This was studied by Wade et al 1960. They recommended that no dissection should be done behind the nerve, and skeletonization of the nerves were not warranted to prevent permanent hypocalcemia.

Both RLN nerve has different location, Left RLN arises from vagus where it crosses aortic arch, loops around ligamentum arteriosum, ascends medially in the neck within tracheoesophageal groove. Whereas Rt. RLN arises from vagus crosses Rt. Subclavian Artery. Superior parathyroid gland which is dorsal to the plane of recurrent laryngeal nerve. Whereas the inferior gland is ventral to the nerve. Knowing the anatomy is more essential to identify both RLN & Both parathyroid which will prevent inadvertent excision of Parathyroid gland and injury to recurrent laryngeal nerve so that it avoids post operative hypocalcemia.

AGE

Older age is associated with Vitamin D deficiency. By knowing the metabolism of Vitamin D will help to correlate the association of Vit. D deficiency with older age.

Cholecalciferol is a performed Vitamin D activity which is formed in the skin by the use of 7 dihydrocholesterol when skin exposed to

UV light. This is catalysed by specific hydrolase in the liver to form 25 hydroxy D3. By the use of 1 alpha hydroxylase in the kidney regulate the formation of 1,25 dihydroxy cholecalciferol. This conversion is stimulated by low PO4 and PTH stimulation. This Vit. D3 form enter into intestine and increase the absorption of calcium and phosphate by MRNA translation and calcium binding protein activation and absorption of Calcium & release into blood stream. With the help of PTH it acts on bone and stimulate the mobilization of calcium and phosphate.

Thus in older age is associated with deficiency of 1,25 dihydrocholesterol, renal 1 alpha hydroxylase activity and reduction in calcium absorption.

SEX

Female sex have more prediction to get transient hypocalcemia. Postulated mechanism include lower Vit.D level in women.

This is explained by O Edage et al 2014, Gazi university faculty of Medicine. Ankara et al 2000 describes routine post operative calcium and Vitamin D supplementation therapy might be useful for the prevention of Symptomatic hypocalcemia after total thyroidectomy.

SIZE OF GOITER

LARGER GOITER



MEDIUM SIZED GOITER



Post operative hypoparathyroidism is most important consequences in dealing with larger goiter. Antakia et al suggested that there is increased risk of injury to parathyroid glands during operation on larger goiter. The reason behind this injury is that difficulty in dissection, which may injure parathyroid gland vasculature and parathyroid gland removal. Other factors that play role in postoperative hypocalcemia.

- 1) Toxic cases (Primary/ Secondary)
- 2) Malignancy.
- 3) Surgery for recurrent goiter

4. POSTOPERATIVE HEMODILUTION

Several metabolic alteration can occur in the body after surgery & stress. After thyroid surgery, acute volume loss trigger the presor receptors in the carotid artery and aortic arch, stretch receptor in the wall of the left atrium and the juxtaglomerular apparatus of the kidneys. This will cause antidiuretic hormone (ADH) release and activation of rennin angiotensin system causing the release of aldosterone. Pain after surgery also causes activation of above mechanism, end results are fluid retention. After volume loss there is a marked shift of fluid across the capillary bed into the blood stream.

These phenomena will cause dilution in the serum protein concentration because of reduction of red blood cells as measured by hematocrit. This will attribute to transient fall in total serum calcium levels in postoperative period. After 24-48 hours of surgery these levels return to normal. The false misinterpretation will be avoided by measuring ionized serum calcium levels after post thyroidectomy.

5. VENOUS OCCLUSION DURING SAMPLING

The effect of using tourniquet during blood sampling for serum calcium level estimation pointed out venous occlusion will increase in the protein concentration and shows an erroneous increase in total serum calcium and may mislead our study.

6. HYPOCALCEMIA IN THYROTOXIC PATIENTS EG. GRAVES DISEASE

In Graves disease because of thyroid hormone stimulation, there will be difference in calcium and bone metabolism.

This mechanism influences the bone development and bone turnover . Some prospective studies revealed the evidence of bone disease in most of the Graves disease patients known as thyrotoxic osteodystrophy It may not been presented with symptoms of bone disease, but negative calcium balance will be the evidence.

Michie et al[1998] showed that Graves disease patient undergoing thyroidectomy, there will be sudden reversal of osteodystrophy that

existed before surgery causes hypocalcemia. Most do occur to the fact that the patients of Graves disease have higher risk for post thyroidectomy hypocalcemia.

7. EFFECT OF BLOOD TRANSFUSION

Usually during thyroidectomy patients do not require interoperative (or) post operative blood transfusion. If it needs transfusion that indicates several factors are at play, increased vascularity, inadequate hemostatic and intraoperative mishaps. This will indirectly suggest parathyroid glands are at a higher risk for injury during surgery. Due to anticoagulant used in the blood that chelates calcium being transfused is deficient of calcium may provoke hypocalcemia. When administering three or more units of blood it had a significant effect on the incidence of postthyroidectomy hypocalcemia noted by Wingest et al³⁷.

8. PREOPERATIVE INGESTION OF DRUGS

Thiazide, Vit. A, Vit. D and lithium have been associated with hypercalcemia. Anticonvulsants, steroids, diazepam and mitramycin are known to produce to hypocalcemia. Rejnmark et al (49) stated that use of B Blocker decrease urinary calcium and ceases the incidence of reduction in bone mineral density.

Pttou F et al [1999] found that high risk for permanent hypoparathyroidism was associated with inadvertent excision of more

than 2 parathyroid glands or fewer than 2 parathyroid glands were identified and preserved in situ during thyroidectomy (or) early serum parathyroid hormone level $<15\text{pg/ml}$ (or) delayed serum calcium level $<8\text{mg/dl}$ on oral calcium therapy. Risk of permanent hypoparathyroidism is more with radical thyroid surgery as for thyroid malignancy (or) recurrent goiter.

Patient who underwent total thyroidectomy have 8 hr post operative PTH level 15pg/ml or higher, are at low risk for developing post thyroidectomy hypocalcemia .When the PTH level $<15\text{pg/ml}$ in who underwent total thyroidectomy have been monitored by serum calcium levels should be considered for early supplementation of oral calcium and Vitamin D supplementation. this prevents the develop permanent hypocalcemia.

Govanini C et al[2000] studied 30 patients that intraoperative PTH levels obtained following skin closure and ionized calcium level obtained 6 hours postoperatively and every day thereafter who underwent total thyroidectomy. They found that following total thyroidectomy, intraoperative PTH level can predict in a reliable and timely fashion that which patients will develop symptomatic hypocalcemia. Eventhough serial serum calcium levels may correlate with the development of symptomatic hypocalcemia. however these results are not useful until 12-24 hours postoperatively. This can postpone therapy and increase the duration of hospitalization. These

studies interprets that which patient requires early calcium and Vit. D supplementation.

When hypocalcemia in hypomagnesemic state usually attributed to refractiness of end organs to calcemic action of parathyroid hormone. Parath hormone is most important fator in maintaining calcium homeostatis.

Parathyroid hormone increase the concentration of calcium in extracellular fluid and plasma. In case of magnesium deficiency hypocalcemia is frequently associated. Restriction of dietary magnesium producing hypomagnesemia associated with reduction in the concentration of total and ionized calcium and increase in the concentration of phosphate produces parathyroid gland functional derangement. In these study magnesium depleted animals were responding to PTH. Hypomagnesemia observed in hypocalcemia have refractiness to parathyroid hormone and it could not be explained. It was due to impaired synthesis (or) reduced secretion of parathyroid hormone.

Wong W K et al[1996] evaluated early postoperative serum calcium concentration as a predictor of hypocalcemic symptoms. They concluded that calcium determination in early post operative period have lease impact in predicting the onset of hypocalcemia symptoms.

Michael R Marohn et al 1994 studied 150 patients who undergone total thyroidectomy to find out a regimen for safe cost effectiveness and hospitalization days. After 12-18 hours post operatively airway and wound related problem will not occur. The only morbidity which require closed monitoring and follow up is hypocalcemia. They constituted a three point groups based on serum calcium levels at 8, 14 and 20 hrs after surgery and suggested which patients are at risk of developing significant hypocalcemia.

All patients with positive sloping curve at 20 hours did not develop hypocalcemia. They could be safely discharged at 24 hours. Patients with negative sloping curve at 20 hours had at risk of developing hypocalcemia and need close monitoring in the hospital.

Yamashita et al [1999] found that total thyroidectomy in patient with Graves disease is associated with a higher incidence of postoperative hypocalcemia (or) Tetany compared with total thyroidectomy performed in patients with nodular thyroid disease.

Difference in calcium and bone metabolism induced by thyroid hormone have influence on bone development and bone turnover. If it is caused by parathyroid insufficiency related to injury, devascularization (or) inadvertent excision of parathyroid glands then it could not able to explain the reason for tetany in Graves disease. In some of the studies

suggested the possible role of calcium release in early post thyroidectomy hypocalcemia.

McHenry et al 1994 recently reported that serum Calcitonin levels were unchanged after thyroidectomy. Some studies analysed the predictive risk factors for post operative tetany developed in only 4 out of 15 patients with severe hypoparathyroidism in which PTH <5pg/ml. The difference between the patients with and without postoperative tetany inspite of decreased hypothyroid fuction is important for clarifying the mechanism of postoperative tetany.

Estimation of 1,25 (OH)₂D/ 25 hydroxy Vit. D ratio used to identify the difference between patient with and without tetany. Renal conversion of 25 OH D to 1,25 (OH)₂ D is regulated by PTH in response to increasing calcium and phosphorus requirement of the body. Hypocalcemia may present in immediate post operative day as perioral numbness, tingling sensation. After 48-72 hours patient may shows and chvostek & Trousseau's sign. When tapping on the face at a point just anterior to ear, twitching of ipsilateral facial muscle showed positive sign. Inflating sphygmomanometer cuff above systolic blood pressure for severe minutes lead to flexion of wrist and metacarpophalangeal joint and hyperxtension of finger. In case of severe hypocalcemia may present as tetany or convulsion. Monitoring serum calcium every 6-12 hours and 48-72 hours after thyroidetomy is essential in these patients.

Hypocalcemia is a condition defined by a net loss of calcium from extracellular fluid in greater quantities that can be replaced by bone or intestine. The signs and symptoms are generalized neuromuscular irritability including paresthesia, muscle cramps, laryngospasm, tetany and seizure. Tetany is caused because hypocalcemia impedes Ach release at neuromuscular junction. So that increase in neuronal excitability over rides the inhibition of muscle contraction.

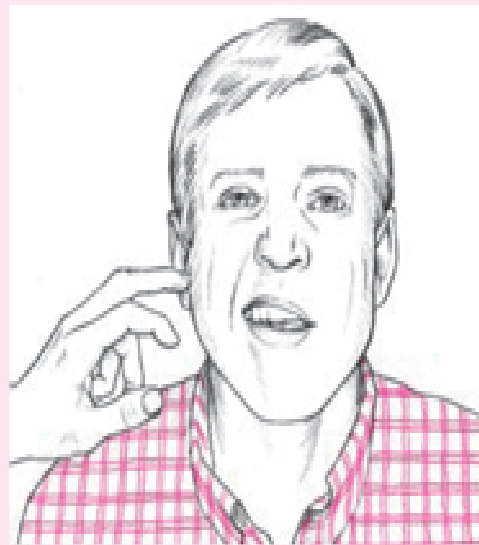
- ❖ Eliciting Chrostek's sign
- ❖ Trousseau sign
- ❖ ECG changes.



ASSESSMENT TIP

Eliciting Chvostek's sign

Begin by telling the patient to relax his facial muscles. Then stand directly in front of him, and tap the facial nerve either just anterior to the earlobe and below the zygomatic arch or between the zygomatic arch and the corner of his mouth. A positive response varies from twitching of the lip at the corner of the mouth to spasm of all facial muscles, depending on the severity of hypocalcemia.






Trousseau sign:

(very uncomfortable and painful)

- ▶ A blood pressure cuff is inflated to a pressure above the patients systolic level.
 - ▶ Pressure is continued for several minutes.
 - ▶ Carpopedal spasm:
 - * flexion at the wrist
 - * flexion at the MP joints
 - * extension of the IP joints
 - * adduction thumbs/fingers
-





▶ Long QT interval with normal T waves

▶ Prolongation of the ST segment with little shift from the baseline

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MANAGEMENT

When the patient is severely symptomatic like tetany, carpopedal spasm, prolonged QT interval in Ech should be treated with bolus intravenous calcium in the form of calcium gluconate 10ml of 10% solution is equalent to 90mg of elemental Ca. The duration of action of IV Ca bolus is 1-3 hours. So add 11amp of Ca gluconate in D5/NS to make 1L solution with Ca concentration of 1mg/ml at a rate of 1ml/min or 60mg/hour.

