"ROLE OF DRAINS IN THYROID SURGERIES"

SUBMITTED BY

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DISSERTATION SUBMITTED TO

B. L. D. E. (DEEMED TO BE UNIVERSITY)
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RESEARCH CENTRE, VIJAYAPUR,
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MASTER OF SURGERY

In

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UNDER THE GUIDENCE OF

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DR. KOTHURI SRICHARAN RAJ

ABSTRACT

AIMS & OBJECTIVES: To study and compare the efficacy of thyroid surgeries without placement of drains and with placement of drains.

METHODS: Prospective, Interventional Study. 60 cases were studied; in each group 30 cases were allocated.

Depending upon the thyroid disorder, a total thyroidectomy / sub-total thyroidectomy / hemi-thyroidectomy was performed. The efficacy of placement of drains in thyroid surgeries was compared with the thyroid surgeries with no drains. Closed negative suction drains were placed before wound closing, brought out through separate site, if the patient was in the drained group.

RESULTS:

In drain group, 21 underwent hemi thyroidectomy, 3 underwent sub-total thyroidectomy, 6 underwent total thyroidectomy. In no drain group of 30 patients, 23 underwent hemi thyroidectomy, 1 underwent sub-total thyroidectomy, 6 underwent total thyroidectomy.

Complications: Drain group - 3 patients had hypocalcemia, 27 didn’t have any complications. No drain group – 1 patient had hypocalcemia and seroma was noted in 1 patient.

Operating time was 91.8 ±11.3 minutes in the drain group and 93.5± 14.3 minutes in no drain group. The difference in operation time between drain and no drain groups was not statistically significant (p=0.619).

The mean vas pain scores at post operative day 2 was significantly lower in the no drain group as compared to the drain group (3.9 ± 0.4 vs. 4.4 ± 0.6, p=0.001).

The length of hospital stay was 5.6±1.4 days in drain and 4.6±0.7 in no drain group. P value was o.oo1 which was statistically significant.

CONCLUSION: The mean VAS pain score on post operative day 2 was significantly lower in the no drain group (p<0.001). The mean length of stay in the hospital was significantly lower in the no drain group (p=0.001). A lower pain score accompanied by a lower length of hospital stay considerably reduces the requirement of analgesics and hospital costs.

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INTRODUCTION

Thyroidectomy is one of the most commonly performed operative procedure in general surgery. Indications for thyroid surgery are thyroid swellings, hyperthyroidism and thyroid cancers [(1)] . The use of drains in thyroidectomy is a common practice among surgeons, with the hope that this will obliterate the dead space and evacuate collected blood and serum. This belief is further reinforced by the fact that postoperative drains usually yield fluid [(2)].

Thyroid being a highly vascular gland, any small haemorrhage can lead to serious life-threatening complications including venous oedema of the airway, which if detected early enough requires emergency decompression, in the absence of which may lead to fatal consequences. The concern of postoperative complications such as the formation of hematoma or seroma, drives the surgeons' decision to use drains [(3).]

However, the argument against this is the rare occurrence of postoperative bleeding, as low as 0.3 to 1 % in thyroid surgeries [(3)]. The need for drainage has been questioned after various types of surgeries with much larger potential dead spaces like cholecystectomy and colonic anastomosis, are now routinely not drained [(2).] It has been suggested that clotted blood and serum which they are supposed to drain may block the drain thereby causing more harm than benefit, as the surgeon may not be aware of a major bleeding, if it occurs. Nevertheless, surgeons continue to consider that a drain in the thyroid bed acts as an 'early indicator' of significant postoperative haemorrhage and provides a safeguard against compressive effects [(3)].

Whether or not drains reduce the risk of hematoma in thyroid surgery, their placement may augment scarring in a cosmetically sensitive area and also add discomfort to the patient, and increase the length of stay and cost of surgery [(3)].

Our goal in undertaking this study is to compare the outcomes of thyroid operations with drainage and without drainage, to develop an evidence-based preferred approach in thyroidectomy.

AIM AND OBJECTIVE OF THE STUDY

- To study and compare the efficacy of thyroid surgeries without placement of drains and with placement of drains.

RESEARCH HYPOTHESIS

Avoiding drains in thyroid surgeries significantly reduces the operating time, length of the hospital stay and surgical site infections. It also relatively reduces the post operative pain and is better accepted cosmetically.

REVIEW OF LITERATURE

Historical aspect :

The term thyroid gland (Greek thyreoeides, shield shaped) is attributed to Thomas Wharton in his Adenographaia in 1656. But Goitres, (from the Latin guttur, throat) defined as an enlargement of the thyroid, have been recognised long before that, since 2700 B.C [4] in China, and in as early as 1600 BC, the Chinese used burnt sponge and seaweed to treat goitres. Pliny the Elder noted goitre epidemics in the Alps and also mentioned the use of burnt seaweed in their treatment which supposedly they learnt from the Chinese. The Artharva Veda (2000 BC), an ancient Hindu collection of incantations, also contains exorcisms for goitre. It termed the swelling of the neck (goitre) as 'galaganda' [5]. In 1619, Hieronymus Fabricus ab Aquapendente recognised that goitres arose from the thyroid gland. Albrecht von Haller classified thyroid as a ductless gland in 1776, ascribing numerous functions to it, ranging from lubrication of the larynx to acting as a reservoir for blood to provide continuous flow to the brain, and to beautifying women's necks [4].

One of thyroid surgery's earliest references comes from the seventh century when a classical Byzantine doctor, Paul of Aegina, described struma and its operation, but it is not certain whether what was struma according to him was actually a goitre of the present day. The earliest distinct reference of a successful attempt at surgical treatment of goitre is present in the medical writings ('Al Tasrif') by the Moorish physician Ali Ibn Abbas or Albucasis in about 952 AD. His experience is recorded as the removal of a large goitre under sedation with opium with the use of simple ligatures along with hot cautery irons as the patient sat with a bag tied around his neck to collect the blood from the wound [5]. In 1170, a prominent surgeon, Roger Frugardii, performed a thyroidectomy using setons, hot irons, ligaments and caustic powders.

In 1791, Pierre Joseph Desault achieved a landmark in thyroid surgery by performing the first partial thyroidectomy . Surgeons like Dupuytren in 1808, William Blizard in 1811 or Henry Earle in 1823 followed him closely. In between 1842 and 1859, Heusser is said to have performed 35 thyroidectomies with only one death. Victor von Bruns of Tubigen, in between 1851 and 1876, was the first surgeon to have separated the isthmus from the gland and performed 28 thyroidectomies with six deaths [5].

However, Halsted in his ‘The operative history of goitre’ scrutinised procedures done before 1850 and analysed them to be associated with 40 % mortality. The high mortality was mainly due to haemorrhage, asphyxia due to tracheal compression and air embolism [5].

In the middle of the nineteenth century there was concerted improvement in anaesthesia, infection prophylaxis and better haemostasis leading to improved outcomes after thyroidectomies. Nikolai Piringoff performed a successful thyroidectomy using ether anaesthesia in St. Petersburg in 1850.

Theodor Billroth performed 36 thyroidectomies experiencing 16 deaths, in Zurich and Vienna With the use of newer methods of antisepsis and haemostasis in between 1877 to 1881, Billroth performed 48 thyroidectomies and was able to decrease the mortality to 8.3 %. Theodor Kocher, a pupil of Billroth, carried forward the baton of thyroid surgery from his teacher. During his first 10 years in Berne as professor of surgery, he had performed 101 thyroidectomies, experiencing a mortality of 2.4 %. By 1895, the mortality rate improved to about 1 %. He operated initially through an oblique incision along the anterior border of sternomastoid or by a vertical midline incision. He suggested a more cautious resection and a more precise technique by extracapsular dissection.

In 1909, Kocher was awarded the Nobel Prize for the work done by him on thyroid surgery. At the age of 76, in 1917, he presented the results of his entire work at the Swiss Surgical Congress, weeks before his demise. His presentation revealed his enormous amount of work, about 500 thyroid surgeries performed by him with a mortality rate of 0.5 %. Toxic thyroidectomies were performed by surgeons like Theodor Kocher, Frank Hartley, Charles Mayo, Thomas Peel Dunhill and George Washington Crile. To provide greater safety, Kocher practised initial ligation of the thyroid arteries. Hartley was a pioneer in removing the second lobe partially in a select number of patients. Mayo practised unilateral or bilateral pole ligation prior to partial thyroidectomy in patients with severe thyrotoxicosis. A second lobectomy was suggested by Dunhill in patients with thyrotoxicosis who failed to respond to their initial procedure. In 1886, P.J. Moebius suggested that the cause of Graves' disease was the disordered function of the thyroid gland itself.

Although seaweed was traditionally used to treat goitre, it was only in 1811 that Bernard Courtois discovered iodine in burnt seaweed, which fostered the idea that this was the active ingredient in the treatments that were being successfully prescribed for goitre. Ten years later, Coindet was the first to recommend iodine in the preoperative treatment of goitre to decrease vascularity and consequently lessen the operative risk. This was endorsed further by Marine in 1907, who proposed that iodine was necessary for normal function of the thyroid gland, and in 1911, iodine was recommended as the therapy for Graves' disease which happened to be a landmark in the treatment of toxic goitres.

In 1923, Plummer published results of the 600 thyrotoxic patients that he had operated upon after using Lugol's iodine preoperatively. He demonstrated that the operative mortality rate dropped from 4 to 1 % by using Lugol's iodine [(5)].

Further progress in the management of toxic goitre happened with the introduction of radioactive iodine and its incorporation in therapeutics in 1942 by Means, Evans and Hertz. A year later, in 1943, came thiouracil, introduced by Edwin Bennet Astwood. Beta blockers (propranolol), developed about 20 years later, were inducted into the armamentarium for treatment of toxic goitres in 1965. The incorporation of these drugs contributed significantly to the perioperative management of toxic goitre, the group of treatment: drugs, radioiodine and surgery, still followed as the basis of treatment for thyrotoxicosis.

With the development of radiological procedures like ultrasound and computerised tomography scanning, the diagnosis has become even more precise. The introduction of fine needle aspiration cytology (FNAC) in 1952, as described by Soderstorm, further improved the diagnosis of goitre [(5)].

Along with advances in other disciplines of medical science, viz., anaesthesia, physiology and radiology, surgical treatment of thyroid diseases improved significantly. The procedure became safer with introduction of devices like the nerve monitor for electro-identification of the recurrent laryngeal nerve intraoperatively. The transplantation of accidentally removed parathyroid glands also gave a new hope in total thyroidectomy surgeries.

Apart from making the surgery safe and effective, the quest started for newer techniques of performing the procedure to achieve cosmetically better results and surpassing its other drawbacks, leading to the development of Minimally Invasive Thyroid Surgery (MITS) including pure endoscopic techniques, video-assisted techniques and minimally invasive open surgery ushering in a new era in thyroidectomy.

Anatomy of the Thyroid gland:

The thyroid gland is anterior in the neck below and lateral to the thyroid cartilage. The thyroid is a ductless gland. The normal adult thyroid gland weighs about 20 g and is brown in colour and firm in consistency [4]. The gland weight varies with body weight and iodine intake. The anatomic relations of the thyroid gland and surrounding structures are depicted in the given figure 2 and 3.

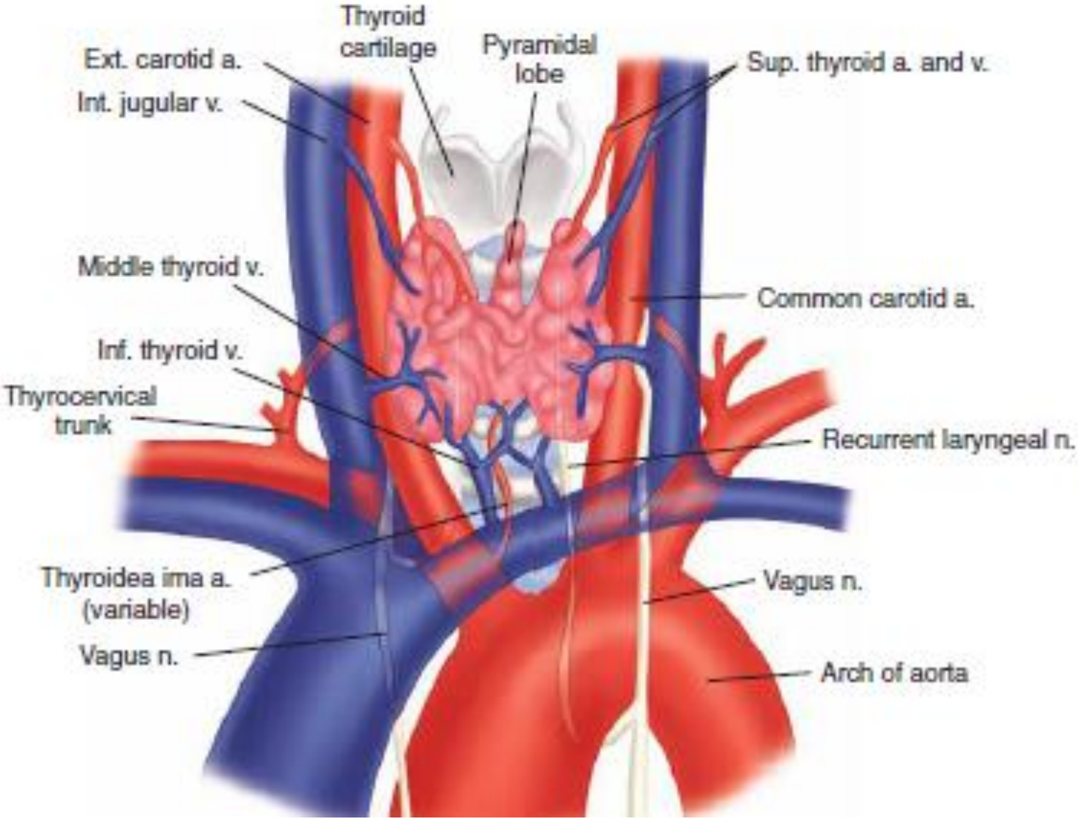


Figure 1: Anatomy of the thyroid gland and surrounding structures, viewed anteriorly.
a = artery; m. = muscle; n. = nerve; v. = vein.

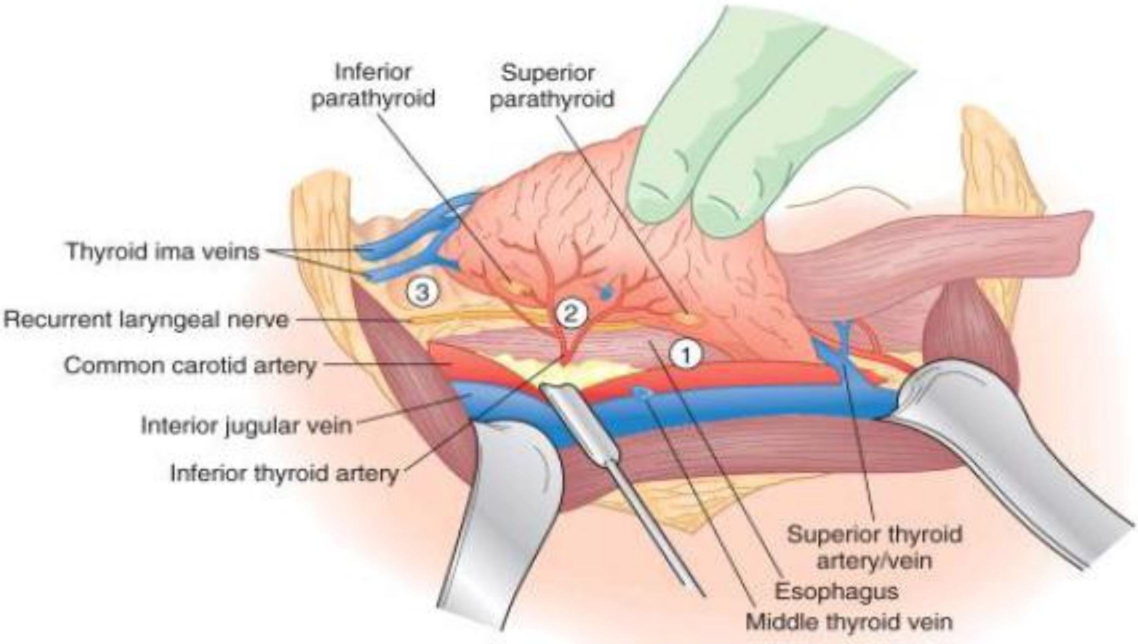


Figure 2: Anatomy of the thyroid gland lateral view.