With concurrent hypomagnesemia is corrected by giving 2gm of Mg(16meq) of MgSo4 as 10% solution over 10-20mts followed by 1gm MgSo4 (8meq) at 100ml/hr.

Oral calcium 1-2gm TID along with Vit.D₃ preparation.

High degree of hypocalcemia in early post operative period reflect irreversible injury to Parathyroid gland and these patients are closely monitored by estimation of free calcium or ionized calcium level.

Following surgery of thyroid or parathyroid glands stable postoperative calcium level is the main predictor of transient (or) persistent hypocalcemia .So that we can discharge the patient early and prevent the delay in hospitalization.

Conclusion was positive slope in two early post operative calcium level is strongly predictive of stable post operative calcium level, down sloping in post operative calcium level has risk of developing temporary/ permanent hypocalcemia after total thyroidectomy.

MATERIALS AND METHODS

The present study was conducted in the Department of Surgery, Madras Medical College and Hospital, Chennai-3. The patients were selected among thyroid patients attending Surgery Department of Madras Medical College and requiring thyroid surgery. Total of 52 Thyroid patients who underwent thyroid surgery for benign or malignant disorders were included in the study. The study was conducted between Jan 2015- June2016.

INCLUSION CRITERIA

Patients undergoing total thyroid surgery with / without lymphnode dissection.

EXCLUSION CRITERIA

- 1) Patients with previous thyroid or parathyroid surgery
- 2) Patients having confounding factors like hypoalbuminemia.
- 3) Patients taking any form of calcium supplementation preoperatively
- 4) Patients of chronic renal failure and those having secondary hyperparathyroidism.
- 5) Patients on drugs causing hypocalcemia (anticonvulsant, chlorpromazine, diazepam, oral contraceptive, steroids and

mithramycin) or hypocalcemia (thiazide, Vitamin A, Vitamin D, lithium and absorbable antacids).

- 6) Patients receiving blood transfusion within the first 24 hours after surgery.

CONSENT: Written informed consent was taken from all the subjects.

CLINICAL ASSESSMENTS AND PATIENT WORKUP

Detailed history and clinical examinations were evaluated in all patients taken up for study, with reference to symptoms like heat intolerance, palpitation, dyspnea, insomnia, restlessness, weakness, muscle cramps, frequent bowel movement, weight loss in spite of good appetite (in hyperthyroid patients) and for cold intolerance, lethargy, constipation, weight gain in (hypothyroid patients) all other clinical findings were included.

INVESTIGATION

Following investigations were subjected in all the patients included in this study

Biochemical and laboratory tests

- 1) Routine hematological investigations
- 2) Serum biochemistry including blood sugar, urea, creatinine, and electrolytes.

- 3) Total and ionized calcium
- 4) Serum phosphorus
- 5) Serum albumin
- 6) Serum alkaline phosphatase
- 7) Thyroid functions test (serum TSH, Free T4)
- 8) Serum parathyroid hormone

RADIOLOGICAL STUDIES

❖ Chest X-Ray

❖ Xray neck

1. Anteroposterior

2. Lateral view

❖ USG and CT Neck

1. Indirect laryngoscopy

Fine needle aspiration cytology for histological diagnosis

All blood samples were collected without using a tourniquet. Blood sampling were immediately sent to laboratory for analysis and reporting.

Serum ionized and total calcium levels were assessed.

- ❖ Preoperatively
- ❖ 12 Hours postoperatively
- ❖ 24 Hours postoperatively
- ❖ 48 Hours postoperatively

Parathyroid hormone estimation is done within 24 hours postoperatively.

After completion of surgery the proforma of the patients were completed with regards to

Intraoperative findings are

- 1) Blood loss approximately (in ml) any need for blood transfusion if present.
- 2) No. of parathyroid gland identified and preserved
- 3) Recurrent laryngeal nerve identified and preserved or not.
- 4) Lymphnode dissection was done or not
- 5) Any other major intraoperative event.

Patients have been followed up postoperatively with signs and symptoms of hypocalcemia in immediate post operative period, 12 hours, 24 hours and 48 hours postoperatively and patient with evidence

of clinical and biochemical hypocalcemia have been followed up on outpatient department (OPD) basis with weekly ionized serum calcemia levels. Ionized calcium levels are used as follow up marker.

RESULTS

A total of 52 patients were included in the study as per the criteria listed earlier. They underwent thorough pre operative work up as per the study Performa prior to surgery.

They were 48 Female and 4 Male Patients aged between (35-65) who were included in the study. All routine and specific investigation were done in all the study cases prior to surgery.

Four patients were known hypertensive on treatment at the time of surgery. 3 patients had non insulin depended diabetes mellitus and 4 patients were known asthmatics on treatment for the same. These patients were given medication for associated medical illness before and after the surgery. 3 patients received anti thyroid medications preoperatively for control of hyperthyroid state and to render them euthyroid preoperatively. 3 patients received insulin for diabetes and 4 patients received oral deriphyllin for asthma.

(1)Patient of Graves disease, and (9) Patients of thyroid malignancy.

Preoperatively serum calcium “ total & ionized “ serum albumin and serum alkaline phosphate levels of the patients were recorded . All patients undergone thyroidectomy through the standard collar crease incision which was modified in those who need functional neck

dissection for malignancy. Suction drain were used in all cases. The signs & symptoms of hypocalcemia were followed up in the postoperative periods and also with serial estimation of ionized calcium levels or postoperative day one at 12 hours and 24 hours and 48 hours, then weekly depending upon initial calcium levels.

HYPOCALCEMIA- INCIDENCE, SYMPTOMS AND TREATMENT

In our study the incidence of symptomatic hypocalcemia apparent in the postoperative period was 34.6% i.e. 18 out of 52 patients. All patients had initial fall in serum ionized calcium level in the postoperative period. In all patients the fall in ionized calcium levels was noticed at 12 hour after surgery. Serum calcium continued to fall in 18 patients at 12 hours post operatively. At 24 hrs serum calcium continued to fall in same 18 patients. By serial calcium measurement remaining 34 patients serum calcium level remains normal like its preoperative levels. At 72 hrs those 18 patients who had hypocalcemia continued to show low serum calcium level.

BASED ON PARATHYROID HORMONE LEVEL

In our study the incidence of symptomatic hypocalcemia was 34.2% i.e. 18 out of 52 patient. All the patients had fall in parathyroid hormone level noted in 24 hours after surgery. It could be due to larger Goiter (or) longer duration of surgery (or) difficulty in dissection (or) need for lymph node dissection (or) posterior infiltration (or)

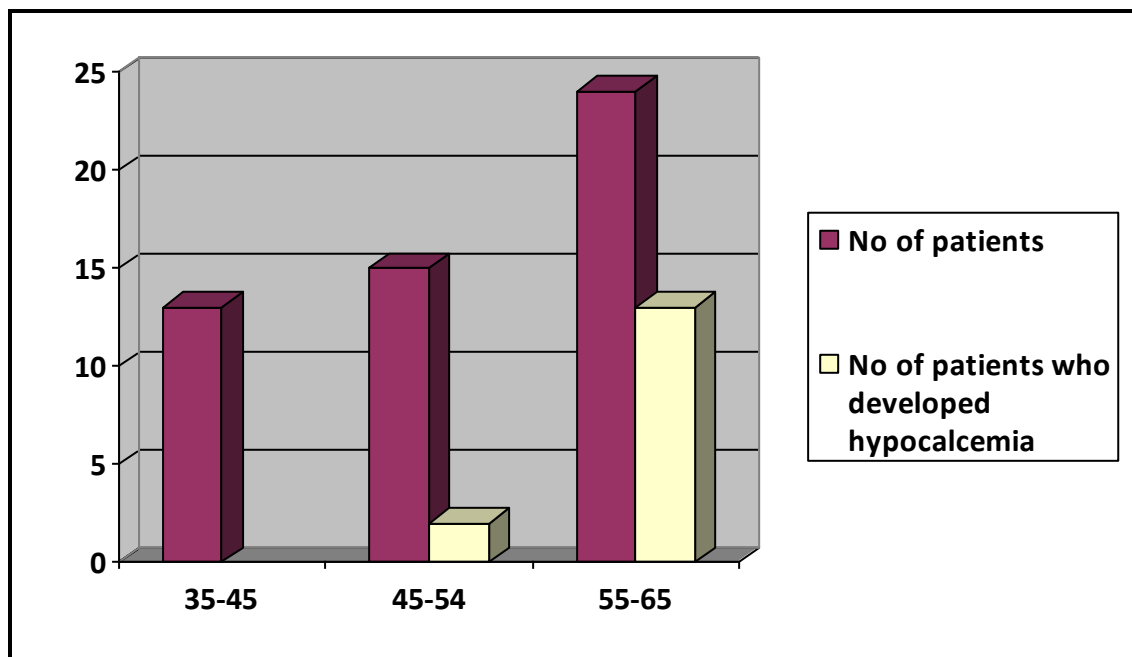
devascularization of parathyroid gland during surgery, (or) inadvertent excision of parathyroid glands (or) identification of fewer than 2 parathyroid gland.

The various symptoms & signs are documented consisted of paresthesia, circumoral tremor, hand or feet, positive trousseaus sign, positive chvostek's sign. Out of 18 patients 4 patient had symptom sever enough to have required intravenous calcium therapy. Other were started and oral calcium and vitamin D₃ supplementation and followed up weekly on outpatient basis and treated accordingly.

STATISTICS

Age distribution of the subjects (n = 52)

Age	No. of Patients	Hypocalcemia observed	%
35-44	13	-	0
45-54	15	2	13.3
55-65	24	13	54.1



The overall mean age among patients was 45 years on the whole, the male patients are lesser than female patients. Largest subgroup of patients were in 5-6 decades.

In our study 4 male and 48 female patients were there, in which 1 out of 4 male Patients and 17 out of 48 female patients developed

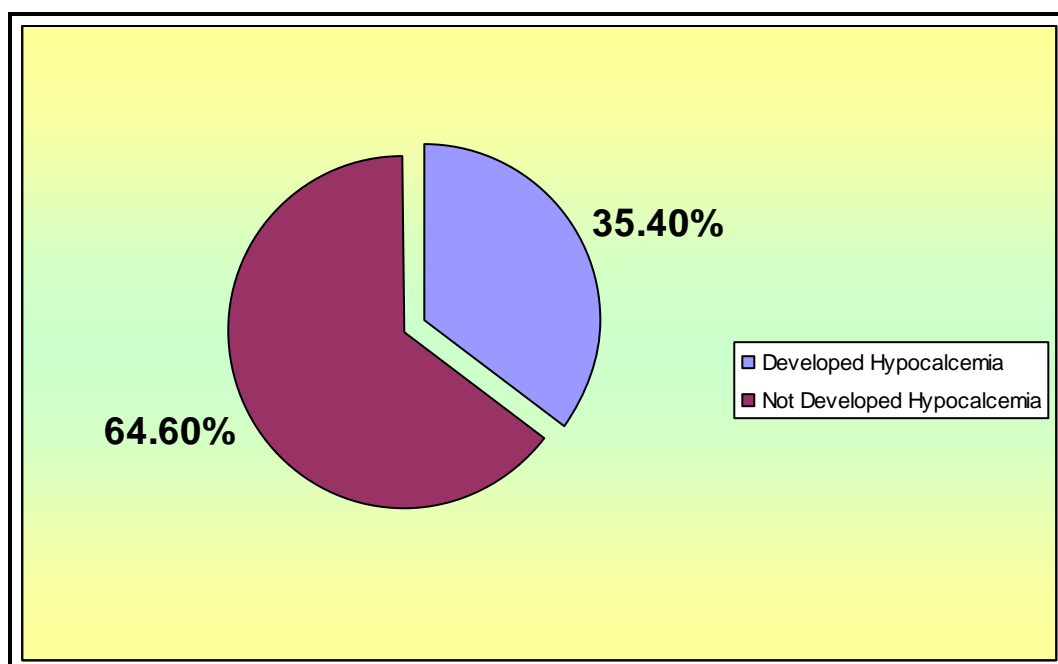
hypocalcemia. So 25% of the male and 37.5% of the female patients had postoperative symptomatic hypocalcemia following thyroidectomy. Female patients have low level of vitamin D. so they will have reduced absorption of calcium and developed hypocalcemia.