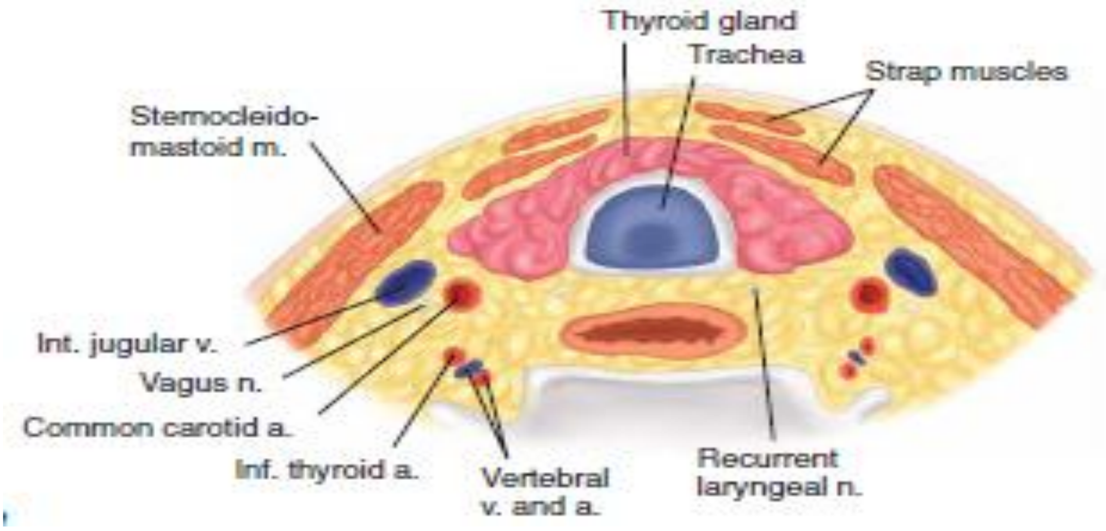


Figure 3: Anatomy of the thyroid gland and surrounding structures, viewed in cross-section.
a = artery; m. = muscle; n. = nerve; v. = vein.

The thyroid gland consists of two pyramid shaped lateral lobes covering the anterolateral surfaces of the trachea, the cricoid cartilage, and the lower part of the thyroid cartilage. An isthmus connects the two lateral lobes and crosses the anterior surfaces of the second and third tracheal cartilages. The gland lies deep to the sternohyoid, sternothyroid, and omohyoid muscles (strap muscles). It is in the visceral compartment of the neck which also includes the pharynx, trachea, and esophagus. The gland is enveloped loosely by the pretracheal layers of fascia (6). The true capsule of the thyroid is a thin, densely adherent fibrous layer that sends out septa that invaginate into the gland, forming psuedolobules. The thyroid capsule is condensed into the posterior suspensory or Berry's ligament near the cricoid cartilage and upper tracheal rings [(6).]

During fetal development, the thyroid gland arises as a median outgrowth from the floor of the pharynx near the base of the tongue. The foramen cecum of the tongue indicates the site of origin and the thyroglossal duct marks the path of migration of the thyroid gland to its final adult location. The thyroglossal duct usually disappears early in development, but remnants may persist as a cyst or as a connection to the foramen cecum (i.e. , a fistula) [6].

Blood supply to the thyroid gland:

Arteries: The superior thyroid arteries arise from the ipsilateral external carotid arteries and divide into anterior and posterior branches at the apices of the thyroid lobes. The inferior thyroid arteries arise from the thyrocervical trunk. They travel upward in the neck posterior to the carotid sheath and enter the thyroid lobes at their midpoint. The inferior thyroid artery crosses the recurrent laryngeal nerve (RLN). Hence it is necessary to identify the RLN correctly prior to ligating the arterial branches. A thyroidea ima artery arises directly from the aorta or innominate in 1 % to 4% of individuals to enter the isthumus or replace a missing inferior thyroid artery.

Veins: The venous drainage of the thyroid gland occurs via many small surface veins which join to form three sets of veins- the superior, middle, and inferior thyroid veins. The superior thyroid veins run with the superior thyroid arteries bilaterally. The middle vein or veins are least consistent. The superior and middle veins drain directly into the internal jugular veins. The inferior veins often form a plexus, which drains into the brachiocephalic veins [4].

Nerves to the thyroid gland:

The left RLN arises from the vagus nerve where it crosses the aortic arch, loops around the ligamentum arteriosum, and ascends medially in the neck within the tracheoesophagal groove.The right RLN arises from the vagus at its crossing with the right subclavian artery. The nerve usually passes posterior to the artery before ascending in the neck, its course being more oblique than the left RLN. As they pass through the neck, the RLNs may branch, and pass anterior, posterior, or interdigitate with branches of the inferior thyroid artery. The right RLN may be nonrecurrent in 0.5 % to 1 % of individuals and often is associated with a vascular anomaly. Non recurrent left RLNs are rare but have been reported in patients with situs inversus and a right- sided aortic arch. The RLN may branch in its course in the neck, and identification of a small nerve should alert the surgeon to this possibility. Identification of the nerves or their branches often necessitates mobilization of the most laterial and posterior extent of the thyroid gland, the tubercle of Zuckerkandl, at the level of the cricoid cartilage. The last segments of the nerves often course below the tubercle and are closely approximated to the ligament in 25 % of individuals and are particularly vulnerable to injury at this junction. The RLNs terminate by entering the larynx posterior to the cricothyroid muscle.

All the intrinsic muscles of the larynx, with the execption of the circothyroid muscles, are innervated by the RLNs. The external laryngeal nerve innervates the circothyroid muscles. If the RLN on one side is injured, it leads to paralysis of the ipsilateral vocal cord, which comes to lie in the paramedian or abducted position. The paramedian position results in a normal but weak voice, whereas the abducted position leads to a hoarse voice and an ineffective cough. Bilateral RLN injury may result in the obstruction of the airway, necessitating emergency tracheostomy, or loss of voice. If both cords come to lie in an abducted position, air movement can occur, but the patient has an ineffective cough and is at increased risk of repeated respiratory tract infections from aspiration.

The superior laryngeal nerves also arise from the vagus nerves. After their origin at the base of the skull, these nerves travel along the internal carotid artery and divide into two branches at the level of the hyoid bone. The internal branch of the superior laryngeal nerve is sensory to the supraglottic larynx. Injury to this nerve is rare in thyroid surgery, but its occurance may result in aspiration. The external branch of the superior laryngeal nerve lies on the inferior pharyngeal constrictor muscle and descends alongside the superior thyroid vessels before innervating the cricothyroid muscle [(4)].

Sympathetic innervation of the thyroid gland is provided by fibres from the superior and middle cervical sympathetic ganglia. The fibers enter the gland with the blood vessels and are vasomotor in action. Parasympathetic fibres are derived from the vagus nerve and reach the gland via branches of the laryngeal nerves.

Lymphatic system

The thyroid gland has an extensive network of lymphatics. Intraglandular lymphatic vessels connect both thyroid lobes through the isthumus and also drain to perithyroidal structures and lymph nodes. Regional lymph nodes include pretracheal, paratracheal, perithyroidal, RLN, superior mediastinal, retropharyngeal, esophageal, and upper, middle, and lower jugular chain nodes [(4)].

Thyroid histology

The microscopic appearance of the thyroid shows numerous follicles filled with proteinaceous and colloid material. Follicle is the structural unit. The wall of acinus is composed of single layer of cuboidal cells resting on a basement membrane that is richly supplied with capillaries. The acini are arranged in the sub units of 22-40 which are demarcated by connective tissue to form lobules each surrounded by an individual artery. The height of the epithelial cells lining the follicles varies with the state of functional activity but normally is about 15 microns. The size of the follicle depends on the degree of distention by secretion. It is approximately 200 microns in diameter. The total number of follicles is about 20 millions. The shape of the follicle is spheroidal or elongated [7].

Structure of follicular cells :

The apices of follicular cell may bulge slightly into the lumen and their nuclei usually lie in the basal half of the cell. The cells are low when the gland is underactive and high when the gland is active. The cytoplasm appears homogenous and rarely it contains colloid droplets which have staining properties like those of colloid.

Parafollicular cells :

These cells appear to be of ellipsoidal shape. Their cytoplasm appears less dense and homogenous than that of follicular cells. These cells never come into contact with the colloid and are separated from it by a layer of follicular cells. They are enclosed within the confines of follicular basement membrane.

Colloid :

The thyroid is a gland notable for its storage of reserve secretion. This reserve is semifluid colloid that fills the lumen. The colloid is thin, homogenous, clear fluid in fresh state. In active follicles the colloid is definitely basophilics. Inactive follicles have acidophillic colloid. It consists chiefly a thyroglobulin, a large protien having a molecular weight of 7,00,000. Colloid contains other substance in addition as for example protease activity and ribo nuclear protien. The former is the intermediatery which frees the thyroid hormones from thyroglobulin.

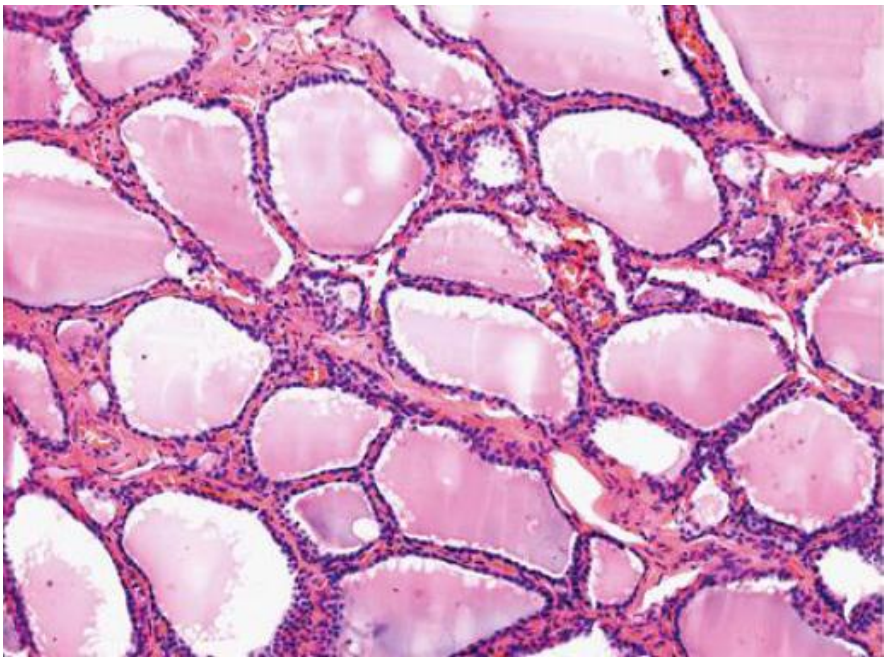


Figure 4. Normal Histology of Thyroid gland [7]

Synthesis and secretion of thyroid metabolic hormones [8]

The thyroid secretes two major hormones, *thyroxine (93%)* and *Triiodothyronine (7%)*, commonly called T4 and T3, respectively. However, almost all the thyroxine is eventually converted to triiodothyronine in the tissues, so that both are functionally important. The functions of these two hormones are qualitatively the same, but they differ in rapidity and intensity of action. Triiodothyronine is about four times as potent as thyroxine, but it is present in the blood in much smaller quantities and persists for a much shorter time than does
thyroxine.

Iodine Is Required for Formation of Thyroxine. To form normal quantities of thyroxine, about 50 milligrams of ingested iodine in the form of iodides are required each year or about *1 mg/week*.

Fate of Ingested Iodides: Iodides ingested orally are absorbed from the gastrointestinal tract into the blood in about the same manner as chlorides. About one fifth of the iodides are selectively removed from the circulating blood by the cells of the thyroid gland and used for synthesis of the thyroid hormones. The remaining iodides are rapidly excreted by the kidneys.

Iodide Pump (Iodide Trapping)

The first stage in the formation of thyroid hormones, shown in Figure 5, is transport of iodides from the blood into the thyroid glandular cells and follicles.

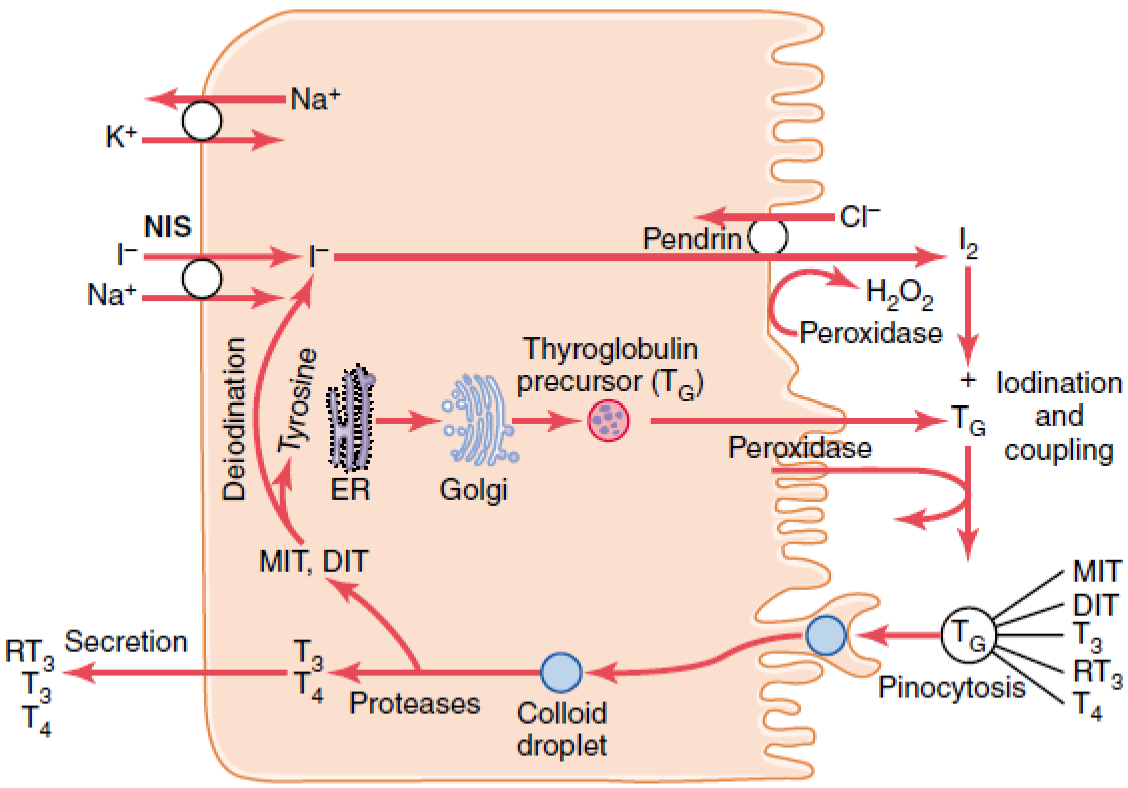


Figure 5: Thyroid cellular mechanisms for iodine transport, thyroxine and triiodothyronine formation, and thyroxine and triiodothyronine release into the blood. DIT, diiodotyrosine;MIT, monoiodotyrosine; NIS , sodium-iodide symporter; RT3, reverse triiodothyronine; T3, triiodothyronine; T4, thyroxine; TG, thyroglobulin.

The basal membrane of the thyroid cell has the specific ability to pump the iodide actively to the interior of the cell. This is called *iodide trapping*. In a normal gland, the iodide pump concentrates the iodide to about 30 times its concentration in the blood. When the thyroid gland becomes maximally active, this concentration ratio can rise to as high as 250 times. The rate of iodide trapping by the thyroid is influenced by several factors, the most important being the concentration of TSH; TSH stimulates and hypophysectomy greatly diminishes the activity of the iodide pump in thyroid cells.

The thyroid cells are typical protein-secreting glandular cells, as shown in Figure 5. The endoplasmic reticulum and Golgi apparatus synthesize and secrete into the follicles a large glycoprotein molecule called *thyroglobulin,* with a molecular weight of about 335,000. Each molecule of thyroglobulin contains about 70 tyrosine amino acids, and they are the major substrates that combine with iodine to form the thyroid hormones. Thus, the thyroid hormones form *within* the thyroglobulin molecule.

The steps involved in the formation of T3 and T4 cab be summarised as follows:

1. Oxidation of the Iodide Ions to an oxidized form of iodine, either nascent iodine (I_0) or $I_{3.}$
2. Combination of amino acid tyrosin with the oxidised form of iodine in the thyroglobuline molecule, known as "Organification" of Thyroglobulin in the presence of iodinase enzyme to form monoiodotyrosine and diiodotyrosine.
3. Iodotyrosine residues couple with one another to form triiodothyronine and thyroxine. The figure 6 shows the successive stages of iodination of tyrosine

and final formation of the two important thyroid hormones, thyroxine and triiodothyronine.

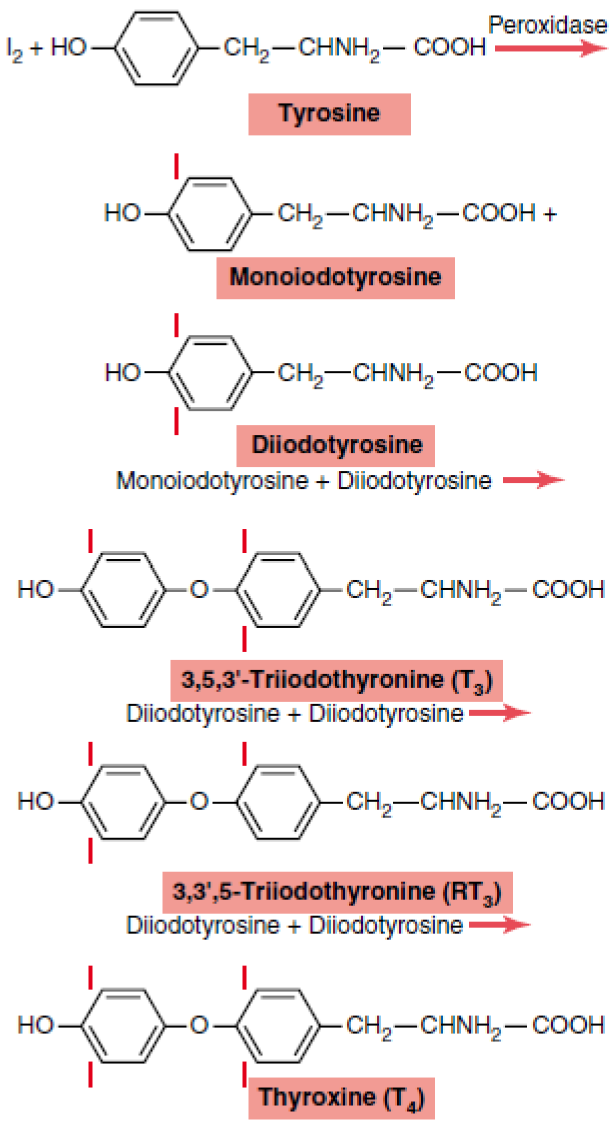


Figure 6: Chemistry of thyroxine and triiodothyronine formation.

Storage of Thyroglobulin.

After synthesis of the thyroid hormones has run its course, each thyroglobulin molecule contains up to 30 thyroxin molecules and a few tri-iodothyronine molecules. In this form, the thyroid hormones are stored in the follicles in an amount sufficient to supply the body with its normal requirements of thyroid hormones for 2 to 3 months.

Therefore, when synthesis of thyroid hormone ceases, the physiologic effects of deficiency are not observed for several months.

Release of Thyroxine and Triiodothyronine from the Thyroid Gland

Thyroxine and triiodothyronine must first be cleaved from the thyroglobulin molecule, and then these free hormones are released. This process occurs as follows: The apical surface of the thyroid cells sends out pseudopod extensions that close around small portions of the colloid to form *pinocytic vesicles* that enter the apex of the thyroid cell. Then *lysosomes* in the cell cytoplasm immediately fuse with these vesicles to form digestive vesicles containing digestive enzymes from the lysosomes mixed with the colloid. Multiple *proteases* among the enzymes digest the thyroglobulin molecules and release thyroxine and triiodothyronine in free form. These then diffuse through the base of the thyroid cell into the surrounding capillaries. Thus, the thyroid hormones are released into the blood.

Thyroid Gland Anomalies

Developmental abnormalities (excluding biochemical abnormalities) of the thyroid gland can be divided into three major groups: (1) agenesis of thyroid gland, which is an important cause of neonatal hypothyroidism; (2) dysgenesis of the thyroid; and (3) abnormalities due to persistence of the thyroglossal duct. [9]

Dysgenesis can be in the form of hemiagenesis of the thyroid or as an ectopic thyroid. The left lobe is absent in 80 % of the patients. The thyoid lobe which is present is often enlarged. Both hypothyroidism and hyperthyroidism have been reported. Females are affected three times as often as males. Both malignant and benign nodules have been reported in these conditions. Ectopic thyroid may be lingual, perihyoid, intratracheal, intraoesophagal, mediastinal or cardiac. (10)

Both cysts and fistulas can develop along the course of the thyroglossal duct. Cysts are the most common anomaly of thyroid development seen in clinical practice. Normally, the thyroglossal duct is obliterated early in embryonic life, but occasionally it persists as a cyst.

Such lesions occur equally in males and females. Cysts commonly become frequently infected and may rupture spontaneously. When this complication occurs, a sinus tract or fistula forms and persists. Removal of a thyroglossal cyst or fistula requires excision of the central part of the hyoid bone and dissection of the thyroglossal tract up to the base of the tongue (the Sistrunk procedure) if recurrence is to be minimized. This procedure is necessary because the thyroglossal duct is intimately associated with the central part of the hyoid bone.

Types of thyroid surgery

All thyroid operations can be assembled from three basic elements:

- Total Lobectomy
- Isthumectomy
- Subtotal Lobectomy

Total thyroidectomy = 2 x total lobectomy + isthumectomy

Subtotal thyroidectomy = 2 x subtotal lobectomy + isthumectomy

Near total thyroidectomy = total lobectomy + isthumectomy + subtotal lobectomy

Hemithyroidectomy = total lobectomy + isthumectomy

Drains

Definition: A surgical drain is a tube used to remove pus, blood or other fluids from a wound. Drains inserted after surgery don't result in faster wound healing but are sometime necessary to drain body fluid which may accumulate and in itself become a focus of infection. Drain may be hooked to wall suction, a portable suction device, or they may be left to drain by gravity.

Indications [11]:

1. To help eliminate dead space in areas of redundant tissue (eg. neck and axilla) .

2. To evacuate existing accumulation of fluid like pus, blood, serous exudates , chyle or bile by providing a focussed drainage.

3. To provide early warning of a surgical leak (either bowel contents, secretions, urine, air or blood)

4. To control an established fistula leak [11]

Types of drains:

1. Tube drains

Fig 7: Tube drain with multiple side holes.

At one end of the tube, which is placed in the wound cavity, there are multiple holes. The other end can be connected to a bag or reservoir forming a closed drainage system and suction can also be applied [12].

2. Sheet Drains

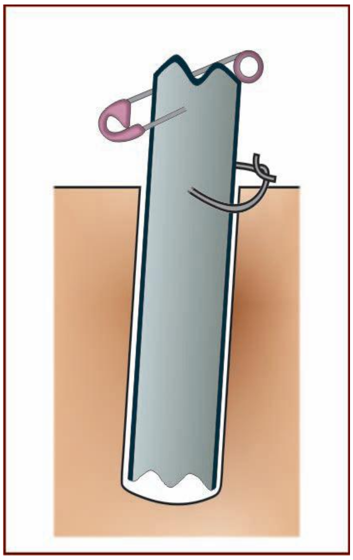


Figure 8: Corrugated sheet drain

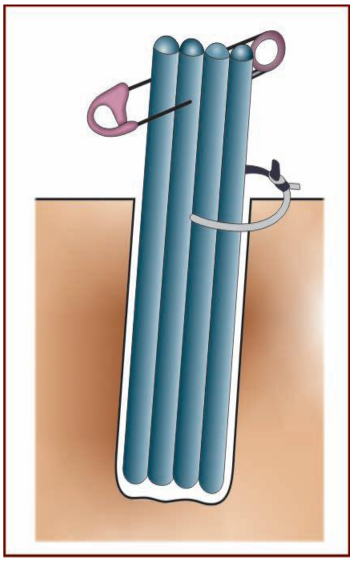


Figure 9: Yeates drain

These consist of corrugated silicone material, or sheets forming parallel tubes (Yeates drain), in which fluid passes through and around the tubes. They are fixed bypassing suture to the skin. Nowadays, such drains are not commonly used.

3. Gauze packs and ribbon gauze wicks

Gauze packs are sheets of sterile cotton gauze placed on a raw surface where discharge is expected to occur over a wide area. The gauze soaks up the secretions by capillary action. Dry gauze packs are more effective but tend to adhere to raw areas and are difficult to remove, resulting in pain and bleeding during removal.

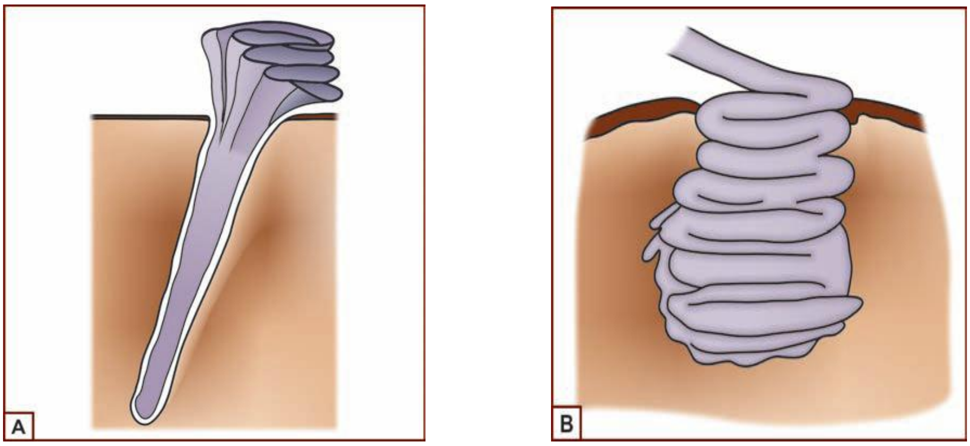


Fig10 A and B: Wound being packed by a folded gauze piece (A) or a ribbon pack. (B) This is usually performed to drain a cavity

If a cavity is deep and discharge cannot be brought to the surface, it can be drained by a wick of moistened folded gauze which is passed down. Sometimes wicks can be passed through a thin walled latex tube, known as ‘cigarette drain”. The latex tube prevents the wick from sticking to the tissues.

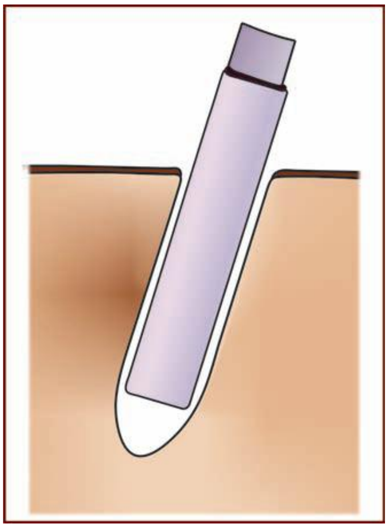


Figure 11: 'Cigarette' drains: This is formed by passing a folded gauze piece or a ribbon pack through a finger glove stalk or a thin walled rubber tube.

Classification of drains:

Drains may be classified as:

1. Open and closed drains [12]

   a. Open drainage: In this system, Penrose drain, multitubular drain or corrugated drain is used. The drain is taken out through the main operative wound or via s separate stab wound stitched to the skin. This is then covered by a surgical dressing pad. This type of drain increases the risk of wound infection and the chance of passing on the infection to other patients in the surgical ward and is hence seldom used nowadays.

   b. Closed drainage: In this system a tube drain is connected to a drainage bag. Fluid may be collected by either siphon (passive) or suction (active) in the drainage bag.

Alternatively, drains may be classified as:

2. Passive and Active drains [13]

a. Passive drains: They depend on the higher pressure inside the wound in conjunction with capillary action and gravity to draw fluid out of a wound (ie, the difference in pressure between the inside and the outside of the wound forces the fluid out of the wound). Passive drains, such as a Penrose drain, do not require special attention; the dressing is changed when it becomes saturated, or, if the drain is attached to a reservoir, then the reservoir is emptied or changed when it is full.

b. Active drains: Active drains use negative pressure to remove accumulated fluid from a wound. The collection reservoir of an active drain expands as it collects fluid drainage by exchanging negative pressure for fluid. The drain becomes ineffective if the vacuum is lost.

Active or Vacuum drains are further classified according to the degree of pressure used.

i) High negative pressure drains e.g typical bottled vacuum drains (eg, Redi-vac) High-pressure bottled vacuum drains have the advantages of being sealed, closed-circuit systems that allow for easy monitoring and safe disposal of the drainage. These systems consist of a clear, plastic reservoir with a rubber cap that has indicator wings to monitor the presence of vacuum pressure and an opening in which to connect the drainage tube. When a vacuum is present in the system, the wings on the rubber cap are close together; the wings are apart if the vacuum is lost. The end of the drainage tube that is inserted into the wound has multiple openings on its inner side through which fluid can be evacuated from the wound. The wound should be closed before the clamps on the drain are opened; otherwise the vacuum will be lost as the tube sucks in atmospheric air. [13]

ii) Low negative pressure drains e.g Bulb-shaped suction devices (eg, Jackson-Pratt) and collapsible four-channel vacuum drains (eg, J Vac, Blake).

Low-pressure vacuum drains have a plastic bulb shaped reservoir and a silicone drainage tube, with multiple side holes at the end that is inserted into the wound. When the bulb is compressed, air is forced out, which creates negative pressure in the system. Low-negative-pressure drains work gently to evacuate excess fluid and air. It is easy to educate the patient so that he or she can care for a bulb-type, low-pressure vacuum drain at home without help.

Lo Bianco et al. (2015) [14] investigated, in relation to the volume of blood drained, which type drainage to use after thyroidectomy natural drainage or negative drainage. Based on the study, they concluded that the best drainage in thyroidectomy was the natural one, diverging from the older concept of the use of negative drainage in superficial cavities.