In our case 1 out of 4 male patients developed hypocalcemia ,reason behind hypocalcemia in that one patient was he had SNT with level II and III. During dissection and lymphadencetomy devascularisation of parathyroid gland was happened, and the patient developed temporary hypocalcemia.

Sex distribution of the subjects (n= 52)

Sex	No.of Patients	Hypocalcemia	%
Male	4	1	25
Female	48	17	35.4

Percentage distribution of hypocalcemia patients observed among female subjects (n= 48)

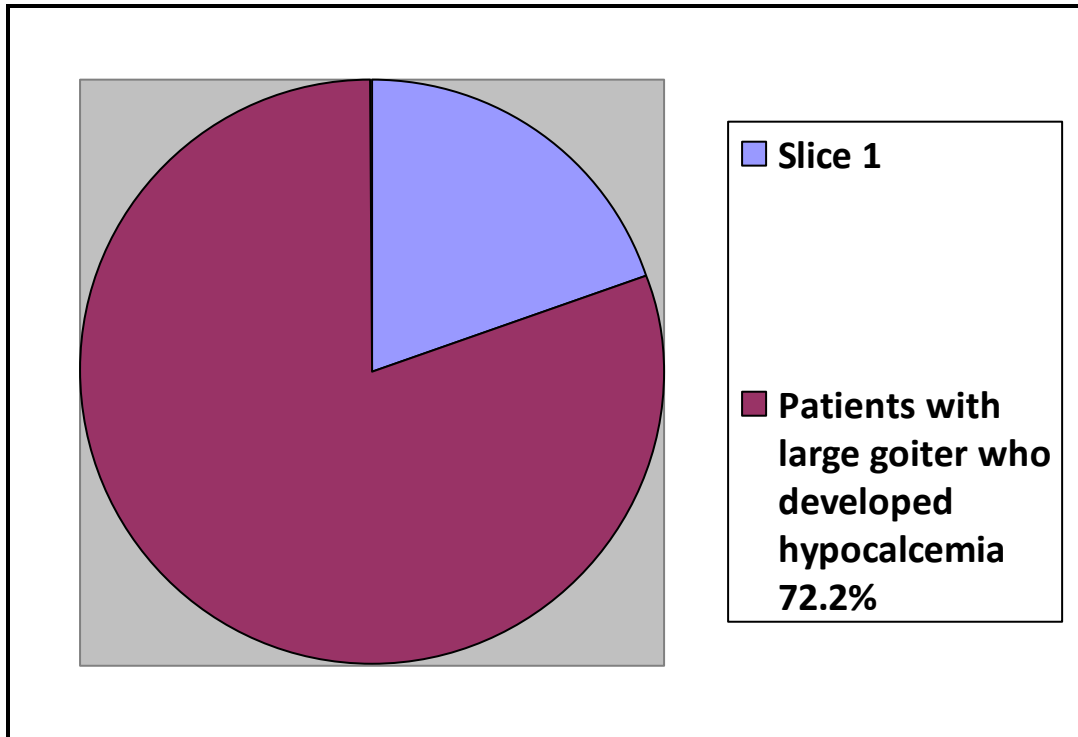


Distribution Based on the Size of Goiter

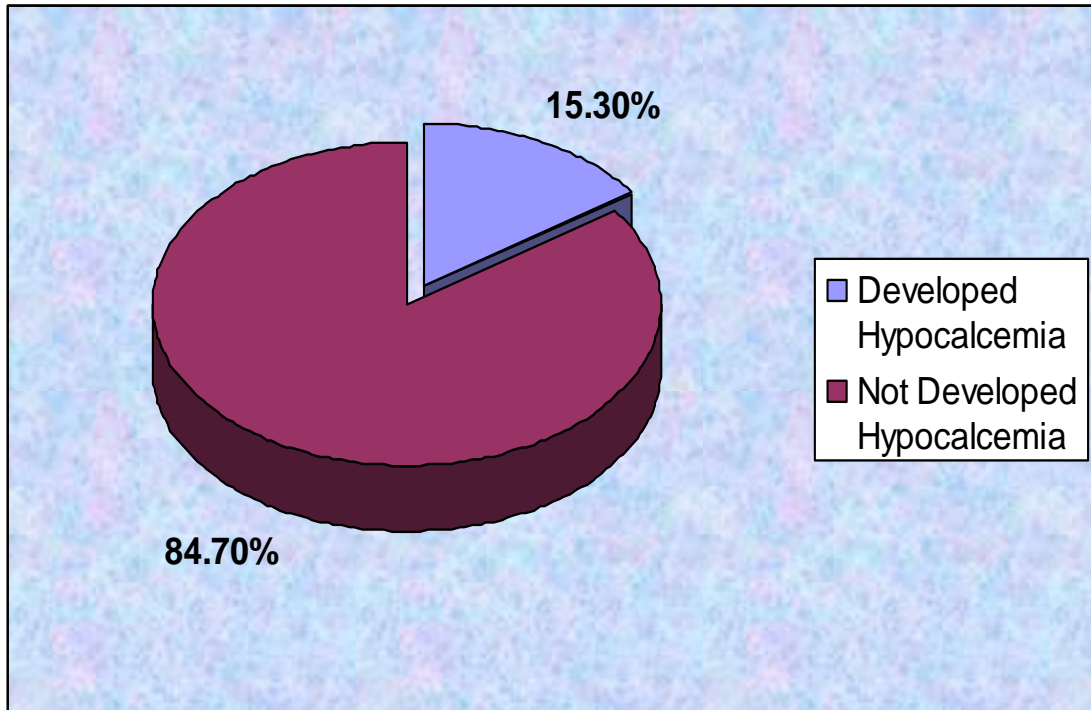
Size	No. of patients	Hypocalcemia observed	%
Large	18	13	72.2
Medium	26	4	15.3
Small	8	1	12.5

Hypocalcemia observed among large size goiter patients (n=18)

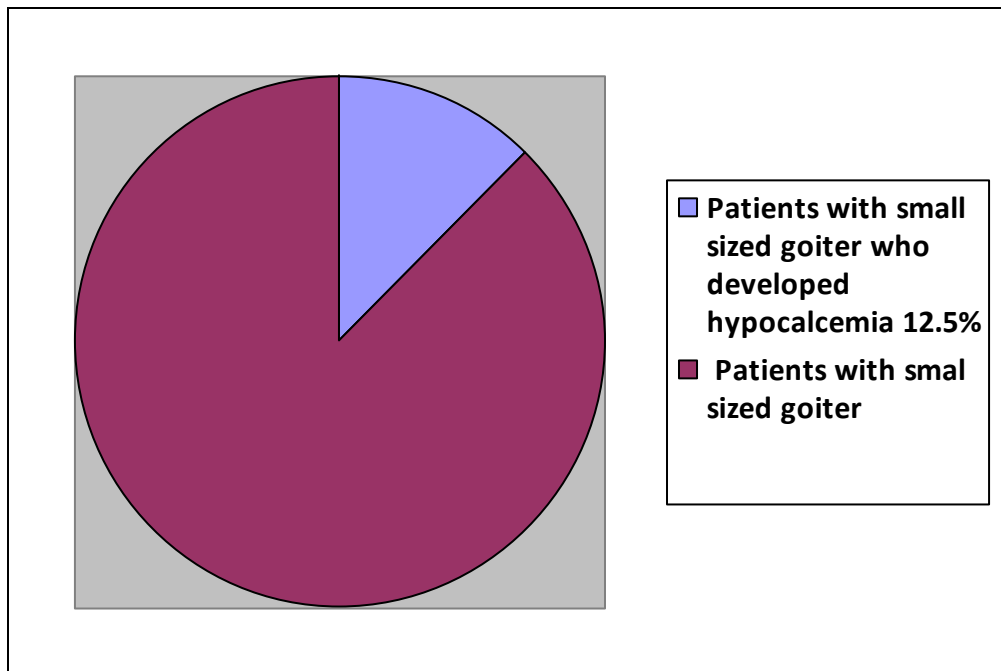
Hypocalcemia among large size goiter



Hypocalcemia observed among medium sized goiter patients (n=26)



Hypocalcemia Observed Among Small Sized Goiter Patients (N=8)



The incidence of hypocalcemia among small size goiter was 12.5%, so the risk of hypocalcemia is higher in case of large size goiter.

Distribution of Hypocalcemia Based on Histo Pathological Diagnosis

Type	No. of Patients	Hypocalcemia	%
Malignancy	9	6	66.7
Graves	1	1	100
Adernonatous goiter	40	8	20
Hashimoto thyroidites	2	1	50

Out of 9 patients, 6 patients developed hypocalcemia, so the incidence of hypocalcemia is higher among malignant cases compared to benign cases.

Distribution of hypocalcemia in relation with intra operative preservation of parathyroid gland.

Parathyroid glands preserved	No.of patients	Hypocalcemia observed	%
Less than 2	15	15	100
2 or more	37	2	5.4

Percentage distribution of hypocalcemia observed when more than 2 parathyroid gland preserved (n=15) was 5.4%

In this study 52 patients were studied

Among 52 patients, in 15 patients <2 parathyroid glands were preserved, all patients developed symptomatic hypocalcemia. Those who had >2 parathyroid glands preserved during surgery 5.4% of patients developed hypocalcemia.

In 18 symptomatic hypocalcemia patients, 13 patients had relieved symptoms within 6 months. 5 patients needed treatment for 1 year, could be due to inadvertent excision of parathyroid glands more than 3 (or) lymph nodes in the tracheoesophageal groove which was dissected during neck dissection.

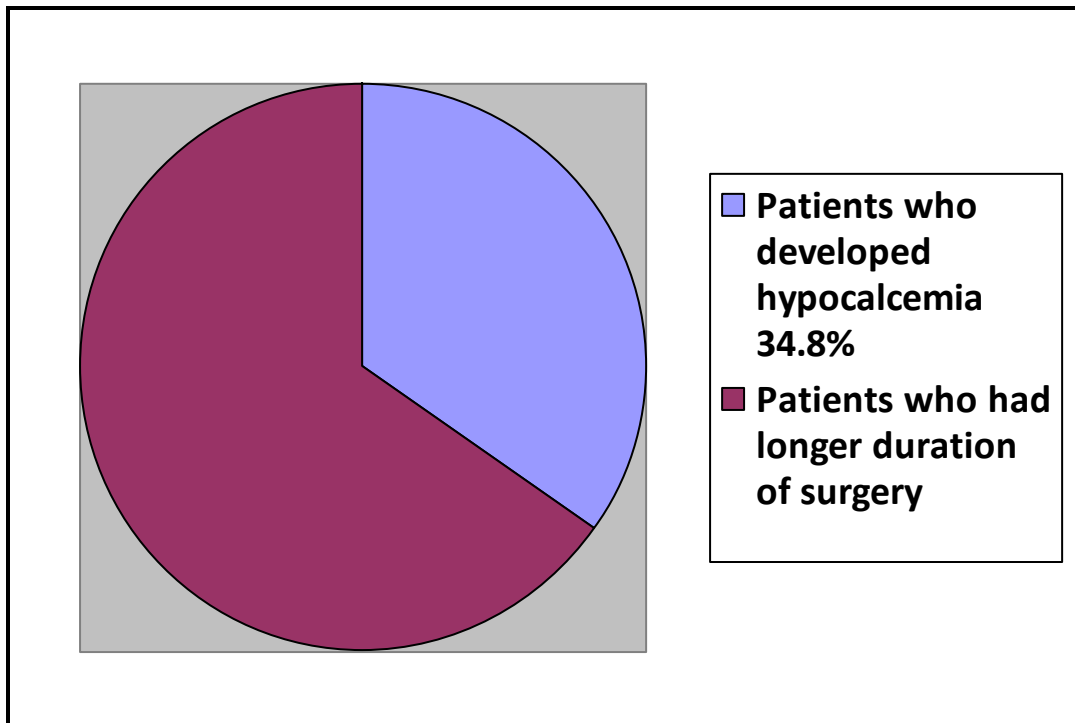
Relation observed between PTH and serum calcium

When accidental injury to a parathyroid gland during thyroidectomy may alter the parathyroid hormone secretion, it will automatically reflect the serum calcium level which falls below normal. The normal parathyroid hormone level around 18-20 pg/ml will correspond to a normal ionized calcium level that is between 4.7-5 mg/dl. So serial monitoring of calcium showed a low level, we are forced to monitor serum parathyroid hormone level and it will indirectly reflect parathyroid gland injury.