Advantages of drains

1. The dead space that develops after surgery is reduced [15]
2. Repositioning of the flaps is facilitated [15]
3. The recovery of the patient is faster due to reduction of pressure to surgical site as well as adjacent organs, nerves and blood vessels [16].

Disadvantages of drains:

1. Breakage : Though drains are made of strong silicone or polyvinyl chloride plastic and are unlikely to break, but breakage can sometimes occur. Reopening of the wound may be required if part of a drain breaks off inside the patient's body during removal [13].
2. Difficulty in removal : If a drain remains inserted for a long period of time, it may become difficult to remove if the drain has been stitched to the wound during closure of deeper layers. The wound may need to be temporarily opened to remove the drain [13].
3. Inadvertent removal : Drains may get tangled in the patient's other lines (eg, IV tubing, electrocardiogram leads) or become tangled in clothing or linen and accidentally be pulled out. This might cause bleeding or pain [13].
4. Infection : Drains can increase the risk of infection via retrograde bacterial migration [13].
5. Occlusion : Drain tubes can become occluded by blood clot, tissue, or the omentum. This can lead to the formation of a hematoma and subsequent discomfort and increased risk for infection [13].
6. Pain : Drain sites can be painful and may prevent the patient from lying on the side where the drain is inserted. Furthermore, some patients are apprehensive about moving with a drain in place after surgery; lack of movement can potentially increase the risk of postoperative immobility complications (eg, venous thrombosis) [13].
7. Unsightly scar: A drain site is left to heal by secondary intention so the site may form a puckering scar [13].

COMPLICATIONS OF THYROID SURGERY

During the 1800s, the mortality rate from thyroid surgery was approximately 40%. Most deaths were caused by infection and hemorrhage. Sterile surgical arenas, general anaesthesia, and improved surgical techniques have made death from thyroid surgery extremely rare today [17]. The potential major complications of thyroid surgery are as follows:

a. Bleeding- The incidence of bleeding after thyroid surgery is low (0.3-1%), but an unrecognized or rapidly expanding hematoma can cause airway compromise and asphyxiation. Patients present with neck swelling, neck pain, and/or signs and symptoms of airway obstruction (eg, dyspnea, stridor, hypoxia).
b. Recurrent laryngeal nerve (RLN) injury - It manifests clinically as hoarseness, weakness, and breathiness of the voice and occurs with an incidence between 0% and 3.6% after thyroidectomy [18]. It results in true vocal-fold paresis or paralysis. Deliberate intraoperative identification and preservation of the RLN minimizes the risk of injury.
c. Hypoparathyroidism - It can result from direct trauma to the parathyroid glands, devascularization of the glands, or removal of the glands during surgery with incidence rates of postthyroidectomy hypoparathyroidism ranging from 0% to 33% depending on the severity of the underlying disease and the extent of the operative procedure [18]. Postoperative hypoparathyroidism, and the resulting hypocalcemia, may be permanent or transient. Hypocalcemia after thyroidectomy is initially asymptomatic in most cases.

d. Thyrotoxic storm - It is an unusual complication that may result from manipulation of the thyroid gland during surgery in patients with hyperthyroidism. It can develop preoperatively, intraoperatively, or postoperatively. Signs and symptoms of thyrotoxic storm are increased sympathetic output (eg, tachycardia hyperthermia) in anaesthetised pateints and nausea, tremor, and altered mental status in awake patients. Cardiac arrhythmias may also occur. Untreated patients may progress to coma.

e. Injury to the Superior Laryngeal Nerve- The external branch of the superior laryngeal nerve (SLN) is probably the nerve most commonly injured in thyroid surgery, with an injury rate estimated at 0-25%. Trauma to the nerve results in an inability to lengthen a vocal fold and, thus, inability to create a high-pitched sound; this may be career-threatening for singers or others who rely on their voice for their profession. Speech therapy is the only treatment. [17]

f. Hypothyroidism- It is an expected sequela of total thyroidectomy. Measurement of TSH levels is the most useful laboratory test for detecting or monitoring of hypothyroidism in these patients. [17]

g. Infection- Currently, postoperative infection occurs in less than 1-2% of all thyroid surgery cases. Sterile surgical technique is the key to prevention; routine use of perioperative antibiotics has not proven to be beneficial. [17]

STUDIES

This study is about the efficacy of placement of drains in thyroid surgery. To obtain a meaningful study and result, a proper and detailed review of the literature is of utmost importance. The present literature reviews the related studies found in literature from 1985 onwards till date.

A randomized study of the value of drainage in thyroid and parathyroid surgery was presented by Kristoffersson, Sandzén and Järhult (1986) [19]. Fifty patients were provided with surgical drains and another fifty patients were allocated to a control group without drainage. Complications were few in either group and the rate of subjective discomfort from the collar incision was equally low in both groups. The observations suggested that the provision of drainage was not necessary after uncomplicated neck surgery.

Wihlborg, Bergljung and Martensson (1988) [20] performed a prospective, randomized study on the rate of complications after drainage or no drainage in thyroid surgery. One hundred fifty patients were allocated to drainage or no drainage. No difference was seen between the two groups according to the experience of the surgeon, type of operation, diagnosis, weight of thyroid specimens, operation time, and hospital stay. All complications were recorded and resulted in two patients receiving reoperation because of bleeding, two permanent laryngeal nerve palsies, one case of permanent hypocalcemia, ten minor hematomas, one wound infection, and one lymphatic leakage. No difference was seen between the groups. This study did not support prophylactic routine drainage after uncomplicated thyroid surgery.

The need for drainage after primary thyroid or parathyroid surgery was evaluated in a prospective study by Ayyash et al (1991) [21] in which 100 consecutive patients were randomly allocated to drainage or no drainage. Seroma developed in the wound in seven of the 50 patients without drainage and in two of the 50 with drainage. There were no residual effects of the seromas, which resolved spontaneously. The incidence of wound complication was unrelated to the surgeon's opinion on the need for drainage. The study provided no statistical report for routine use of drains in primary thyroid or parathyroid surgery.

Ariyanayagam et al (1993) [(22)] presented a large series of non-drainage cases in thyroid surgery, comprising 260 patients over a 15-year period. No case selection for non-drainage was employed. Two hundred and fifty-nine cases were not drained and included toxic goitres, and bilateral and redo procedures. There was one thyroid storm and two cases of subcutaneous fluid collection, treated by needle aspiration. No cases of recurrent laryngeal nerve injury, airway obstruction or death were recorded. This study strongly demonstrated the safety of non-drainage in routine thyroid surgery.

Shaha and Jaffe (1993) [(23)] have reported an experience based study, retrospectively. In their 9 years of practice, they had performed 400 thyroidectomies. For the first 6 years, they drained the operative site in most of thyroid procedures. However, it became apparent from their experience that drains had very little effect on the prevention of post-operative hematoma or of seroma. As a matter of fact, all four patients who required re-exploration in their initial series had drains in place. As a result of that experience over the next 3 years, during which time they performed 150 thyroidectomies, they used drains selectively. The indications for draining the thyroid bed have been the presence of a large dead space, operation for a large substernal goiter, and subtotal thyroidectomy for either large, multinodular goiter or for Graves' disease. Thus, among 150 recent thyroidectomies, they drained only 35, and avoided drains in 115 patients. Though this was not a prospective study, they found no difference in the overall outcome whether drains were employed or not. Most patients who had no drains were ready for discharge within 24-48 hours of surgery. The researchers proposed that drains should be utilized only selectively for thyroid surgery.

Wak, Valliulis and Hurst (1995) [24] assessed the postoperative complications in patients who underwent elective thyroid or parathyroid surgery without postoperative drainage during a 6-year period. Fifty-seven patients undergoing thyroid surgery and eight patients undergoing parathyroid surgery were evaluated. Twenty-four patients were excluded because drains were placed postoperatively. Reasons for exclusion included presence of a large dead space, substernal goiter, extensive neck dissection for malignant neoplasm, and large goiters. Major complications consisted of a hematoma requiring reexploration in one patient, and a recurrent nerve palsy in one patient. Minor complications consisted of temporary hypocalcemia (three), seroma (one), and superior flap edema that resolved in 3 months [20].The study concluded that routine prophylactic drainage in a select patient population is unnecessary after uncomplicated thyroid or parathyroid surgery.

In a retrospective study, Karayacin et al. (1997) [25] reviewed their experience with 1057 thyroidectomies with and without drains. Between 1983 and 1993, 520 patients were closed with drains and 537 patients without drains after thyroid surgery. The indications for drainage of the selective period included wet operative field and large areas of dead space at the conclusion of the operation. Reoperation for bleeding was done in twelve patients in the drainage group and two patients in the non-drainage group ($p < 0.05$). Wound infection was seen in seven patients in the drainage group and none in the no-drainage group ($p < 0.05$). The study suggested that routine drainage after thyroid surgery was not necessary and a selective policy could be applied safely.

Daou (1997) [26] undertook a prospective study in order to evaluate the effectiveness and the moraoubidity of a non drainage strategy after thyroidectomy. Between April 1993 and May 1995, one hundred fifty consecutive patients underwent thyroidectomy without drainage. Age range was 16 to 72 years. Sex ratio was 126F/124M. Indication for surgery was: solitary nodule (16), multinodular goiter (56), Graves' disease (21), toxic nodular goiter (34), cancer (8), retrosternal goiter (13), thyroiditis (2). The surgery done was: total lobectomy + isthmusectomy (15), total lobectomy + subtotal controlateral thyroidectomy (42), bilateral subtotal thyroidectomy (84), total thyroidectomy (9). Surgical technique was identical to that used previously by the author when drainage was installed routinely. Patients left the hospital on the first or second postoperative day and were reexamined on day 7 and day 30. There was no mortality, no suffocating hematoma, no reoperation and no laryngeal nerve paralysis. One patient developed a transient hypocalcemia that regressed one month later. Two patients developed a minor hematoma of which one disappeared after two weeks and the other drained spontaneously through the surgical incision on the seventh postoperative day. The researchers concluded that drainage after thyroidectomy had no adverse effects and could be avoided if meticulous surgery was done. Absence of drainage simplified the early postoperative course, improved the comfort of the patient, decreased hospital stay and reduced hospital cost. However, the authors opined that drainage might be of value in case of hemostatic problems or associated cervical neck dissection.

Defechereux et al. (1997) [27] conducted a retrospective review of a personal series of 1789 thyroidectomies over a 3 1/2-year period. Except for thyroid cancer surgery with lymphadenectomy and large mediastinal goiters requiring sternotomy, no case selection for non-drainage was employed. Patients were stratified only on a chronological basis, according to whether key were drained (n = 575, 1993-1994) or not drained (n = 1214, 1994-1996). Both series included toxic goiters, large plunging compressive goiters, bilateral and redo procedures. Severe life-threatening hematoma requiring reexploration occurred in 5 drained patients (0.9%) and in 5 undrained patients (0.4%). Minor postoperative wound hematoma were conservatively treated in 17 drained patients (2.9%) and 6 undrained patients (1.3%). The researchers pointed out that in their experience, drainage after thyroid surgery may not mandatory provided that the field was completely dry before closure. They therefore, progressively modified their operative strategy in order to improve a meticulous haemostatic technique, considered to be more important than the use of drains. Meticulous surgical technique and obliteration of dead space led them to observe a dramatic decrease of the incidence of hemorrhagic complications, eliminating the need for systematic drainage after thyroid surgery.

Willy et al (1998) [28] investigated the effectiveness of high-vacuum and passive drainage systems after elective thyroid resection using a prospective randomised clinical study in a Germany military hospital. 40 patients were treated with passive closed drains and 40 with high-vacuum systems. The amount of blood collected during drainage was measured and the extent of residual haematoma was recorded on ultrasonography. In the 40 patients in whom passive closed drainage was used, the median volume drained was 34 ml (range 0-175) compared with 115 ml (40-346) in the high vacuum group ($p < 0.01$). In the passive drainage group the extent of residual haematoma measured by us was 4.4 ml (range 0-21.7) compared with 5.3 ml (0.6-24.9) in the high vacuum group. Concurrently, a multicentre postal survey was undertaken in Austria, Germany and Switzerland of annual number of bilateral thyroid resections, type of drainage used, and volume of postoperative drainage. 799 of the 1698 hospitals surveyed replied (47.2%). 785 (98.2%) of the 799 surgeons said that they used drainage systems of whom 766 (97.6%) used high-vacuum systems. The researchers concluded that the high-vacuum drainage that was most commonly used in Austria, Germany, and Switzerland resulted in increased blood loss with no reduction in the extent of residual wound haematoma and offered no additional advantage over passive drainage systems in thyroid surgery.

Tabaqchali, Hanson and Praoud (1999) [(29)] aimed to establish if the routine use of drains following thyroid/parathyroid surgery was of any value. Medical records of patients who underwent thyroidectomy or parathyroidectomy under the care of a single endocrine surgeon (GP) over a 14-year period were reviewed. For the first 6 years, the neck was routinely drained (drain group) and for the subsequent 8 years the neck was only drained if the surgeon felt it necessary according to the operative situation (selective group). A total of 606 procedures (425 thyroidectomy and 181 parathyroidectomy) were performed on 582 patients. Drains were routinely used in 134 (22%) procedures (drain group) and were selectively used in 472 (78%) (selective group) of which 191 (40%) were drained. In all patients, there was a significant increase in the rate of postoperative bleeding/haematoma in patients with a drain (8/314 versus 1/282, Fisher's exact, $P < 0.05$). Wound infection occurred only in the patients with a drain. There was no difference in the incidence of postoperative bleeding and airways obstruction between the drain and selective groups. The study concluded that the routine use of neck drains was unnecessary and may indeed be harmful, drain insertion being associated with an increased incidence of wound infection. Drains should, therefore, be used selectively after thyroidectomy and parathyroidectomy.

In a study by Debry, Renou and Fingerhut (1999) [30] a series of 100 consecutive unselected patients undergoing all types of thyroid surgery--including even those inducing large dead space e.g. substernal goitre and carcinoma thyroid with recurrent nerve dissection--were randomly allotted to either receive drainage (n = 43) or not (n = 57). Patients with cervical dissection for lymph node metastasis were not included. Severe intra-operative haemorrhage was not a reason for exclusion. No complications such as haematoma or seroma were found in the undrained group whereas only minor complications such as haematoma (n = 4) were noted in the drained group. Whatever the group, none of the patients required re-exploration. The difference in overall hospital stay (1.72 days in the group of undrained patients versus 2.09 days in the drained group) was not statistically significant.

Ardito et al (1999) [31] analyzed their experience of a 10 year-period in which 1.217 thyroidectomies were performed by the same surgical team and prophylactic routine drainage was always adopted. In 13 patients (1.06%) a benign hematoma occurred with spontaneous remission. In 6 patients the bleeding was severe and compressive hematoma occurred; it required surgical re-exploration. The authors opined that such a complication was unusual in the neck surgery (0.49% in the authors' series) performed by experienced surgeons and when life-threatening hematomas did occur they depended on various uncontrolled factors and drainage was often not helpful. A meticulous haemostatic technique was necessary and patients should be observed very closely during the few first hours following surgery on the thyroid gland. Therefore on the basis of the analysis of their series, although it was not always possible to prove the benefit of the drainage, the authors suggested its indication in the neck surgery, as in other fields with dead space, to remove blood and secretions reducing postoperative complications. They have never observed wound infections and patients were discharged within 72 hours.

Pezzullo et al. (2001) [32] analysed the results of a prospective randomised trial in order to assess the utility of drainage after thyroid surgery. Sixty patients were entered into the study, thirty of whom were drained after surgery and thirty who received no drainage. The two groups were well matched with regard to most characteristics. There was no difference between the two groups in terms of early or late postoperative complications. Hence the researchers concluded that drainage after uncomplicated thyroid surgery was of no benefit.