Distribution Of Hypocalcemia In Relation To The Duration Of Surgery

Time	No.of patients	Hypocalcemia	%
Short duration (1-2hr)	9	1	11.1
Long duration (>2hrs)	43	15	34.8

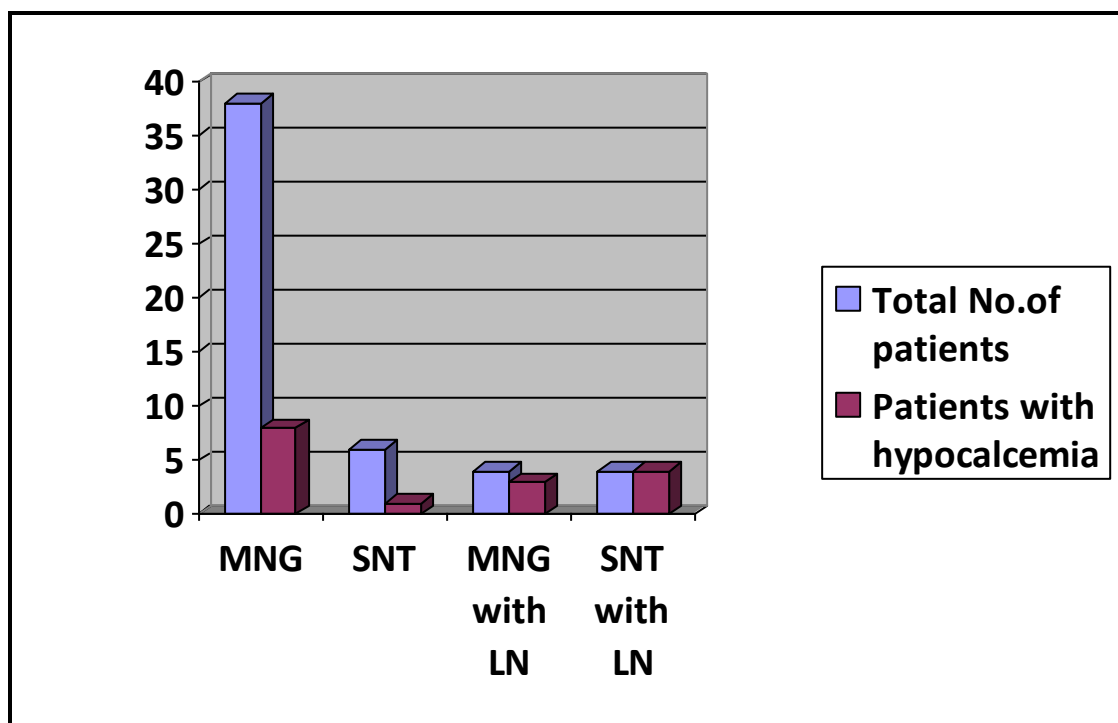
Percentage Distribution Of Hypocalcemia Among Longer Duration Surgery (N=43)



Distribution of Hypocalcemia Based on Usg Neck

Type	No.of patient	Hypocalcemia	%
MNG	38	8	21.05
SNT	6	1	16.6
MNG with LN	4	3	75
SNT with LN	4	4	100

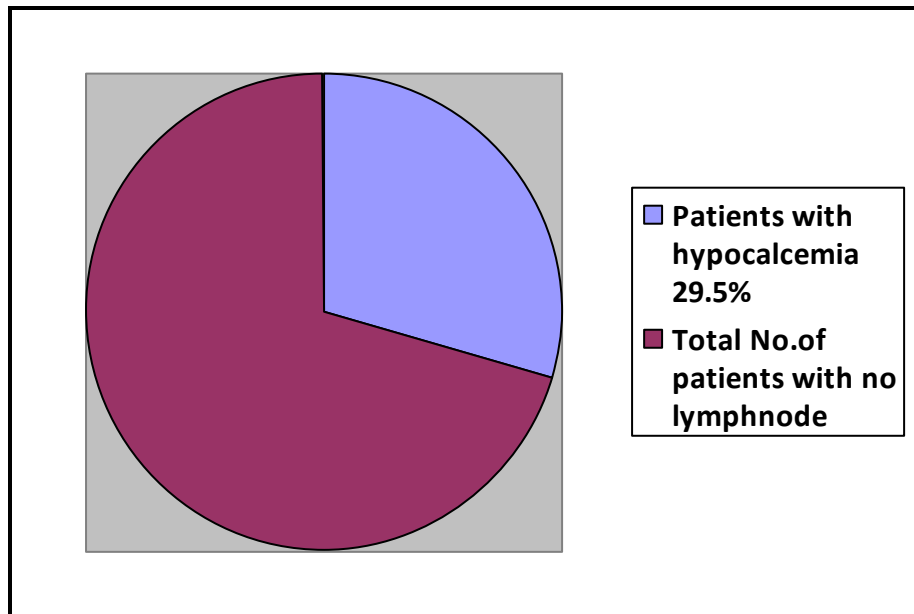
Representation based on usg findings



Distribution of Hypocalcemia in Relation to CT Findings

CT	No.of People	Hypocalcemia	%
CT with LN	8	8	100
CTwith out LN	44	13	29.5

Percentage distribution of hypocalcemia among patients without lymph node (n=44)



In this study of 52 patients, all had undergone bilateral thyroidectomy and in which 8 patients underwent neck dissection. Recurrent laryngeal nerve identified on both sides in 44 out of 52 cases. It was identified only on L side in 4 cases. Only on right side in 3 cases. In one case the nerve could not be identified on either side, due to dense vascularity & posterior infiltration. In that case postoperative vocal cord status were checked & mobile on both side.

In all other cases identified nerves were preserved.

Distribution of the Identification of the Recurrent Laryngeal Nerve in Bilateral Dissection

S. No	Recurrent laryngeal nerve identified	No.of patients	Post operated palsy
1	Both sides	44 (84.6%)	Mobile in all
2	R side only	3 (5.7%)	Mobile in all
3	L side only	4 (7.6%)	Mobile in all
4	None	1 (1.9%)	Mobile in all

Out of 44 patients in whom the recurrent laryngeal nerve was identified on both sides, 16 patients (36.3%) developed symptomatic hypocalcemia. Out of 7 patients with unilateral identification of recurrent laryngeal nerve, 2 patients developed symptomatic hypocalcemia. of the 1 patient in whom none of the nerve could be identified, had no symptom of hypocalcemia, and serial monitoring also did not show any fall in calcium &PTH level. Hence it can be derived that identification of the nerve during the course of thyoidectomy does not place the parathyroid gland at a greater risk of damage.

Hypocalcemia in Relation with Intraoperative Blood Loss and Blood Transfusion:-

Intra operative blood loss among the patients in the study varied from 50ml to 550ml, the mean blood loss was 175 ml after total thyroidectomy

S. No	Intra operative Blood loss	No.of patient	Hypocalcemia Patient
1	<100ml	8	1 (12.5%)
2	100-150ml	37	12 (32.43%)
3	>150ml	7	5 (71.42%)

In 8 patients intra operative blood loss was <100ml in which 1 patient (12.5%) developed hypocalcemia. 37 Patient intra operative blood loss was 100-150 ml in which 12 patient (32.43%) developed hypocalcemia. In 7 patient intra operative blood loss>150ml in which 5 patient (71.42%) developed hypocalcemia.

Thus it can be concluded that the greater the blood loss the more is the incidence of hypocalcemia This can be possibly due to the fact that the parathyroid are at higher risk of damage in such cases due to increased difficulty during thyroidectomy (or) neck dissection. This leads to a higher incidence of post operative hypo parathyroidism.

HYPOCALCEMIA IN RELATION WITH PREOPERATIVE DRUG INTAKE

Of the 4 patients who were taking antihypertensive for hypertension, 3 patients on oral hypoglycemia agents, 4 patients on deriphyllin, none had developed symptomatic hypocalcemia. Hence no conclusion can be drawn regarding effect of pre operative drug intake on hypocalcemia.

DISCUSSION

Thyroid disorder is a common issue in India. Since these disorders are endemic in India, these are called Goitre Belt. The surgical intervention requirement for the load of thyroid disorders are enormous but the resources and hospital facilities are scarce. To reduce the cost and decrease the load on the resources is important to decrease the duration of hospital stay by early and safe discharge. The trend has changed that keeping the patients for long duration to, day care surgery in most of the surgical discipline.

Hypocalcemia is the most common etiology for prolonged hospitalization in post thyroidectomy patients. We have come a long way from the times when thyroid surgery cause mortality. Since the mortality rate is less than 1%, our aim is to reduce the morbidity which varies from 2%-31%. Several factors affect the development of hypocalcemia, the important things are direct and indirect injury to parathyroid gland by devascularisation of parathyroid gland. Predictive information on the development of postoperative hypocalcemia could permit the implementation of series of therapies aimed at reducing symptoms and preventing improper (or) delayed discharge.

Traditionally daily monitoring of serum calcium has been used. This biomarker can be altered even 24-48 hours after surgery. In view

of early and safe patient discharge, the dosage of parathyroid hormone was tested as a biomarker of postoperative hypocalcemia which gives good sensitivity and specificity. PTH can be affected by sex, hyperthyroidism and Vit. D level. Transient hypocalcemia remains the most frequent complication after total thyroidectomy with incidence of 1.6% to 50% but incidence of permanent hypocalcemia is 1%-3%. Other than bleeding, hypocalcemia is the most common cause of delayed discharge or readmission after total thyroidectomy. By knowing which patients will experience a hypocalcemia will allow to anticipate therapy to reduce symptoms and safe discharge. It was supported that women and a diagnosis of Graves disease with a low level of Vit. D have higher risk for postoperative hypocalcemia. In fact the patient with a deficit of Vit. D, the dosage of PTH after surgery is not useful as a predictor of post thyroidectomy hypocalcemia. Lombardi et al⁴⁹ reported a false negative rate of 13.4% and concluded that PTH level is less than 10pg/ml gives high predictive value.

Other complications are being damage to recurrent laryngeal nerve and symptomatic hypocalcemia. Serum calcium exist in three forms. Ionized calcium, protein bound and a small amount as diffuse complexes. Ionized form of calcium is active form and stay in the equilibrium with protein bound form. Estimation of ionized serum calcium is accurate for diagnosis of hypocalcemia rather than total calcium because later

Ionized form of calcium is affected by many confounding variable factors like hypoalbuminemia, hemodilution. Hypocalcemia is defined when ionized calcium level is less than 4.7 mg/dl. Most of the time before diagnosing serum calcium level the symptoms appears. So that it is important to identify the patient with low calcium level before the symptoms appears. The behavior of early serum calcium levels postoperatively can be used to predicts the eventual outcome of serum calcium.

Parathyroid glands are important endocrine glands, its location is behind the thyroid gland. They are four in number, two on either side. upper two glands are constant in position. Develop from 4th Pharyngeal pouch hence they are called parathyroid IV. It lies behind recurrent laryngeal nerve. Two lower glands are variable in position, develop from endoderm of 3rd pharyngeal pouch hence called parathyroid III. It is usually in front of recurrent laryngeal nerve and adjacent to the anastomoses between superior and inferior thyroid arteries posteriorly. parathyroid hormone increases absorption of the gut, mobilizes calcium from bone and increases calcium reabsorption from the renal tubules. Parathyroid glands contain chief cells which secretes parathyroid hormone.

In our study some of the patient had asymptomatic fall in ionized calcium levels in immediate postoperative period, it is improved after a period of time and in these cases resected specimen does not show

presence of parathyroid glands. The explanation was asymptomatic, hypocalcemia is due to surgical manipulation of parathyroid gland leading to transient loss of their function.

ANALYSIS OF OUR STUDY

In the study 52 patients of thyroid disease were assessed for the occurrence of postthyroidectomy symptomatic hypocalcemia using serial monitoring of pre and post operative ionized serum calcium levels , parathormone and Vit. D levels.

INCIDENCE OF SYMPTOMATIC HYPOCALCEMIA:

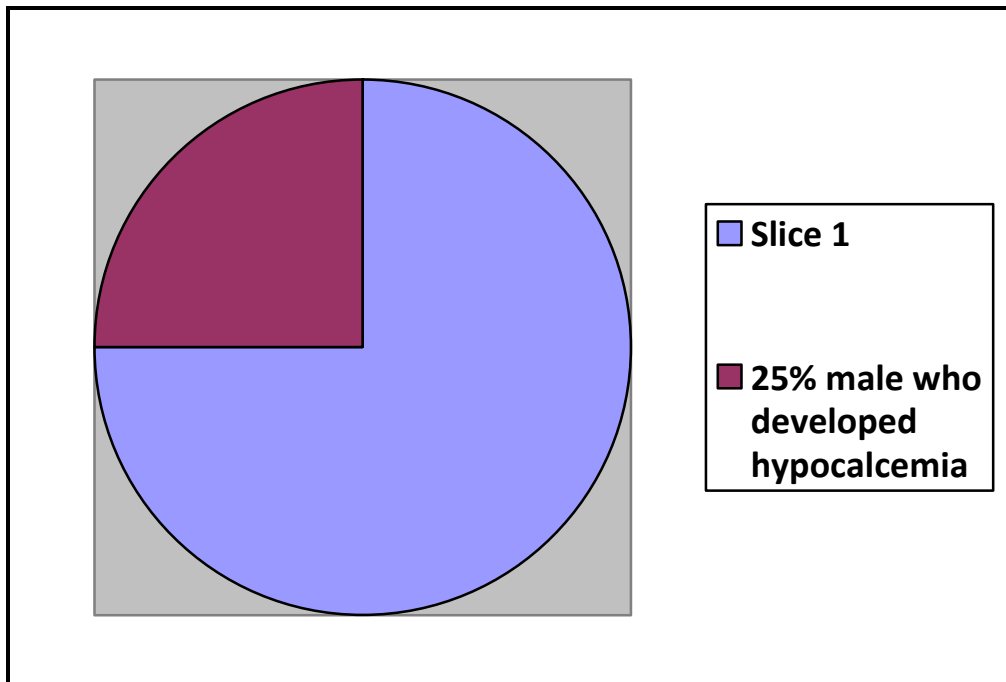
In the present study the incidence of post thyroidectomy symptomatic hypocalcemia was 36.5%

This figure corroborate with that Jacobs et al²⁸ reported that 27.7% of early hypocalcemia patients received calcium supplementation after total thyroidectomy.

Wingert et al³⁷ total of 220 patients for malignant as well as benign goiters, they reported 12.5% incidence of symptomatic hypocalcemia. Scanlon et al²¹ reported 250 patients undergone total thyroidectomy over a period of 10 years. In which atleast 20% patient required at least one dose of calcium during the immediate postoperative period.

AGE AND SEX OF THE PATIENTS WITH INCIDENCE OF HYPOCALCEMIA

Percentage share of hypocalcemic patients observed among males (n=4)

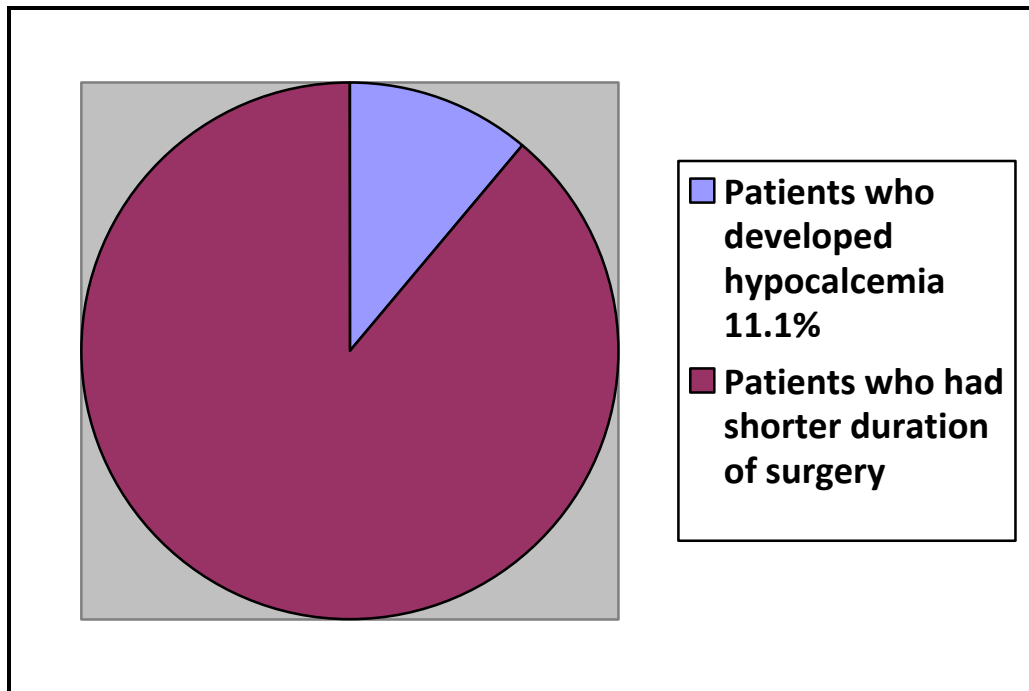


In present study there were 2 male 50 female patint with overall mean age of 46.5 years. Results concluded that old age will have high incidence of hypocalcemia. Female sex will have more prediction towards hypocalcemia and in men with lymphnode dissection resulted in hypocalcemia. Age and sex had influence on symptomatic hypocalcemia .

Thus our study concluded that old age, and female sex had more incidence of post thyroidectomy hypocalcemia. .

DURATION OF SURGERY WITH INCIDENCE OF HYPOCALCEMIA

In the present study Percentage distribution of hypocalcemia among short duration surgery (n=9)

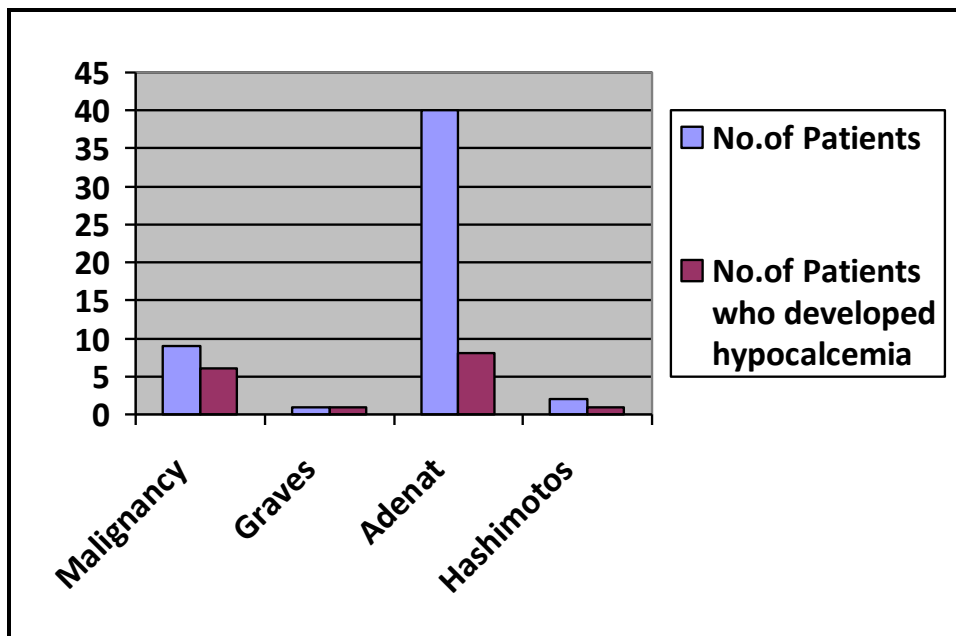


In our study, duration of surgery is classified into 1 hr, 1-2 hr, more than 2hours, none of the patients was operated in 1 hour, 9 pts operated with 1-2 hours and remaining 43 pts completed total thyroidectomy in more than 2 hours.so 15 out of 43 patients had been operated in longer duration developed hypocalcemia and, 1 out of 9 developed hypocalcemia. concluded that longer duration of surgery indirectly reflects that difficulty in dissection or lymph node dissection may provoke the incidence of post thyroidectomy hypocalcemia.

Similar results Wingert et al[2009] reported an incidence of symptomatic hypocalcemia of 4% for benign disease which increased 20% following total thyroidectomy.

Tovi et al[2008] reported 4 cases of symptomatic hypocalcemia in 100 patients with malignant thyroid problem followed up for 1 year. Lymphnode dissection had done in three patients in addition to total thyroidectomy.

HISTOPATHOLOGICAL DIAGNOSIS WITH INCIDENCE OF HYPOCALCEMIA



In this study out of 52 patients 8 patients were operated in view of malignancy, remaining 84.6% operated for benign causes.

OEdafe et al[2014] reported that the incidence of post thyroidectomy hypocalcemia was higher in patients with malignant disease than benign goiter. They have given the conclusion that

malignant Goiter will have posterior infiltration and may need lymph node dissection could result in post operative hypocalcemia.

STEPS OF TOTAL THYROIDECTOMY- CERVICAL APPROACH

By making transverse incision provides a direct approach to the thyroid gland, lateral limit of incision upto medial Border of sternocleidomastoid. Subcutaneous fat, the platysmal muscle and superior and inferior flaps are dissected beneath the platysmal layer. Midline raphe can be identified between the sternohyoid muscle can identify isthmus of the thyroid in the midline and each of the lobes laterally. By doing blunt finger dissection can separate sternohyoid muscle, in a deep and lateral position identify sternothyroid muscle. Great care must be used to identify the recurrent laryngeal nerve. When the recurrent laryngeal nerve has been identified on either side look for any scar tissue or throid cancer. In case of anaplastic, aggressive well differentiated carcinoma, the nerve may be sacrificed.

If a nerve is found to be injured during the course, can repair it initially with microscope aided visualization and a microvascular technique and using 8-0 or 9-0 monofilament suture.

Dissection between sternohyoid and sternothyroid muscle will clearly show the lateral and deeper structure.

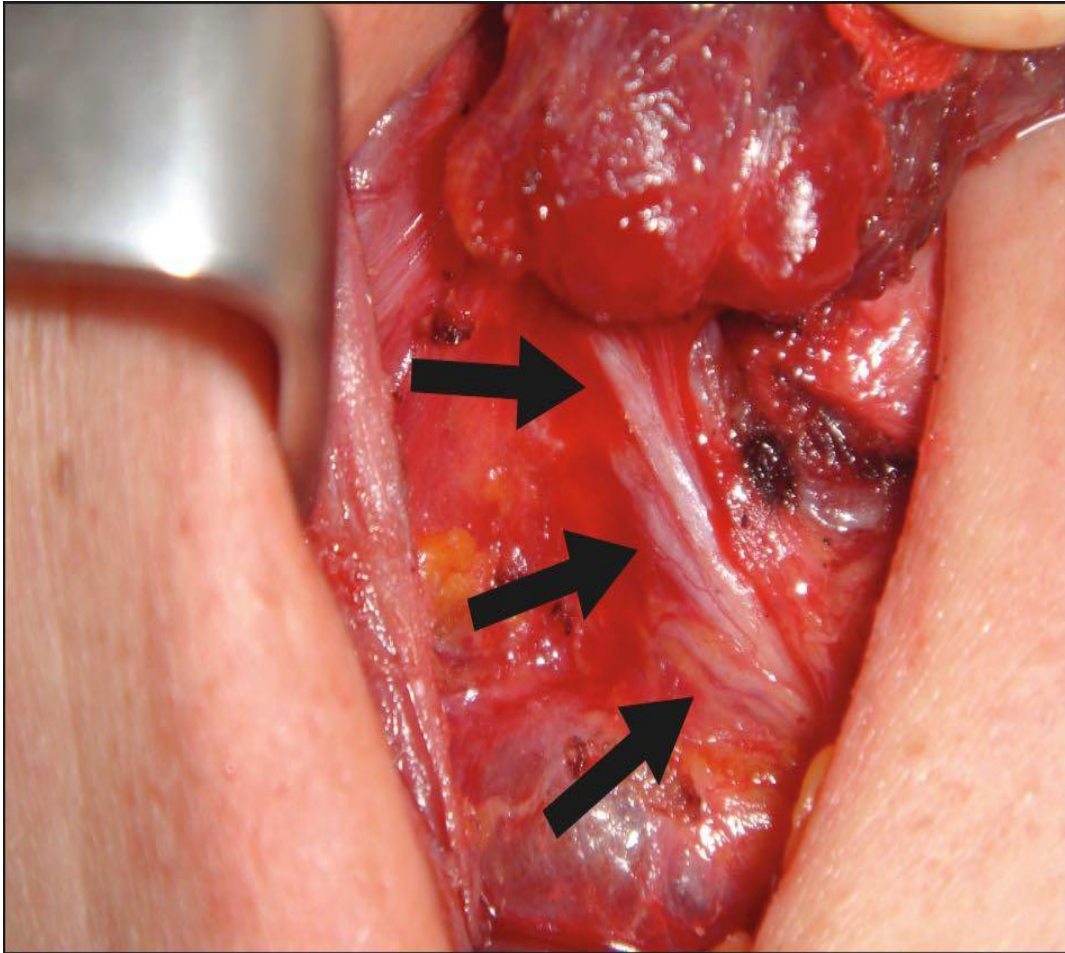
With lateral retraction of the muscle, medial retraction of thyroid lobe will identify common carotid artery quickly .On the left side the esophagus is more prominent. In case of complicated lateral thyroid masses, lymphadenopathy, or previous surgery lateral dissection must be done. After superior thyroid vessels and middle thyroid veins have been divided, continued medial retraction of the thyroid lobe allows the posterior aspect of the thyroid lobe to be visualized.