During the period from 2003 to 2004, Dimov et al [33] performed 100 consecutive thyroid surgeries .Irrespective of clinical diagnosis or type of surgery they were separated into two groups. The first one (43) patients with post operative drainage, and the second one (57) with no drains. Patients with neck dissections were excluded from the study. There were no hematoma or seroma in patients without drains. In the other group two of them were reoperated because of drain insertion into the operative wound in post op. The difference in mean hospital stay for the two groups of patients is not statistically significant.

Khanna et al (2005) [34] conducted a randomized prospective control study on 94 patients undergoing 102 thyroid surgeries, over a period of fifteen months. Patients included in the study were randomly allocated to drain and non-drain group on the basis of computer generated random number table. The surgeon was informed of the group just before the closure of the wound Postoperatively USG neck was done on first and seventh postoperative day by the same ultrasonologist each time. Any swelling, change in voice, tetany and tingling sensation were also recorded. The data was analyzed using two-sample t-test for calculating unequal variance. Both groups were evenly balanced according to age, sex, and size of tumor, type of procedure performed and histopathological diagnosis. There was no significant difference in collection of thyroid bed assessed by USG on D1 & D7 in the two groups ($p = 0.313$) but the hospital stay was significantly reduced in the non-drain group ($p = 0.007$). One patient in the drain group required needle aspiration for collection in thyroid bed. No patient in either group required re-operation for bleeding or haematoma. The study concluded that routine drainage of thyroid bed following thyroid surgery may not be necessary. Not draining the wound resulted in lesser morbidity and decreased hospital stay.

Ozlem et al (2006) [(35)] evaluated retrospectively records of 1,066 patients who underwent thyroid surgery. The rates of the re-operations due to life-threatening postoperative hemorrhage and wound infections were higher in the drained group. The average postoperative hospital stay of the drained group was significantly longer than that of the non-drained group. Hence they concluded that routine drainage of the thyroidectomy bed is not effective in decreasing the rate of postoperative complications after thyroid surgery, and it causes a prolonged hospital stay and surgical site infection.

In a prospective randomised study, Lee et al, (2006) [36] determined the feasibility and safety of thyroidectomy without drains, especially in cases of combined central neck dissection (CND). One hundred ninety-eight consecutive thyroidectomized patients were enrolled in this study. Drain group (n = 101) consisted of 41 hemithyroidectomies (HT), 28 total thyroidectomies (TT), and 32 total TT with CND. No-drain group (n = 97) consisted of 42 HT, 18 TT, and 37 TT with CND. There were no significant differences in age, sex, volume of resected thyroid gland, types of operation, operation time, and histopathlologic diagnosis between two groups. In the drain group, overall perioperative complications occurred in seven (7/101, 6.9%) patients. In the no-drain group, overall perioperative complications occurred in nine (10/97, 10.3%) patients. There was no significant difference in overall perioperative complications between the drain and no-drain groups, even in cases of performing CND. Time of hospital discharge after operation was significantly shorter in the no-drain group than the drain group ($P < .05$). The study concluded that thyroidectomy without drains was safe and effective even in combination with CND and appeared to confer several advantages over the routine drainage method. In additionit achieved significant reduction of hospital stay, which led to a reduction in costs for the patients.

Herranz and Lattore (2007) [37] evaluated the experience on 79 thyroid and parathyroid procedures, using a drain in half of the surgeries. No differences were found in terms of the presence of infections, seromas, or haemorrhage. Post-operative haemorrhage was found in 2.3 % of cases, haematoma in 2.5 %, and seroma in 1.2 %. The mean hospital stay was longer in patients with drains, 1.8 days, than in patients without, 1.2 days. The study concluded that meticulous haemostasis and adequate surgical technique were the key for avoiding haemorrhage and haematoma formation.

The authors indicated using suction drains only for extensive dead space, intrathoracic or retrosternal goiters, and excessive tissue manipulation only.

Ahluwalia et al (2007) (38) carried out a randomised controlled trial in 100 patients to determine the need for suction drainage after elective thyroid and parathyroid surgery. Before wound closure, patients were randomised into either group A (to remain without suction drainage) or group B (to receive suction drainage). Excluded patients were those requiring associated neck dissection and those with bleeding diatheses, all of whom would necessarily require drainage. The primary outcome measure was ultrasound evaluation of any collection in the thyroid bed, performed 1-day postoperatively. The secondary outcome measure was postoperative complications and length of in-patient stay. One hundred patients completed the study, and groups A and B comprised 50 patients each. Patients in each group exhibited a mean age of 49 years, and a male to female ratio of 1 : 9. Both groups were also well-matched regarding type of operation, size of tumour and histopathological diagnosis. Modal and median postoperative neck collection volume on ultrasound examination was 0 and 0 cm3 respectively (range 0-16 cm3) in group A and was 0 and 0 cm3 (range 0-70 cm3) in group B. This difference was not statistically significant, but three patients with a haematoma were all in the suction drainage group. Difference in complication rates between groups was also not statistically significant. Modal and median length of in-patient stay was 2 and 2 days respectively (range 2-3 days) in group A and 3 and 3 days (range 2-4 days) in group B, and this difference was statistically significant (P = 0.0006). The study concluded that routine suction drainage after uncomplicated elective thyroid and parathyroid surgery appeared unnecessary, and prolonged in-patient stay.

In a study by Colak et al. (2008) [39] a total of 116 patients who underwent total thyroidectomy or lobectomy for benign thyroidal disorders were randomly allocated to be drained or not. The study reported that the mean operating time was similar between two groups (the drained and non-drained groups). The mean VAS score was found to be significantly low in the non-drained group patients in postoperative day (POD) 0 and POD 1. The mean amount of intramuscular analgesic requirement was significantly less in the non-drained group. One case of hematoma, two cases of seroma and three cases of transient hypoparathyroidism occurred in the non-drained group, whereas one case of hematoma, two cases of seroma, two cases of wound infections and two cases of transient hypoparathyroidism occurred in the drained group. No patient needed re-operation for any complication. The mean hospital stay was significantly shorter and the satisfaction of patients was superior in the non-drained group. Based on their findings, the researchers suggested that postoperative complications cannot be prevented by using drains after total thyroidectomy or lobectomy for benign thyroid disorders. Furthermore, the use of drains may increase postoperative pain and the analgesic requirement, and prolong the hospital stay. In the light of these findings, the researchers suggested that the routine use of drains might not be necessary after thyroid surgery for benign disorders.

In a prospective, clinical trial conducted by Morrissey et al. (2008) [40] a blinded observer randomized patients into drain and no drain groups. Inclusion criteria included all patients presenting for total, hemi-, or completion thyroidectomies. Those with massive goitres or nodules greater than 6 cm were excluded. Fifty-five patients were enrolled in the study. Complications, length of hospital stay, and overall cost were evaluated. They found that in the no drain group, there was a 1.12-day reduction in hospital stay ($p < .01$), with no increase in postoperative complications. This translated into a cost savings of $ 2177 per patient.

Prichard et al (2010) [41] performed a retrospective review of patients undergoing thyroid surgery, over a three year period and post-operative complications documented. One hundred and four thyroidectomies were performed. 63 (60.6%) patients had a partial thyroidectomy, 27 (25.9%) had a total thyroidectomy and 14 (13.5%) had a sub-total thyroidectomy. Suction drains were not inserted in any patient. A cervical haematoma did not develop in any patient in this series and no patient required re-operation. There was no evidence to suggest the routine use of surgical drains following uncomplicated thyroid surgery reduced the rate of haematoma formation or re-operation rates.

Musa et al (2010) [42] evaluated the necessity and benefits of the use of drains and their limitations in thyroidectomy and assessed their relationship with cost of surgery and hospital stay using a prospective randomised study on 67 patients divided into two groups. Group A consisted of 35 patients with drain and Group B, 32 patients without drain between January 2005 and June 2007. All had subtotal thyroidectomy and the technique and method of closure were the same. No anticoagulant was used and the clotting profiles were within normal range in the two groups.The sixty seven patients recruited for the study were made up of 60 females (89.6%) and 7 males (10.4%). The mean age for group A was 50.14 +/- 10.7 years, group B was 51.97 +/- 9.5 years. The P value for the mean ages of the two groups is 0.464 ($p=0.05, t=3.98$).There was no blood transfusion. Three patients developed features of respiratory obstruction (respiratory distress and stridor) -the first 2, one from each group was as a result of laryngeal oedema from trauma of difficult intubation. The third was from group B, as a result of hemorrhage and haematoma collection (she was one of the controlled thyrotoxic patients). Two patients (5.7%) developed wound infections in group A, which increased morbidity, hospital bill and prolonged hospital stay as compared to group B. The highest volume of drainage of 35ml was from a woman with a big goiter (120g). Average drainage was 17.7 +/- 6.9ml. The study concluded that the use of drains was not necessary in all cases of thyroidectomy but for cases with large cavity post extraction and copious oozing in vascular glands. Some of the limitations to the use of drains are infections, which can prolong hospital stay and thereby increase hospital bill.

Abboud et al. (2011) [(43)] conducted a study to review the safety of thyroidectomy combined with cervical neck dissection without drainage in well-differentiated thyroid carcinoma (WDTC). The medical records of consecutive patients who underwent thyroidectomy without drainage for WDTC were retrospectively reviewed. Group 1 included 123 patients who underwent thyroidectomy with central neck dissection and Group 2 included 46 patients who underwent thyroidectomy with central and lateral neck dissection. One hundred twenty-seven patients underwent thyroidectomy without neck dissection and were included in Group 3. Overall, 16 patients (5%) developed postoperative hematoma and/or seroma, seven patients (6%) in the Group 1, three patients (7%) in the Group 2, and six patients (5%) in Group 3. All patients had minor bleeding or seroma not requiring surgical intervention. Overall, 68 patients (23%) had transient postoperative hypocalcaemia, and four patients(1%) had permanent hypoparathyroidism. Seventeen patients (6%) had transient postoperative hoarseness and three had permanent vocal cord paralysis (0.6%). The postoperative stay for all groups was 1 day in 91 per cent of the cases. Patients from

Groups 1 and 2 had no increased perioperative local complications or length of stay as compared with Group 3. This led the authors to conclude that Cervical neck dissection and thyroidectomy without drains was safe and effective in the treatment of WDTC.

Neary et al (2012) [(44)] determined the impact of routine open drainage of the thyroid bed postoperatively on ultrasound-determined fluid accumulation at 24 hours in a prospective randomised clinical trial on patients undergoing thyroid surgery. Patients were randomly assigned to a drain group (n=49) or a no-drain group (n=44) immediately prior to wound closure. Patients underwent a neck ultrasound on day 1 and day 2 postoperatively. It was observed that here was significantly less mean fluid accumulated in the drain group on both day 1, 16.4 versus 25.1 ml (P-value=0.005), and day 2, 18.4 versus 25.7 ml (P-value=0.026), following surgery. No significant differences between the groups with regard to length of stay, scar satisfaction, visual analogue scale pain score and analgesic requirements. There were four versus one wound infections in the drain versus no-drain groups. This finding was not statistically significant (P=0.154). No life-threatening bleeds occurred in either group. The study concluded that fluid accumulation after thyroid surgery was significantly lessened by drainage. However, there was no clinical benefit associated with this finding in the nonemergent setting. Drains themselves showed a trend indicating that they may augment infection rates. Hence, since the frequency of acute life-threatening bleeds remained extremely low following abandoning drains, the researchers advocated abandoning routine use of thyroid drains.

Abboud et al. (2012) [(45)] sought to review the safety of thyroidectomy combined with cervical neck dissection (CND) without drainage. The medical records of consecutive patients who underwent thyroidectomy without drainage were retrospectively reviewed. Two groups were defined depending on whether CND was or was not performed. The main outcome was identification of patients with cervical bleeding, hematoma or seroma.1127 patients (139 who had CND and 988 who did not) were included in the study. Of these, 207 patients (18%) had transient postoperative hypocalcemia, 9 (0.8%) had permanent postoperative hypoparathyroidism, 56 (5%) had transient postoperative hoarseness and 7 (0.6%) had permanent vocal cord paralysis. A total of 44 patients (4%) experienced postoperative hematoma and/or seroma: 8 patients (6%) who had CND and 36 (4%) who did not. There was no major bleeding in the 2 groups; all patients had minor bleeding or seroma not requiring surgical intervention. The postoperative stay in hospital for both groups was 1 day in 92% of patients. Wound infection occurred in 0.8% of all patients: 1 (0.7%) who had CND and 8 (0.8%) who did not. There was no significant difference between the groups in overall perioperative complications or in time of hospital discharge. The study concluded that thyroidectomy without drains was safe and effective, even in combination with CND.

Qian et al.(2013) [(46)] evaluated the necessity of drainage after thyroidectomy for benign thyroid disorders. A total of 272 patients who underwent thyroidectomy for benign thyroid disorders were randomly divided into drainage group or non-drainage group. Operating time, postoperative stay time in hospital, comfort of neck assessed by visual analogue scale (VAS) on postoperative day (POD) 0 and POD1 were and the incidence of complications, including post-thyroidectomy bleeding, hematoma, seroma, wound infection, hoarseness, and hypoparathyroidism, were assessed and compared between two groups. Both groups were found to be similar in the mean age, the sex ratio and the underwent procedure types. There was no significant difference in the mean operating time between two groups (87.5 ± 32.0) min and (93.8 ± 30.1) min (t = 0.12, P = 0.45). The mean postoperative hospital stay time of non-drainage group (1.9 ± 0.3) d was significantly shorter than that of drainage group (2.6 ± 0.6) d (t = 1.45, P = 0.02). The mean VAS scores of neck comfort on POD0 and POD1 in non-drainage group were significantly high than those in non-drainage group(t = 2.67, P = 0.03 and t = 0.33, P = 0.006). There were no significant difference in postoperative complications, including permanent hoarseness and hypoparathyroidism, between two groups. Hence the study concluded that routine drainage was not necessary after thyroid surgery for benign disorders.

Zhang et al (2015) [47] investigated the possibility of thyroidectomy/lobectomy without drainage after surgery. Eighty-eight consecutive cases with thyroid mass have been underwent operations including: lobectomy group(42 cases), thyroid lobectomy with contralateral partial thyroidectomy group (17 cases) and total thyroidectomy group (29 cases) from June- 2013 to June- 2014 in Nanjing Tongren Hospital. Fifteen patients with thyroid operation in other hospital were collected from Jan 2014 to June 2014and the recovery of postoperative incision were compared. Eighty-four cases were smoothly discharged from hospital except 4 thyroidectomy cases suffered from a small amount of effusion in surgical cavity. The study concluded that drainage following thyroidectomy was not essential, if the thyroid surgery was meticulous in each step of the surgery, and this could increase the effect of beauty.

Nawaz, Naeem and Zeb (2015) [48] compared patients undergoing thyroid surgery without the placement of a drain versus patients undergoing surgery with placement of drain; in terms of hospital stay, operative pain score, amount of fluid collection in the neck and postoperative complications in a teaching hospital in Pakistan. The study included 68 patients; being grouped in to two groups the group with drain showed no difference demographically from the group in which drain was not placed post operatively. Mean postoperative pain score 24 hours after surgery was 60.87± 7.06 SD in the drain group and 41.19± 4.18 SD in no drain group (p value < 0.05). Mean duration of hospital stay was 3.63 days ± 0.707 SD in drain group and 1.19 days ± 2.145 SD in no drain group (p value <0.05). The study concluded that "Drain less" Thyroidectomy caused less discomfort, short hospital stay and did not increase the risk of post operative complications. The authors recommended that drains should be used only in selected cases of Thyroidectomy.

Afzal, Ahmad and Naqi (2015) [(49)] compared the outcome of lobectomy and isthmusectomy with and without drain in case of solitary nodule in thyroid surgery in a Randomized control trial with 60 patients in Pakistan. The patients were divided into Two Groups by Lottery method. Patients were observed postoperatively and followed up for mean pain score for 24 hours and mean hospital stay till discharged. Mean age of patients in Group-A and in Group-B was 36.86±12.30 and 40.20±9.28 years. In Group-A there were 6 male and 24 female while in Group-B there were 9 male and 21 female patients. Mean hospital stay of Group-A and Group-B patients was 1.85±0.59 and 1.27±0.19 days. In Group-A and in Group-B mean pain score at 1st post operative day was 2.63±0.49 and 2.13±0.34.Both hospital stay and mean pain score at 1st post operative day was significantly lower in Group-B patients. The researchers concluded that the results of this study confirmed the hypothesis that thyroid surgery in case of solitary nodule without drain was more beneficial for patients in terms of short hospital stay and less pain score as compared to routine use of drain.

Schietroma et al (2017) [50] conducted a prospective, randomized study to evaluate the necessity of drainage after thyroid surgery. The patients (n = 215) were randomly assigned to be treated with suction drains (group 1; n = 108) or not (group 2; n = 107). The postoperative pain scores were significantly lower in the non-drained group than in the drained group of patients at postoperative days 0 and at 1. Hematomas, seromas, wound infections, transient biochemical hypoparathyroidism, and transient damage of the recurrent laryngeal nerve occurred more frequently in the drained group than in the non-drained group. The mean hospital stay was significantly shorter in the non-drained group than in the drained group. The study concluded that routine drain emplacement after thyroidectomy was unnecessary.

In addition to the above studies, literature review revealed several meta analysis' comparing drains vs. no drains in thyroidectomies [51,52,3,53]. Several of the individual studies cited above also figure in one or more of these meta analysis'. All the meta analysis' have reported a common conclusion that the use of drain after thyroid surgery increased postoperative pain and length of stay in the hospital, with no decrease of reoperation rate, hematoma and seroma formation. If the surgery is performed meticulously, there is no need for placement of drains.

MATERIALS AND METHODS

SOURCE OF DATA:

The patients admitted in B.L.D.E (Deemed to be University) Shri. B. M. Patil Medical College, Hospital and Research Centre, Vijayapur in Surgery Department.

METHOD OF COLLECTION OF DATA:

The patients admitted in B.L.D.E (Deemed to be University) Shri. B. M. Patil Medical College, Hospital and Research Centre, Vijayapur in Surgery Department during period of Oct 2016 – August 2018 with a sample size of 30 patients in each group comprising of a total of 60 patients.

Details of cases were recorded including history, clinical examination, and investigations done.

Depending upon the thyroid disorder, total thyroidectomy/sub-total thyroidectomy/hemithyroidectomy was performed. The efficacy of placement of drains in thyroid surgeries was compared with the thyroid surgeries with no drains. Closed negative suction drains (Romovac®) were placed before wound closings, which were brought out through a separate site, if the patient was in the drained group.

INCLUSION CRITERIA

Patients undergoing Total Thyroidectomy, Sub-total thyroidectomy or Hemithyroidectomy were included in the study.

EXCLUSION CRITERIA

Patients with Retrosternal goiter and the operations requiring radical neck dissections were excluded from the study.

SAMPLING

- Prospective, interventional study.
- With Anticipated Mean difference of hospital stay between two study groups (study group and control group) as 0.60 days and anticipated Standard Deviation (SD) as 0.65 days, the minimum sample size per group is 30 patients in each group with 90% Power and 5% Level of significance.
- Calculated sample size was 30 in each group.
- In this study 60 cases were studied, in each group 30 cases were allocated alternatively.

Total Sample Size: 60

No drain group (A): 30

Drain group (B): 30

STATISTICAL ANALYSIS

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean± standard deviation (SD) were used. Chi-square (χ^2) test was used for association between two categorical variables.

The formula for the chi-square statistic used in the chi square test is:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The subscript "c" are the degrees of freedom. "O" is observed value and E is expected value.

C= (number of rows-1)* (number of columns-1)

In cases of more than 30% cell frequency <5, Freeman-Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. The difference of the means of analysis variables between two independent groups was tested by unpaired t test.

The t statistic to test whether the means are different can be calculated as follows:

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}}}$$

where $\bar{x}_1$ = mean of sample 1

$\bar{x}_2$ = mean of sample 2

n_1 = number of subjects in sample 1

n_2 = number of subjects in sample 2

s_1^2 = variance of sample 1 = $\frac{\Sigma(x_1 - \bar{x}_1)^2}{n_1}$

s_2^2 = variance of sample 2 = $\frac{\Sigma(x_2 - \bar{x}_2)^2}{n_2}$

If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23.0. and Microsoft office 2007.

SURGICAL PROCEDURE:

Patients underwent detailed pre-tested questionnaire regarding duration, pain, progression of size, change in voice, difficulty in breathing, family history, previous treatment history.

In clinical examination special attention was given to the situation, size, shape of the nodule, mobility with deglutition, mobility with protrusion of tongue, skin over the swelling.

Routine investigations which includes complete blood picture, blood urea, serum creatinine, blood sugars, urine routine, ECG, chest X-ray with specific investigations like thyroid profile, serum calcium, neck X-ray, ultrasound of neck, indirect laryngoscopy and preoperative FNAC of solitary thyroid nodule.

Cases were prepared for surgery after preoperative correction of anaemia, controlling of hypertension, diabetes.

- Informed written consent was obtained after explaining the surgical procedure, complications and results.
- Adequate pre-operative preparation was done.

  All patients received one dose of preoperative antibiotics.

STEPS OF SURGERY FOR HEMITHYROIDECTOMY :

Under general anaesthesia, the patient was placed in supine position with the apex of the patient's head at the top of the operating bed. A shoulder roll is placed at the level of the acromion process of the scapula to help extend the neck with elevation of head end of table. A slightly curved transverse skin crease incision was made 2–3cm above the sternum, Platysma is incised in line with the skin incision.

The skin and platysma flaps are elevated down to the sternum, and up to the thyroid cartilage. A self-retaining Joll's retractor is then positioned to retract the flaps. The deep cervical fascia was incised vertically in the midline, and the strap muscles retracted laterally. The assistant's help was taken to retract the strap muscles laterally, and away from the surface of the gland.

Areolar tissue around the gland was divided and the middle and inferior thyroid veins are displayed. Attention was next turned to the superior pole, two ligatures are tied and the vessels are then divided between the ligatures and a further ligature tied on the superior thyroid pedicle before the forceps is released. The inferior thyroid artery was ligated in continuity. The medial surface of the lobe was then separated from the trachea, and attachment to the isthmus which was divided close to the contra lateral lobe. A haemostatic continuous absorbable suture in the isthmus was used to control haemorrhage.

A deep vacuum drain was placed beneath the strap muscles before they are approximated in the Drain group (B) and in the No drain group (A), drains are not placed. Drains in the group B were brought out through a separate site away from the incision site. The platysma muscle was sutured, and finally the skin was closed using subcuticular sutures. Similar steps were performed on the contralateral lobe in case of total thyroidectomy.

And about 3 – 5 grams of thyroid tissue was left in the less effected side of lobe and the remaining gland was removed in case of subtotal thyroidectomy.

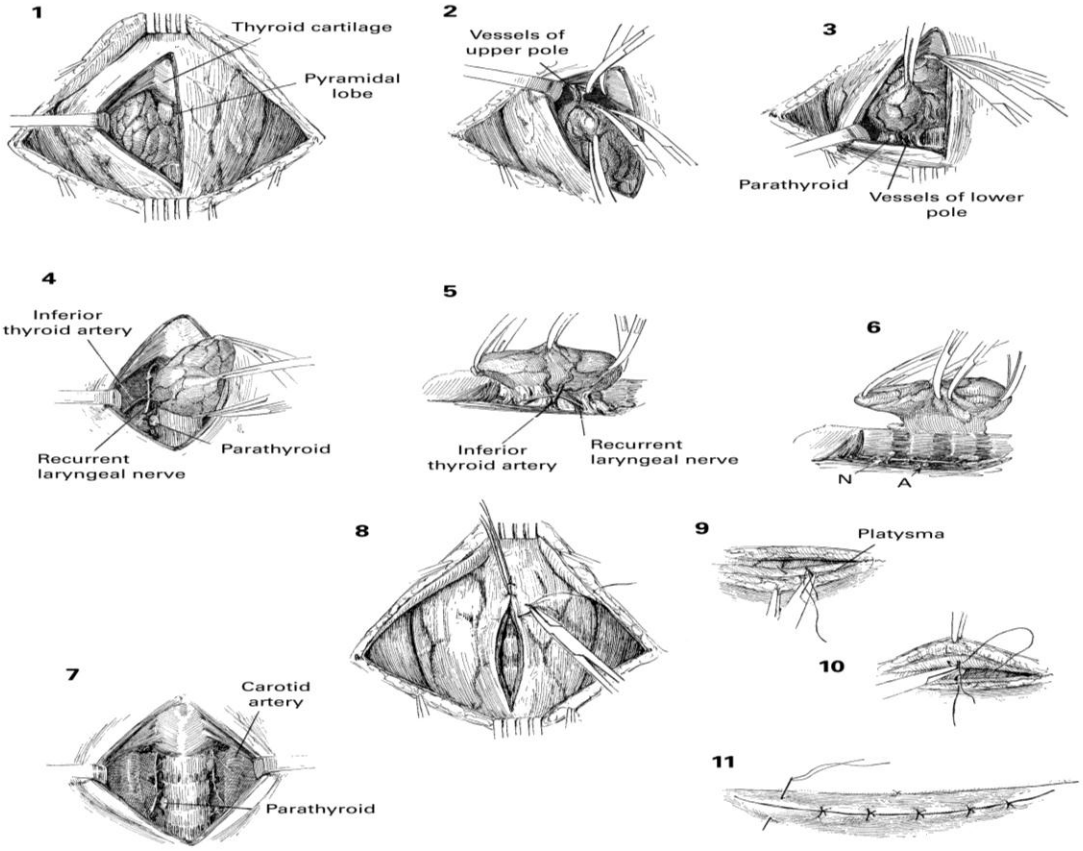


Figure 12: Illustration of left hemi-thyroidectomy.

Figure 13: Patient put on supine position with neck extended.