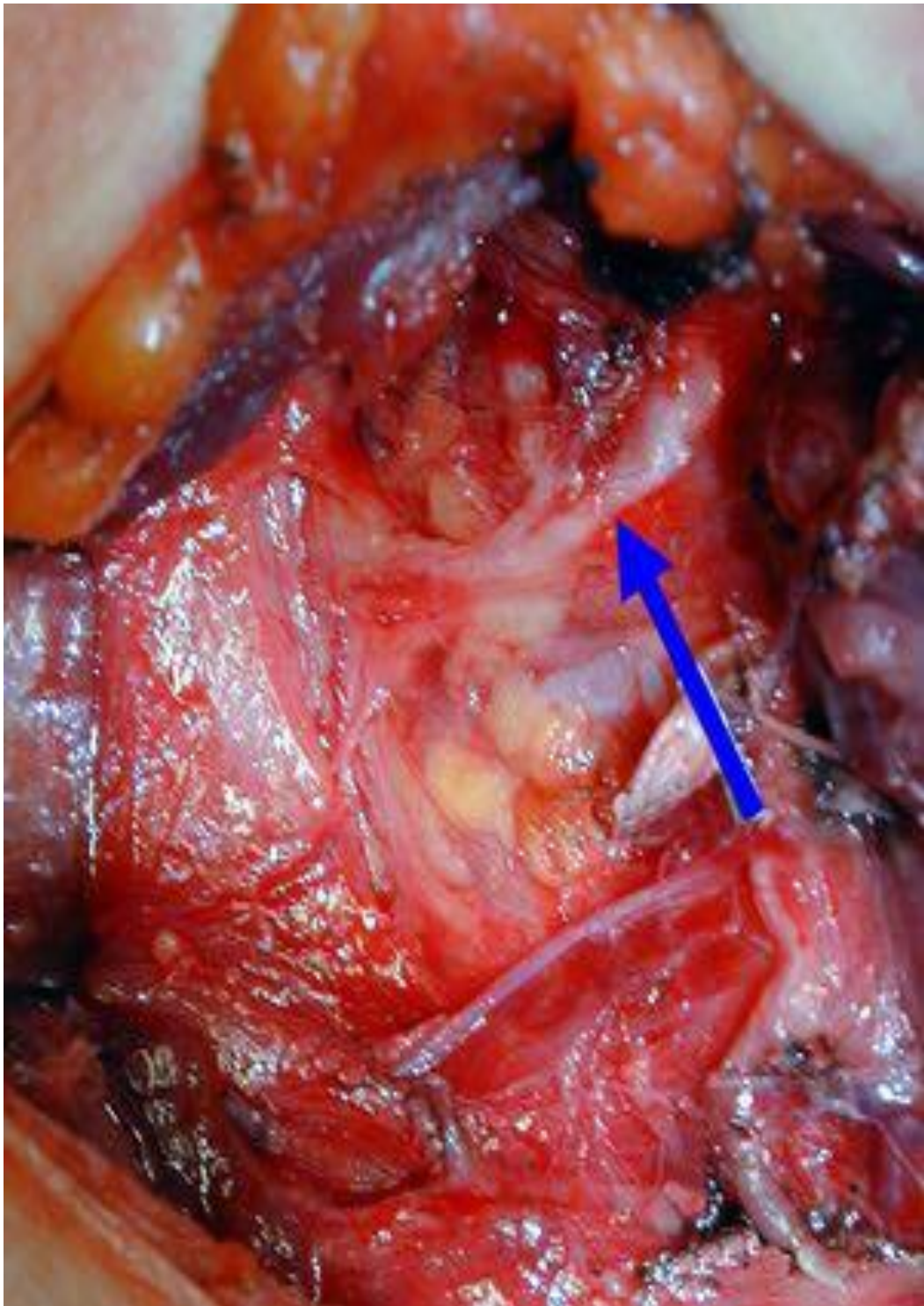
Superior parathyroid gland found lying within the thyroid sheath. When the superior pole vessels are divided, the tissue posterior and lateral to superior pole can be swept from the gland in posteromedial direction, so that reduce the upper parathyroid vessel injury. Lower pole of thyroid glands should be mobilized by gentle sweeping of tissue dorsally.

Inferior thyroid vessels are dissected, ligated as close to thyroid capsule to minimize devascularisation of inferior parathyroid gland and recurrent laryngeal nerve.

When parathyroid glands are inadvertently removed which is confirmed as parathyroid tissue by frozen section divided into 1mm fragment and reimplanted into individual pocket in the non dominant forearm or sternocleidomastoid.

**IDENTIFICATION OF RECURRENT LARYNGEAL NERVE
WITH INCIDENCE OF HYPOCALCEMIA**





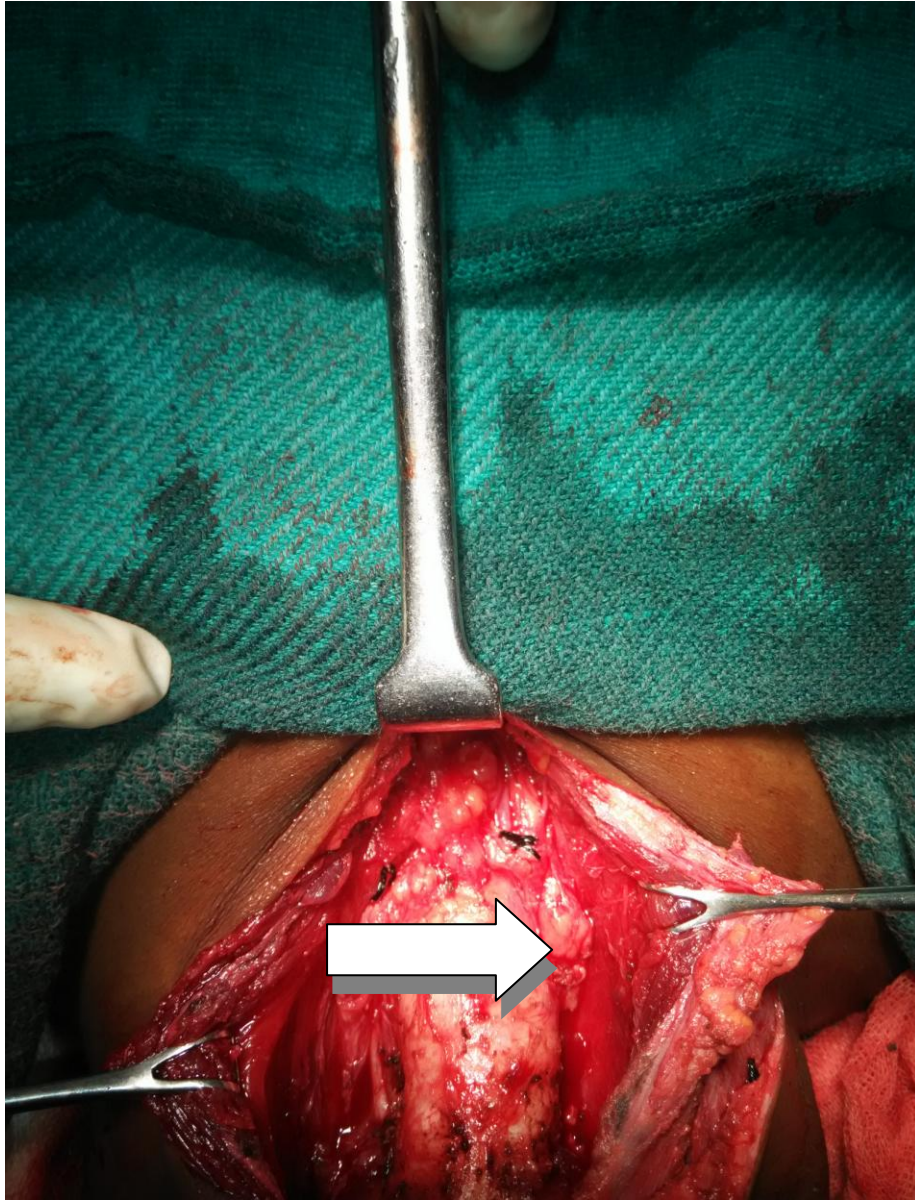
In the present series, the identification of the recurrent laryngeal nerve have not shown any effect on the incidence fo postoperative symptomatic hypocalcemia.

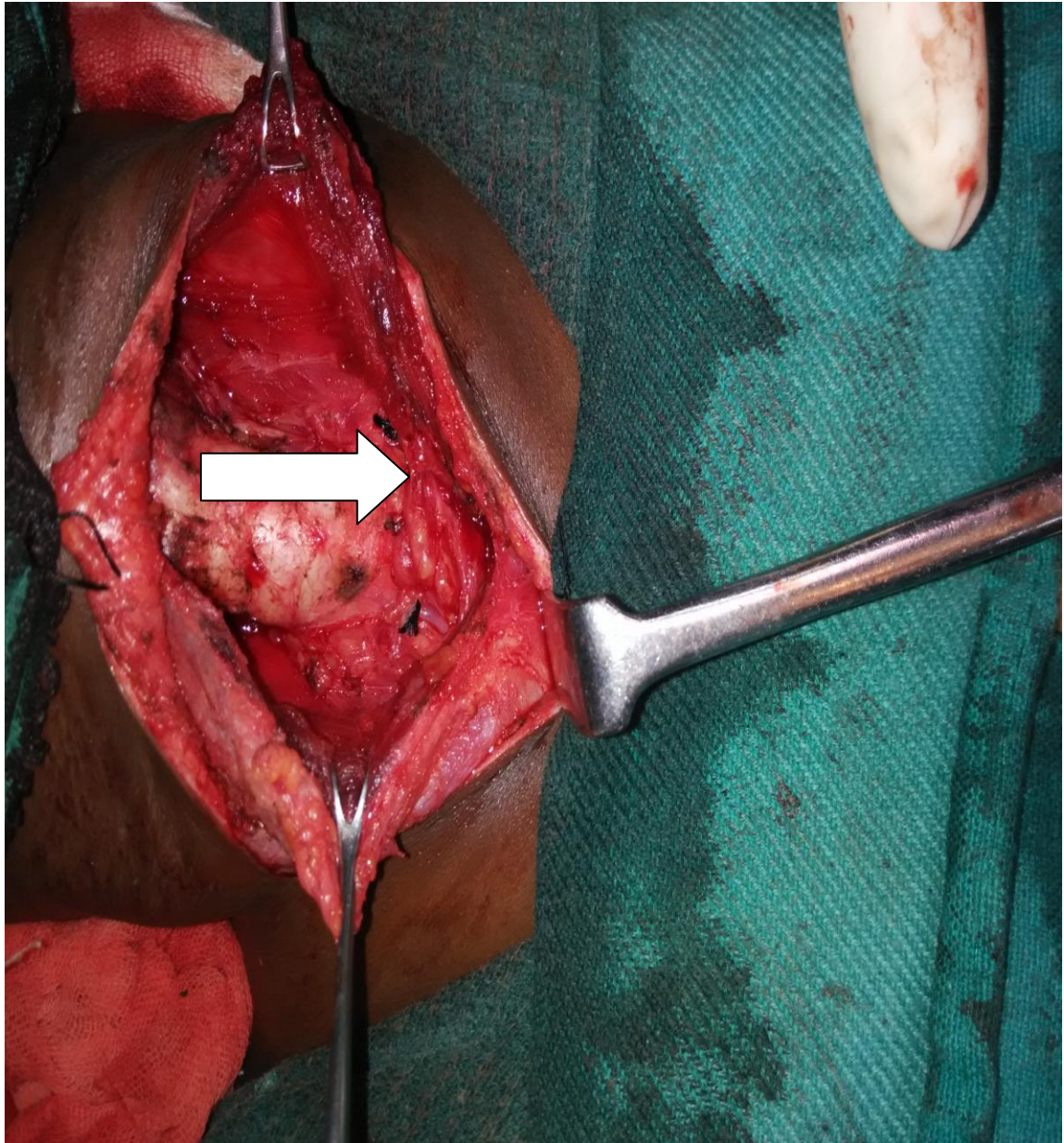
Wade et al[1998] referred that 50 patients undergoing thyroidectomy routine identification of the recurrent laryngeal nerve does not increase the risk of postoperative hypocalcemia.