Figure 14: Skin with platysma flaps

Figure 15: Flaps are retracted with Joll's retractor

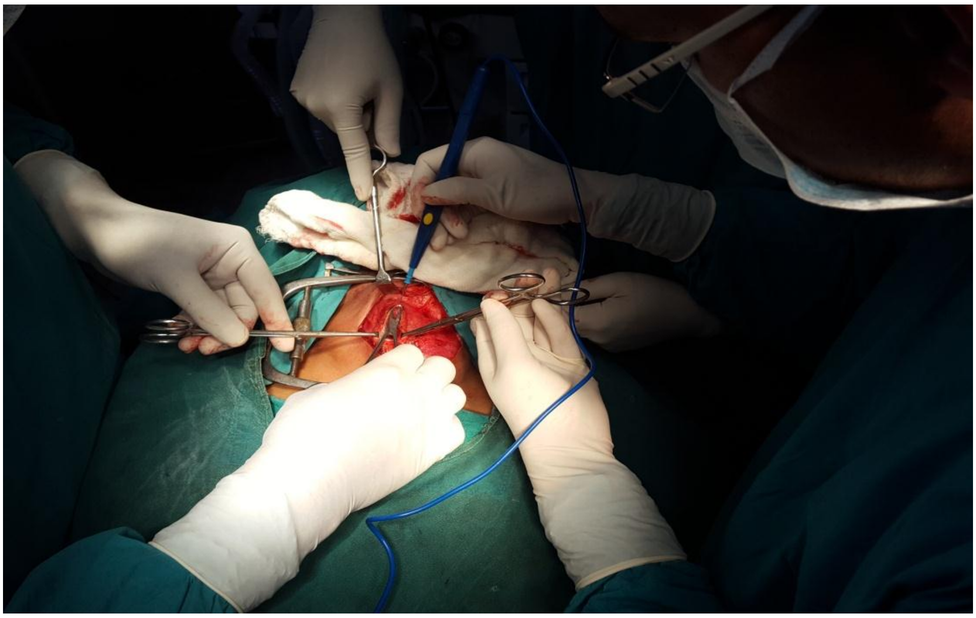


Figure 16: Investing layer of deep cervical fascia is incised vertically

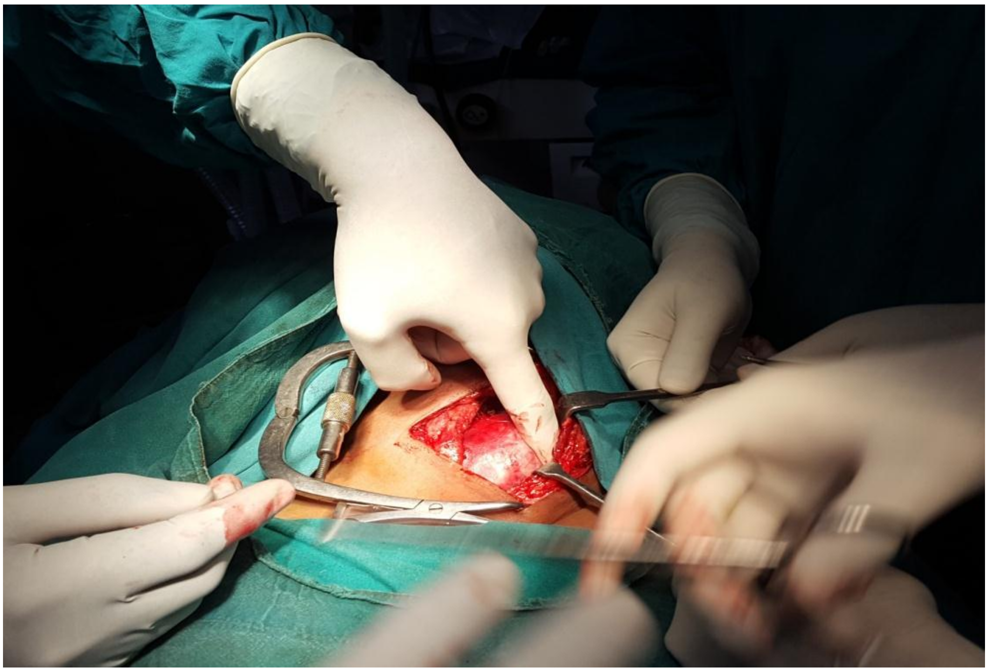


Figure 17: Strap muscles are retracted laterally

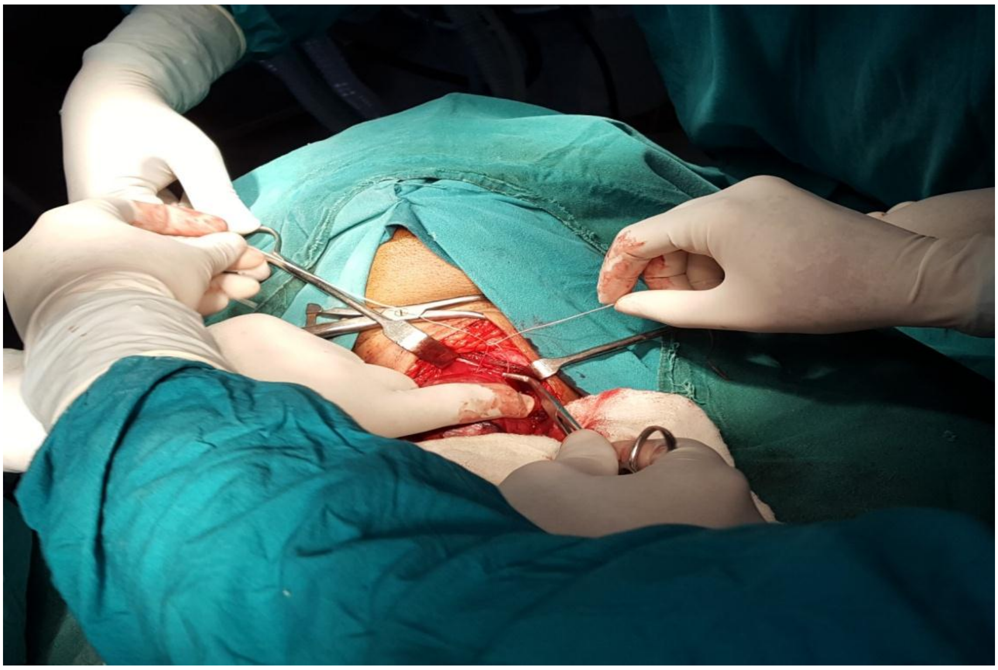


Figure 18: Ligation of superior pedicle

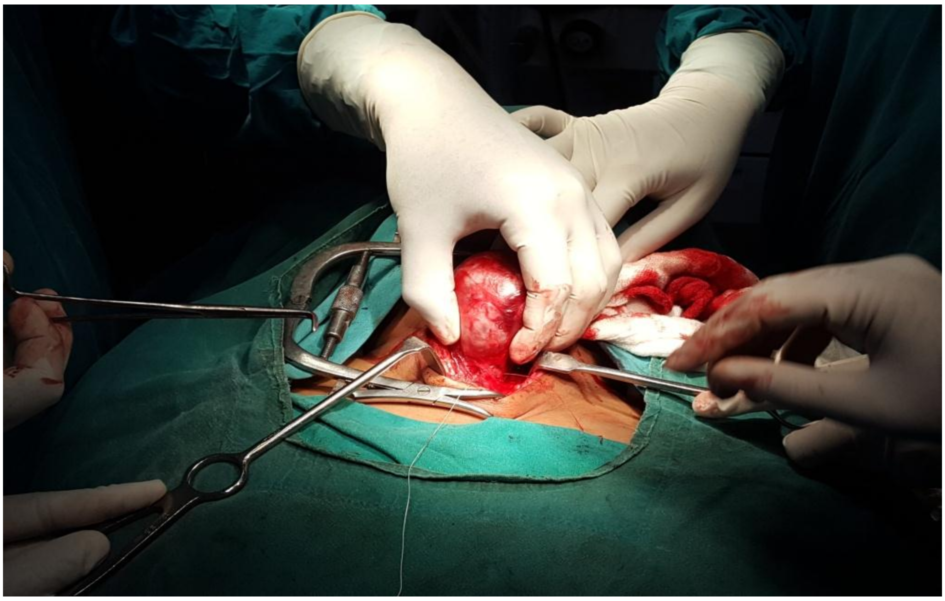


Figure 19: Ligation of inferior pedicle

RESULTS

TABLE 1: DISTRIBUTION OF AGE BETWEEN STUDY GROUPS

AGE(YRS)	DRAIN		NO DRAIN		p value
	N	%	N	%	
15-20	2	6.7	1	3.3	0.327
21-30	10	33.3	8	26.7	
31-40	8	26.7	3	10.0	
41-50	5	16.7	8	26.7	
51-60	3	10.0	8	26.7	
>60	2	6.7	2	6.7	
Total	30	100.0	30	100.0	

The above table shows the distribution of age between the two groups drain and no drain ,2 patients were between 15-20 years in drain group and 1 in no drain group ,10 patients were between 21-30 years in drain group and 8 in no drain group ,8 patients were in between 31-40 years of age group in drain and 3 in no drain group , 5 patients were between 41-50 years in drain and 8 in no drain group ,3 patients were between 51-60 years of age in drain group and 8 in no drain group , 2 patients were above 60 years in drain and 2 in no drain group .

FIGURE 20: DISTRIBUTION OF AGE BETWEEN STUDY GROUPS

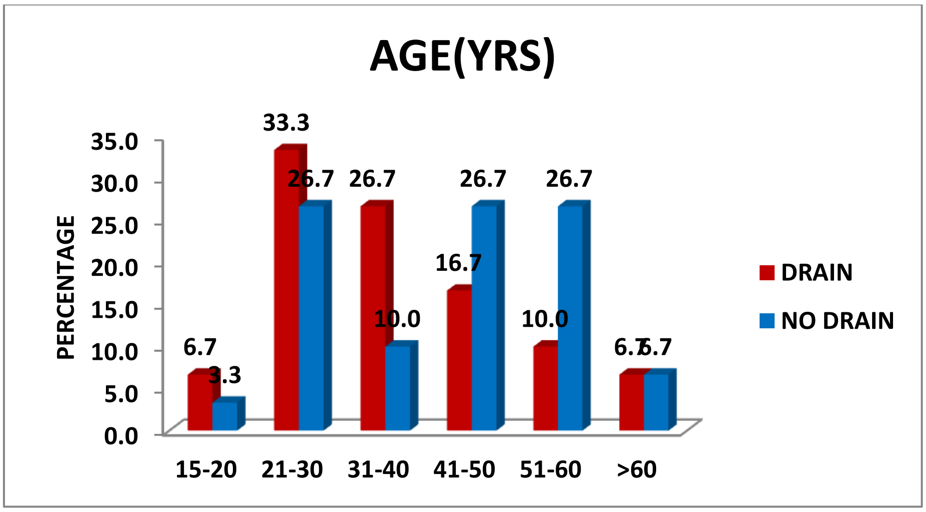


TABLE 2: MEAN AGE BETWEEN STUDY GROUPS

PARAMETERS	DRAIN (B)		NO DRAIN (A)		p value
	Mean	SD	Mean	SD	
AGE	37.6	14.5	43.1	16.0	0.166

The mean age was 37.6± 14.5 years in drain group and 43.1± 16.0 years in no drain group.

FIGURE 21: MEAN AGE BETWEEN STUDY GROUPS

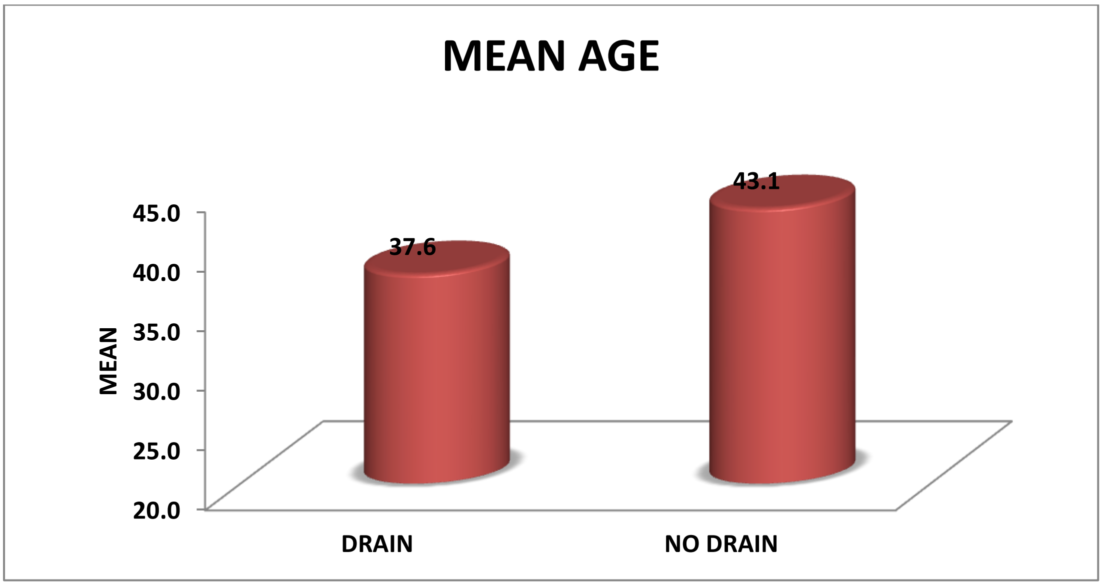


TABLE 3: DISTRIBUTION OF SEX BETWEEN STUDY GROUPS

SEX	DRAIN (B)		NO DRAIN (A)		p value
	N	%	N	%	
Male	4	13.3	5	16.7	0.718
Female	26	86.7	25	83.3	
Total	30	100.0	30	100.0	

Out of 30 patients, 4 were males and 26 were females in drain group.

Out of 30 patients, 5 were males and 25 were females in no drain group.

FIGURE 22: DISTRIBUTION OF SEX BETWEEN STUDY GROUPS

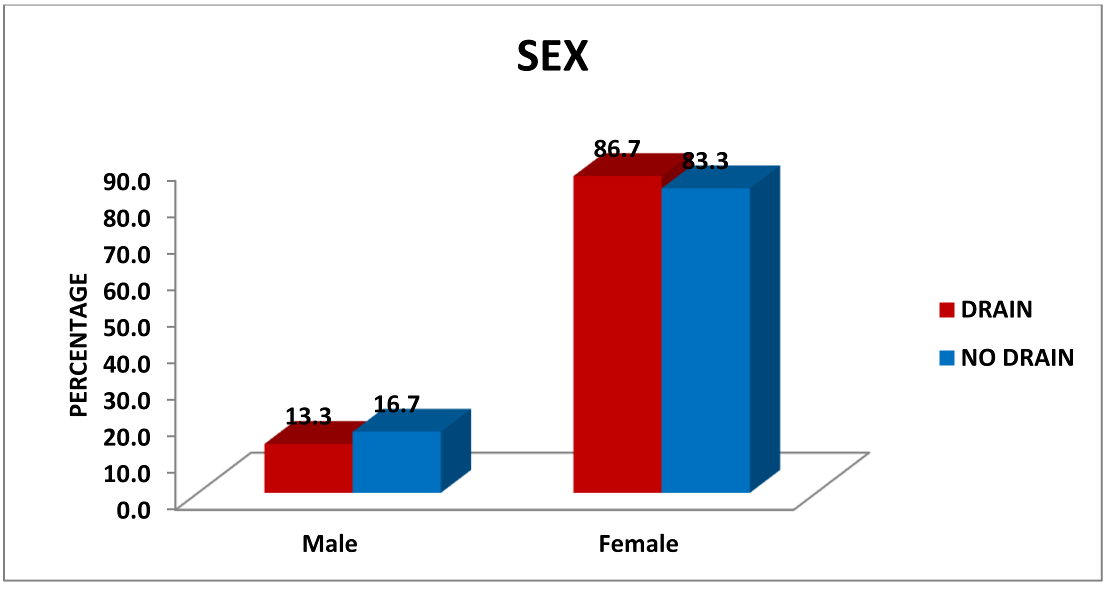


TABLE 4: DIAGNOSIS BETWEEN STUDY GROUPS

DIAGNOSIS	DRAIN (B)		NO DRAIN (A)		p value
	N	%	N	%	
MNG	3	10.0	2	6.7	0.64
STN	27	90.0	28	93.3	
Total	30	100.0	30	100.0	

MNG - Multi Nodular Goiter

STN – Solitary Thyroid Nodule

Out of 30 patients in drain group, 3 were diagnosed as MNG and 27 were STN.

Out of 30 patients in no drain group 2 were MNG and 28 were STN.

FIGURE 23: DIAGNOSIS BETWEEN STUDY GROUPS:

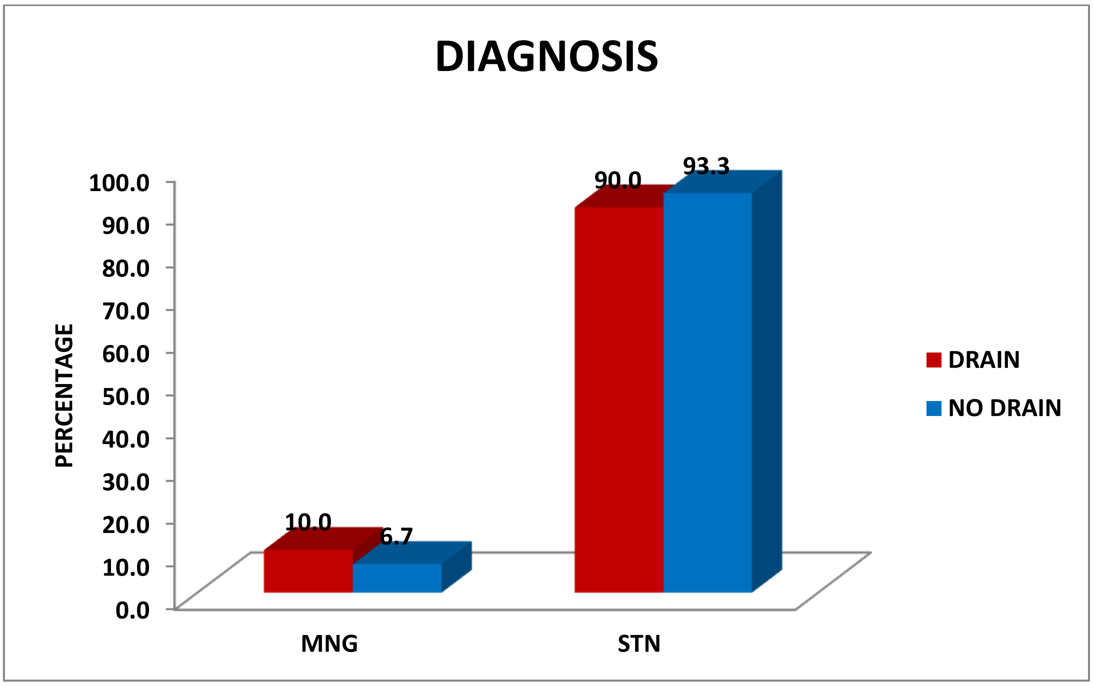


TABLE 5: TYPE OF THYROIDECTOMY BETWEEN STUDY GROUPS

TYPE OF THYROIDECTOMY	DRAIN (B)		NO DRAIN (A)		p value
	N	%	N	%	
HEMITHYROIDECTOMY	21	70.0	23	76.7	0.58
SUB-TOTAL THYROIDECTOMY	3	10.0	1	3.3	
TOTAL THYROIDECTOMY	6	20.0	6	20.0	
Total	30	100.0	30	100.0	

In drain group of 30 patients, 21 underwent hemi thyroidectomy, 3 underwent sub-total thyroidectomy, 6 underwent total thyroidectomy.

In no drain group of 30 patients, 23 underwent hemi thyroidectomy, 1 underwent sub-total thyroidectomy, 6 underwent total thyroidectomy.