Harris et al(1992) reported that series of 95 thyroidectomy patients no case hypoparathyroidism relation with recurrent laryngeal nerve identification.

Rao et al[2006] presented a series in which 29 patients underwent total thyroidectomy, no case of permanent hypoparathyroidism in this series.In all cases recurrent laryngeal nerve were identified.In our study out of 44 recurrent laryngeal nerve identified patients, 16 developed hypocalcemia.Out of 7 unilateral identification of RLN patients,2 developed hypocalcemia. Serial monitoring also did not show any fall in calcium and PTH level.Hence it can be derived that identification of recurrent laryngeal nerve does not place the parathyroid gland at a risk of surgery.

IDENTIFICATION OF PARATHYROID GLAND





DEVASCULARISATION OF PARATHYROID GLAND DUE TO CAUTRY



OEdafe et al[2014] defined that single PTH measurement with in 24 hours after surgery especially 12 hours after total thyroidectomy was more accurate in predicting transient hypocalcemia.

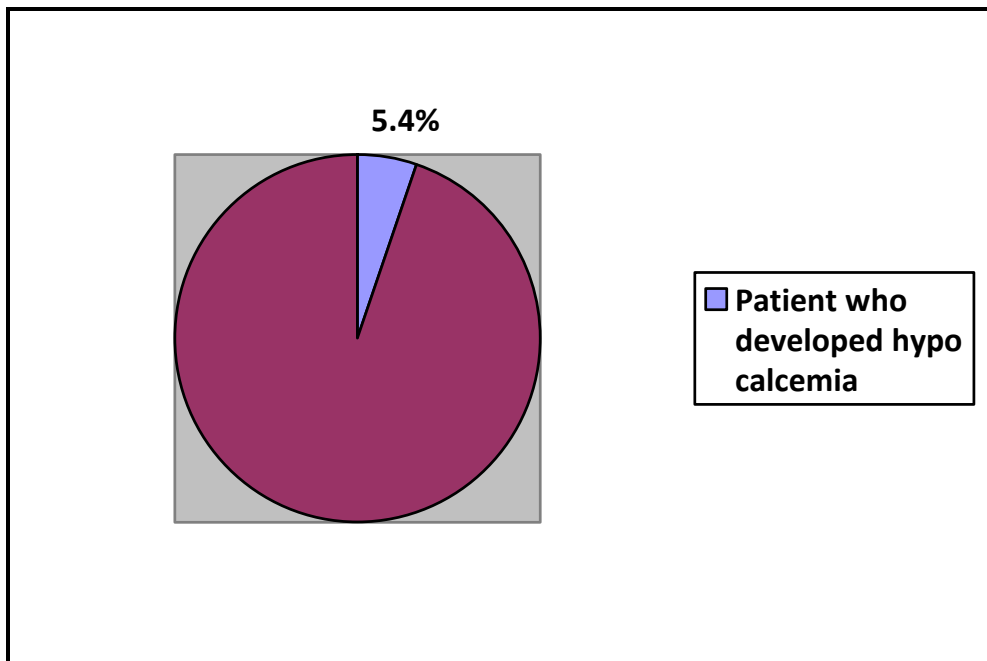
Low PTH concentration after surgery will have increased risk of transient hypocalcemia, which have low false negative value and high negative predictive values.

Normal level of PTH excludes permanent hypocalcemia.

Vit. D deficiencies is an independent predictor of post thyroidectomy hypocalcemia. In high risk group such as dark skin, malabsorption, the elderly and obese individual are more prone to develop Vit. D deficiency. They will develop transient hypocalcemia after thyroid surgery , routine Vit. D measurement helps to predict the incidence of hypocalcemia.

In multivariable analysis found that fewer than 2 parathyroid glands associated with transient and permanent hypocalcemia.

IDENTIFICATION OF PARATHYROID GLAND DURING THYROIDECTOMY WITH INCIDENCE OF HYPOCALCEMIA



Percentage of hypocalcemia when more than 2 parathyroid glands preserved during thyroidectomy.

Transient hypocalcemia is the most frequent complication after that thyroidectomy with the incidence from 2-50% in which only 1-3% of cases will have permanent hypocalcemia.

Above et al[1998] reported that women with a diagnosis of graves disease before thyroidectomy, old age, low level of Vit. D are more prone to develop transient hypocalcemia.

Reza Asan et al[1995] concluded in his study that combined measurement level of parathyroid hormone and serum calcium level helpful in predicting postoperative hypocalcemia which has minimal laboratory effort and low cost.

When the PTH level on 1st Post operative day <15pg/ml and ionized calcium level less than 4.5mg/dl have more sensitivity and specificity in prediction of post thyroidectomy hypocalcemia. So our study concluded that early post operative PTH level at 4-24 hours after surgery and identification of less than two parathyroid glands during total thyroidectomy give accurate prediction of patient at risk of hypocalcemia. So that patient with normal PTH level on first postoperative day can be safely discharged on 2nd postoperative day.

INTRAOPERATIVE BLOOD LOSS WITH INCIDENCE OF HYPOCALCEMIA

In present series mean blood loss when it is significant is 175-200ml.

Here in 8 patients, blood loss was <100ml, 1 patient had symptom of hypocalcemia. In 7 patients blood loss was more than >150ml of which 5 patients had symptomatic hypocalcemia. So it concluded that blood loss >150ml put the parathyroid glands at a higher risk for injury during surgery (or) difficulty in the thyroidectomy.

IN RELATION WITH PREOPERATIVE DRUG INTAKE

In this study concluded that pre operative intake of documented drugs does not increase the incidence of post operative hypocalcemia.

Winger et al[1998] who failed to prove any such drug intake associated with post operative hypocalcemia.

In the end, we concluded that median value of ionized serum calcium levels, positive and negative slope of serum calcium between preop and 12 hours, 24 hours and 48 hours post operatively along with PTH measurement within 24 hours after surgery can be used to predict hypocalcemia and those who are asymptomatic can have early safe discharge and at the same time those who have symptoms of hypocalcemia need intervention.

CONCLUSION AND RECOMMENDATIONS

In this study, the incidence of post thyroidectomy symptomatic hypocalcemia was 34.6%, however all patients had initial fall in ionized calcium levels in immediate post operative period most of them stay among symptomatic hypocalcemia group and ionized calcium level comes to pre operative value early in postoperative period.

- ❖ 7 out of 8 patients with symptomatic hypocalcemia had undergone total thyroidectomy with functional neck dissection for thyroid malignancy.
- ❖ One patient undergone total thyroidectomy for graves disease and 40 patients underwent total thyroidectomy for multi nodular goiter.
- ❖ Hence it can be concluded the greater the extent of surgery more is the chance of developing symptomatic hypocalcemia, or we can say that the malignant goiters have a much higher incidence of symptomatic hypocalcemia than benign goiter by virtue of extent of surgery.
- ❖ The age and sex of patients have influence on incidence of post thyroidectomy symptomatic hypocalcemia. Thus older age and female sex have more chances of developing hypocalcemia.

Intraoperative identification of less than two parathyroid glands will have more risk of developing hypocalcemia.

- ❖ The intra operative identification of the recurrent laryngeal nerve did not affect the incidence of postoperative symptomatic hypocalcemia.
- ❖ The intra operative blood loss is directly correlated with increased incidence of postoperative symptomatic hypocalcemia.
- ❖ The preoperative intake of drug for associated medical disease does not increase the risk of postoperative symptomatic hypocalcemia.
- ❖ Result of our study suggested that early serial ionized calcium, PTH level monitoring in postoperative period can predict whether the patient will have post operative symptomatic hypocalcemia or not. Thus the study concludes that normal levels of post operative calcium values based on two early ionized calcium values and parathyroid hormone level within 24 hrs after total thyroidectomy are strongly predictive of a stable post operative calcium level. These patients thus can have an early and safe discharge from the hospital. Patients with decreased calcium and parathyroid hormone values in the postoperative period are at a higher risk of developing symptomatic hypocalcemia and require careful follow up and monitoring. So these predictors will influence the occurrence of hypocalcemia after total thyroidectomy, and the patients can be discharged early.

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DATA COLLECTION SHEET

I. PATIENT PARTICULARS:

Name I.P.No./O.P.No.

Age Sex

DOA DOD

Address

Occupation:

II. CHIEF COMPLAINTS (WITH DURATION)

A. Neck swelling

B. Pain

C. Other complaints

PAST HISTORY:

HISTORY OF PREVIOUS OPERATION -

PERSONAL HISTORY:

Diet:

Menstrual history:

Marital history:

EXAMINATION:

General:

Height: weight: BMI:

Neck examination:

INVESTIGATIONS:

Biochemical and laboratory tests:

Routine hematological investigations

Blood sugar, urea, electrolyte and creatinine.

Total and ionized calcium (pre and post operative)

Sr. albumin

Vitamin D

Para thyroid hormone. (post operative)

Thyroid function test

Pathological:

Fine needle aspiration-

Imaging

X-Ray Neck :

Ultrasound neck

CT neck

INTRA OPERATIVE FINDING:

- ❖ Approximate blood loss in ml.
- ❖ No of para thyroid gland identified and preserved.
- ❖ Recurrent laryngeal nerve identified and preserved.
- ❖ Wheather lymph node dissection done or not.
- ❖ Anyother major intra operative events.

MASTER CHART

S. No.	Name	Age	Sex	Size of Goiter	Pathology	Sr.ionized Calcium (mg/dl)	Sr.PTH (pg/ml)	Vit.D (ng/ml)	Albumin (gm/dl)	No.of parathyroid Glands Preserved	duration of Surgery	Usg Neck	CT Neck
1	Saraswathi	64	F	L	B	4.2	15	26	3.6	1	C	MNG	No
2	Kamatchi	45	F	M	B	4.8	15	40	3.5	2	C	MNG	No
3	Valli	50	F	L	B	4.2	12	35	3.8	1	C	SNT with level 2 & 3 node	Yes
4	Muniyammal	48	F	S	B	5.1	22	32	3.9	2	B	MNG	No
5	Vanathi	42	F	M	B	4.7	21	34	4	2	C	MNG	No
6	Arumugam	42	M	M	M	4.9	16	35	4.8	3	C	MNG with level 2 & 3 node	Yes
7	Arthy	38	F	M	B	4.7	20	30.2	4.1	3	C	MNG	No
8	Jayakumari	42	F	M	B	5	18	25.6	4.2	2	C	SNT	No
9	MuthuLakshmi	41	F	L	B	4.7	21	40	4.5	3	C	SNT	No
10	Bhairavi	60	F	L	M	4	11	20	3.8	1	C	SNT with level 2 & 3 node	Yes

MASTER CHART

S. No.	Name	Age	Sex	Size of Goiter	Pathology	Sr.ionized Calcium (mg/dl)	Sr.PTH (pg/ml)	Vit.D (ng/ml)	Albumin (gm/dl)	No.of parathyroid Glands Preserved	duration of Surgery	Usg Neck	CT Neck
11	Fathima	45	F	M	B	4	10	31.7	4	1	C	MNG with level 2 & 3 node	Yes
12	Banu	58	F	L	M	4	12	35	4.1	3	C	MNG	No
13	lakshmanan	42	M	M	B	5.2	20	30	3.6	4	B	MNG	Yes
14	Vigneshwari	56	F	L	B	4.2	12	33	4	1	C	MNG	No
15	Rajalakshmi	32	F	M	B	4.9	20	25	4.2	3	C	MNG	No
16	Rathna	32	F	L	M	4.2	11	25	4	1	C	MNG with level 2 & 3 node	Yes
17	Sudha	65	F	L	B	4.2	10	22	3.5	2	C	SNT with level 2 and 3Node	Yes
18	Subashini	47	F	M	B	5	20	22	3.8	3	C	MNG	No
19	Madhan	55	M	L	B	5	25	22	3.7	2	C	MNG	Yes
20	Maidhenbee	58	F	L	B	5.1	17.1	25.2	4	3	C	MNG	No

MASTER CHART

S. No.	Name	Age	Sex	Size of Goiter	Pathology	Sr.ionized Calcium (mg/dl)	Sr.PTH (pg/ml)	Vit.D (ng/ml)	Albumin (gm/dl)	No.of parathyroid Glands Preserved	duration of Surgery	Usg Neck	CT Neck
21	Dhanalakshmi	45	F	M	GRAVES	4.2	13	20	3.5	1	C	MNG	No
22	Kamatchi	48	F	L	Thyroiditis	4	12	26.2	3.7	1	C	MNG	No
23	Surya	43	F	M	B	4.8	21	22	4	2	B	MNG	No
24	Ankayarkani	46	F	L	B	4.9	19	24.6	4.2	3	C	MNG	No
25	Sudha	58	F	M	B	5	20	27.6	4.9	2	C	MNG	No
26	Surya Kala	48	F	L	M	4.1	11.5	20	3.5	1	C	SNT	Yes
27	Anitha	52	F	L	B	4.1	12	25	3.8	1	C	MNG	No
28	Chithra	59	F	L	Thyroiditis	4.2	12	20	3.7	1	C	MNG	No
29	Allikannu	49	F	M	M	4.7	15	15	3.6	2	C	MNG	No
30	Kumari	52	F	L	B	4.1	12	22	4.1	1	C	MNG	No
31	Sarala	41	F	M	M	5	18	23	4.2	3	C	SNT	Yes
32	Selvi	43	F	L	B	5.1	17.5	36	4.1	2	C	MNG	No
33	Kalavathy	45	F	S	B	4.7	21	25	3.8	4	C	SNT	No
34	Sathya	55	F	S	B	4.8	19	26	4	3	C	MNG	No
35	Kokila	48	F	S	M	4.2	11	20	3.9	1	C	MNG with level 3 & 4.	Yes

MASTER CHART

S. No.	Name	Age	Sex	Size of Goiter	Pathology	Sr.ionized Calcium (mg/dl)	Sr.PTH (pg/ml)	Vit.D (ng/ml)	Albumin (gm/dl)	No.of parathyroid Glands Preserved	duration of Surgery	Usg Neck	CT Neck
36	Lakshmi	52	F	M	B	4.8	20.7	32.7	3.8	3	C	MNG	No
37	Priyanka	42	F	S	B	4.9	26.1	21	4.2	4	C	SNT	Yes
38	Pankajam	43	F	M	B	4.85	17.8	26	4	3	C	MNG	No
39	Chinna Ponnu	55	F	M	B	4.9	18	25	3.8	3	C	MNG	No
40	Sasi Kala	57	F	M	B	4.8	22	26	3.6	3	C	MNG	No
41	Pushpa	49	F	M	B	4.9	18.5	24	3.8	3	C	MNG	No
42	Rekha	55	F	M	B	5.2	20	25	3.6	2	C	MNG	No
43	Malar	60	F	L	B	4.1	10	22	3.7	1	C	MNG	No
44	MuthuLakshmi	55	F	M	B	5.3	20.6	23.6	3.9	3	C	MNG	No
45	Suresh	66	M	M	M	4.2	10.6	20	3.6	1	C	SNT with level 2 & 3 node	Yes
46	Valli Nayagi	58	F	M	B	4.9	19.6	22	3.8	2	B	MNG	No
47	Sakila	58	F	M	B	5.1	21	27.6	3.9	3	B	MNG	No
48	Kumutha	48	F	L	B	4.1	12	28	3.6	3	B	MNG	No
49	Easwari	49	F	M	B	4.72	20	25.7	3.9	3	B	MNG	No

MASTER CHART													
S. No.	Name	Age	Sex	Size of Goiter	Pathology	Sr.ionized Calcium (mg/dl)	Sr.PTH (pg/ml)	Vit.D (ng/ml)	Albumin (gm/dl)	No.of parathyroid Glands Preserved	duration of Surgery	Usg Neck	CT Neck
50	Sathya	56	F	S	B	4.8	22	24	3.8	3	B	MNG	No
51	Surya	60	F	L	B	4.5	12	22	3.9	1	C	MNG	No
52	Alamelu	42	F	M	B	5.1	18	30	4	3	B	SNT	No

Pathology: B - Benign, M- Malignancy, Duration of Surgery: I-1 hour, II-1 to 2 Hours, III- More than 2 Hours

SIZE OF GOITER

LARGE - 6 TO 7 CMS

MEDIUM 5 TO 6 CMS

SMALL 3 TO 4 CMS OR BELOW

NORMAL ADULT VALUE

IONIZED CALCIUM - 4.64 TO 5.68 mg/dl

VIT D - 20-50 ng/ml

PTH - 15 to 65 pg/ml

ஆய்வு ஒப்புதல் படிவம்

ஆய்வின் தலைப்பு

முன் கழத்து கழலை அறுவை சிகிச்சைக்கு பின்பு ஏற்படும் கால்சியம் குறைபாட்டிற்கான காரணங்களை ஆராய்ந்து அறிதல்

ஆய்வு நிலையம் : பொது அறுவை சிகிச்சைத்துறை, ராஜீவ் காந்தி அரசு
பொது மருத்துவமனை, சென்னை மருத்துவக் கல்லூரி
சென்னை - 3.

பங்கு பெறுவரின் பெயர் :

பங்குபெறுபவரின் எண் :

பங்குபெறுபவர் இதனை (✓) குறிக்கவும்

..... என்பவராகிய நான் இந்த ஆய்வின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக அறிந்துகொண்டேன். எனது சந்தேகங்கள் அனைத்திற்கும் தகுந்த விளக்கம் அளிக்கப்பட்டது. இந்த ஆய்வில் முழு சுதந்திரத்துடன் மற்றும் சுய நினைவுடன் பங்குகொள்ள சம்மதிக்கிறேன்.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்துகொண்டு நான் எனது சம்மதத்தை தெரிவிக்கிறேன். இச்சய ஒப்புதல் படிவத்தை பற்றி எனக்கு விளக்கப்பட்டது.

இந்த ஆய்வினை பற்றிய அனைத்து தகவல்களும் எனக்கு தெரிவிக்கப்பட்டது. இந்த ஆய்வில் எனது உரிமை மற்றும் பங்கினை பற்றி அறிந்துகொண்டேன்.

இந்த ஆய்வில் பிறரின் நிர்பந்தமின்றி என் சொந்த விருப்பத்தின்பேரில் தான் பங்கு பெறுகிறேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின்வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

இந்த ஆய்வில் கலந்துகொள்வதன் மூலம் என்னிடம் பெறப்படும் தகவலை ஆய்வாளர் இன்ஸ்டிடியூசனல் எத்தீக்ஸ் கமிட்டியினரிடமோ, அரசு நிறுவனத்திடமோ தேவைப்பட்டால் பகிர்ந்துகொள்ளலாம் என சம்மதிக்கிறேன்.

இந்த ஆய்வின் முடிவுகளை வெளியிடும்போது எனது பெயரையோ, அடையாளங்களையோ வெளியிடப்படாது என அறிந்துகொண்டேன். இந்த ஆய்வின் விவரங்களைக் கொண்ட தகவல் தாளைப் பெற்றுக்கொண்டேன். இந்த ஆய்விற்காக இரத்தப் பரிசோதனை செய்துகொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் பங்கேற்கும் பொழுது ஏதேனும் சந்தேகம் ஏற்பட்டால், உடனே ஆய்வாளரை தொடர்புகொள்ள வேண்டும் என அறிந்துகொண்டேன்.

இந்த ஆய்வில் எனக்கு மருத்துவ பரிசோதனை, இரத்தப் பரிசோதனை மற்றும் இதய உட்பு ஆய்வு பரிசோதனை செய்துகொள்ள முழு மனதுடன் சம்மதிக்கிறேன்.

இச்சய ஒப்புதல் படிவத்தில் கையெழுத்திடுவதன் மூலம் இதிலுள்ள அனைத்து விஷயங்களும் எனக்கு தெளிவாக விளக்கப்பட்டது என்று தெரிவிக்கிறேன் என்று புரிந்துகொண்டேன். இச்சய ஒப்புதல் படிவத்தின் ஒரு நகல் எனக்கு கொடுக்கப்படும் என்று தெரிந்துகொண்டேன்.

பங்கேற்பாளர்/ பாதுகாவலர் கையொப்பம்

தேதி:

ஆய்வாளர் கையொப்பம்

தேதி:

ஆய்வு தகவல்தாள்

ஆய்வு தலைப்பு

முன் கழத்து கழலை அறுவை சிகிச்சைக்கு பின்பு சிலருக்கு ஏற்படும் கால்சியம் குறைபாட்டிற்கான காரணங்களை ஆய்ந்து அறிதல்

இராஜீவ் காந்தி அரசு பொது மருத்துவமனைக்கு வரும் நோயாளிகளில் முன் கழத்து கழலை அறுவை சிகிச்சைக்கு பின்பு சிலருக்கு ஏற்படும் கால்சியம் குறைபாட்டிற்கான காரணங்களை ஆராய்ந்து அறிதல் இந்த ஆய்வின் நோக்கமாகும்.

மேலே கூறப்பட்ட நோய்க்கு உள்ளநோயாளியாக இருந்து சிகிச்சை பெற்று வருபவர்களுக்கு மருத்துவ பரிசோதனை, ஆய்வக பரிசோதனை மற்றும் ஊடுகதிர் பரிசோதனை உள்ளிட்ட பரிசோதனைகள் செய்யப்படும்.

இந்த ஆய்வின் முடிவுகளை அல்லது கருத்துக்களை வெளியிடும் போதோ அல்லது ஆய்வின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிடமாட்டோம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த ஆய்வில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில்தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆய்விலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த சிறப்பு சிகிச்சையின் முடிவுகளை ஆய்வின்போதோ அல்லது ஆய்வின் முடிவின் போதோ தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

ஆய்வாளரின் கையொப்பம்

தேதி

பங்கேற்பாளர் கையொப்பம்

பாதுகாவலர் கையொப்பம்

MADRAS MEDICAL COLLEGE, CHENNAI 600 003

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CERTIFICATE OF APPROVAL

To
Dr.M.Rajeswari
PG in M.S.(General Surgery)
Madras Medical College/RGGGH
Chennai 600 003

Dear Dr.M.Rajeswari,

The Institutional Ethics Committee has considered your request and approved your study titled “ **PROSPECTIVE ANALYSIS OF CLINICAL, BIO-CHEMICAL AND PEROPERATIVE FACTORS PREDICTING HYPOCALCEMIA IN PATIENTS UNDERGOING TOTAL THYROIDECTOMY** ” - **NO.13012016**.

The following members of Ethics Committee were present in the meeting hold on **12.01.2016** conducted at Madras Medical College, Chennai 3

- | | |
|---|---------------------|
| 1.Dr.C.Rajendran, MD., | :Chairperson |
| 2.Dr.R.Vimala,MD.,Dean,MMC,Ch-3 | :Deputy Chairperson |
| 3.Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3 | : Member Secretary |
| 4.Prof.B.Vasanthi,MD.,Inst.of Pharmacology,MMC,Ch-3 | : Member |
| 5.Prof.P.Raghumani,MS, Dept.of Surgery,RGGGH,Ch-3 | : Member |
| 6.Prof.M.Saraswathi,MD.,Director, Inst.of Path,MMC,Ch-3 | : Member |
| 7.Tmt.J.Rajalakshmi, JAO,MMC, Ch-3 | : Lay Person |
| 8.Thiru S.Govindasamy, BA.,BL,High Court,Chennai | : Lawyer |
| 9.Tmt.Arnold Saulina, MA.,MSW., | :Social Scientist |

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.



Member Secretary - Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

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BY 221411015 MS GS M. RAJESWARI

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INTRODUCTION

FACTORS INFLUENCING HYPOCALCEMIA

Surgical treatment of choice for most Thyroid cancer is total Thyroidectomy, Provided that complication rates are low.Goiter is a latin word called GUTTER(THROAT). It is defined as a enlargement of the Thyroid gland. Hieronymus Fabricius ab Aquapendente recognised that goiters arose from the thyroid in 1619. By the contribution of Thomas Wharton the term Thyroid Gland(a greek word) was meant shield shaped gland.

In 1170 the **7** first accounts of Thyroid Surgery for the treatment of Goiters was initiated by Roger Frugard. The first standard technique of Thyroidectomy was described by Theodore Kocher in 1872. Later it was refined by Theodar Billroth and William S.Halsted. So as to decrease the postoperative mortality and morbidity after thyroid surgery to <1%.

Few important complications seen after Typoid surgery are recurrent laryngeal nerve injury, haemorrhage and hypocalcemia. Among these the most important morbidity resulting from

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