FIGURE 24: TYPE OF THYROIDECTOMY BETWEEN STUDY GROUPS

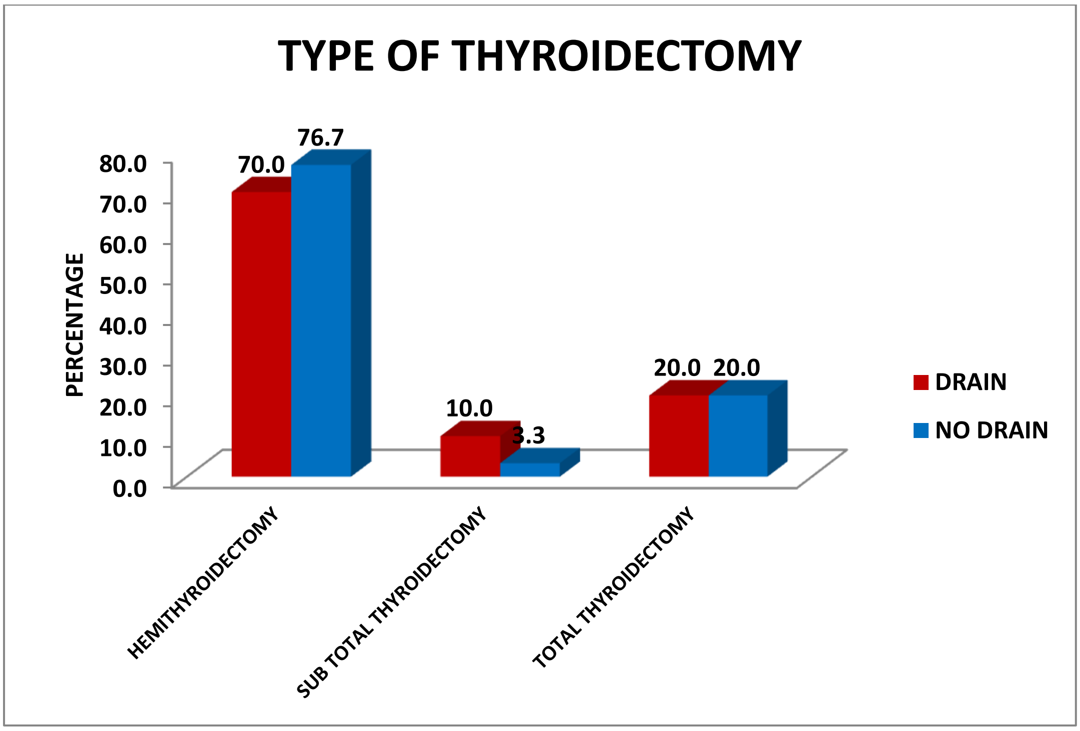


TABLE 6: COMPLICATIONS BETWEEN STUDY GROUPS

COMPLICATIONS	DRAIN (B)		NO DRAIN (A)		p value
	N	%	N	%	
HYPOCALCEMIA	3	10.0	1	3.3	0.365
NO COMPLICATIONS	27	90.0	28	93.3	
SEROMA	0	0.0	1	3.3	
Total	30	100.0	30	100.0	

Out of 30 patients in drain group, 3 had hypocalcemia, 27 didn't have any complications.

Out of 30 patients in no drain group, 1 had hypocalcemia, 28 didn't have any complications and seroma was noted in 1 patient.

FIGURE 25: COMPLICATIONS BETWEEN STUDY GROUPS

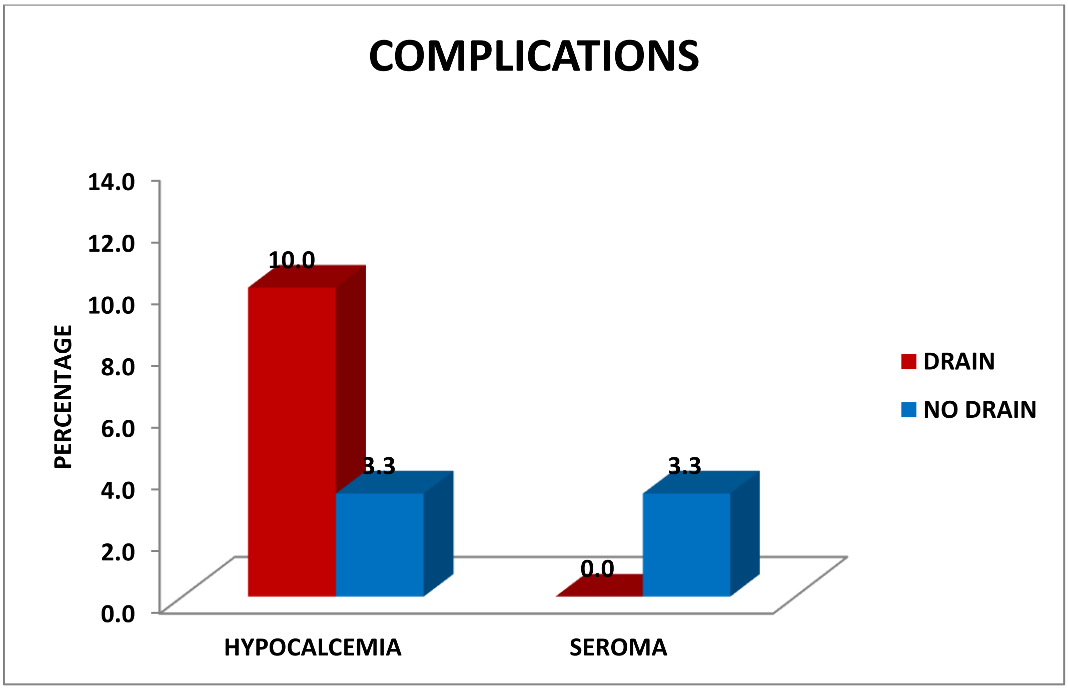


TABLE 7: MEAN PARAMETERS BETWEEN STUDY GROUPS

PARAMETERS	DRAIN (B)		NO DRAIN (A)		p value
	Mean	SD	Mean	SD	
DURATION OF SWELLING (YRS)	1.1	0.9	1.9	1.0	0.003*
OPERATING TIME (MINS)	91.8	11.3	93.5	14.3	0.619

Note: * significant at 5% level of significance ($p<0.05$)

The mean duration of swelling was 1.1 ±0.9 years in group B and 1.9 ±1.0 years in group A.

The mean duration of operating time was 91.8 ±11.3 minutes in the drain group (B) and 93.5± 14.3 minutes in the no drain group (A).

FIGURE 26: MEAN PARAMETERS BETWEEN STUDY GROUPS

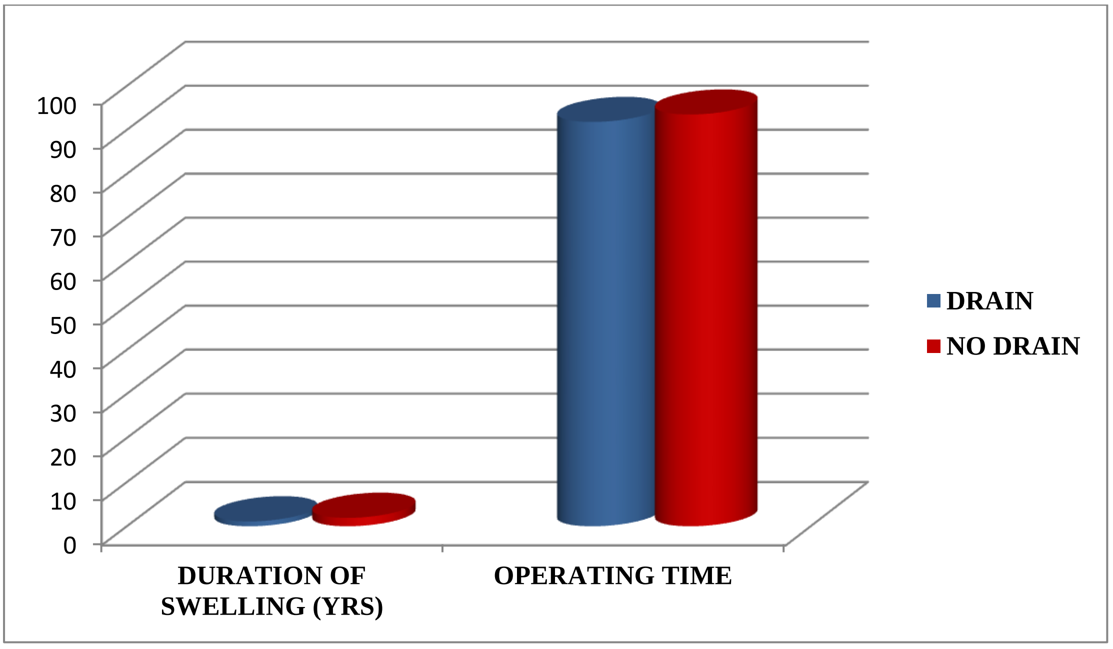


TABLE 8: POST OPERATIVE PAIN SCORE BY VAS BETWEEN STUDY GROUPS:

POST OPERATIVE PAIN SCORE BY VAS	DRAIN (B)		NO DRAIN (A)		p value
	Mean	SD	Mean	SD	
DAY 0	5.2	0.6	4.9	0.6	0.074
DAY 1	5.8	0.6	5.6	0.5	0.112
DAY 2	4.4	0.6	3.9	0.4	<0.001*
DAY 3	2.9	0.6	2.7	0.9	0.317
DAY 4	1.9	0.4	2.0	0.2	0.185
DAY 5	0.9	1.0	0.6	0.9	0.228

Note: * significant at 5% level of significance (p<0.05)

The above table shows the mean values from day 0 to day 5. p value in day 2 was 0.001 which was statistically significant .

VAS- VISUAL ANALOGUE SCALE

FIGURE 27: POST OPERATIVE PAIN SCORE BY VAS BETWEEN STUDY GROUPS

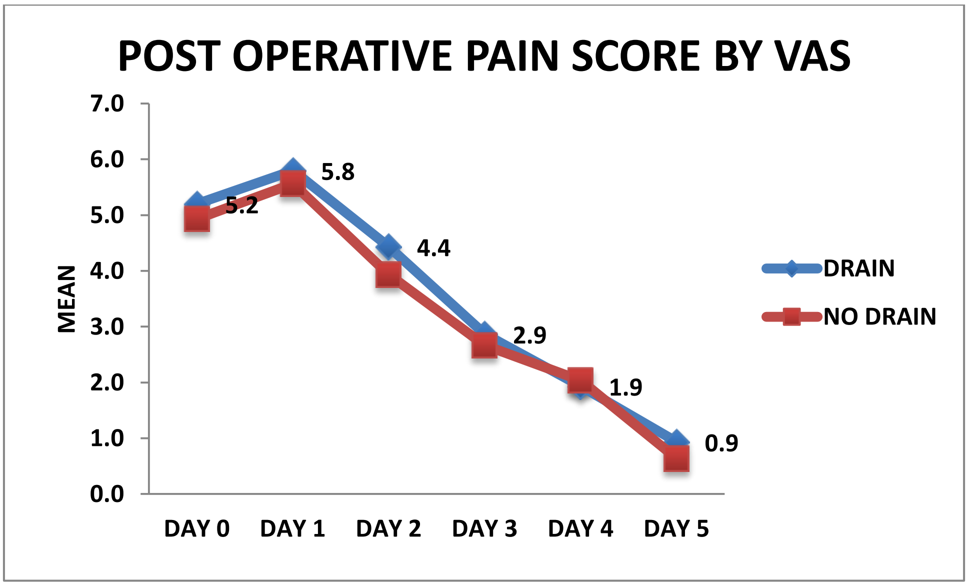


TABLE 9: AMOUNT OF FLUID DRAINED BETWEEN STUDY GROUPS

AMOUNT OF FLUID DRAINED IN ML	DRAIN (B)	
	Mean	SD
FIRST 6 HOURS	23.7	9.6
DAY 1	43.3	12.5
DAY 2	28.3	10.4
DAY 3	18.8	9.8
DAY 4	25.0	14.7
DAY 5	17.5	3.5

The mean ± sd of the amount of fluid drained(ml) in first 6 hours is 23±9.6 , day 1 is 43.3±12.5, day 2 is 28.3±10.4, day 3 was 18.8±9.8.

In 26 patients, drains were removed on day3, when the amount of fluid drained is less than 20ml.

In 4 patients, drain was kept till day 4 and the mean on day 4 was 25.0±14.7.

In 2 patients, drain was kept till day 5, and the mean on day 5 was 17.5± 3.5.

FIGURE 28: AMOUNT OF FLUID DRAINED BETWEEN STUDY GROUPS

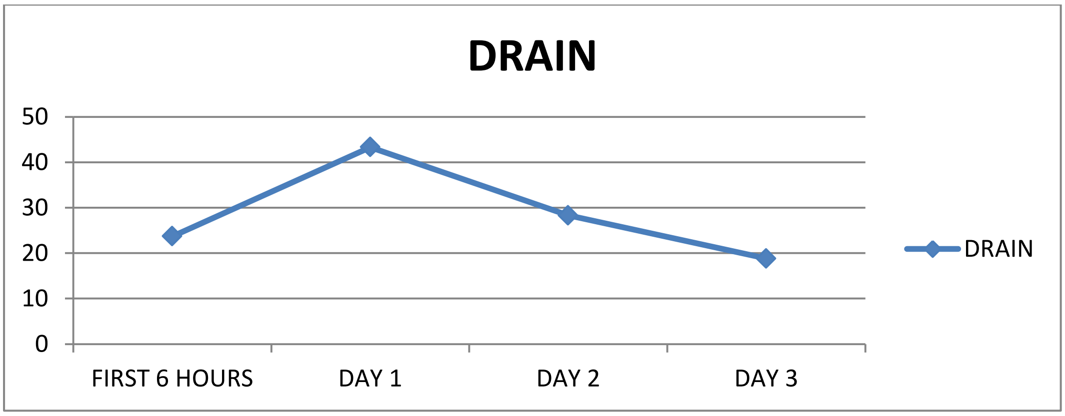


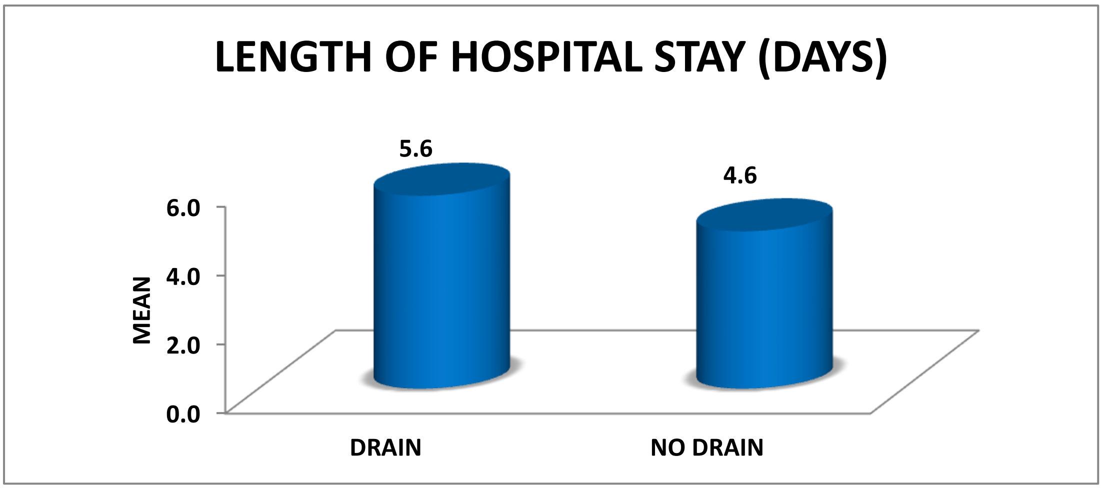
TABLE 10: MEAN LENGTH OF HOSPITAL STAY BETWEEN STUDY GROUPS

PARAMETERS	DRAIN		NO DRAIN		p value
	Mean	SD	Mean	SD	
LENGTH OF HOSPITAL STAY	5.6	1.4	4.6	0.7	0.001*

Note: * significant at 5% level of significance (p<0.05)

The length of hospital stay was 5.6±1.4 in drain and 4.6±0.7 in no drain group. p value was o.oo1 which was statistically significant .

FIGURE 29: MEAN LENGTH OF HOSPITAL STAY BETWEEN STUDY GROUPS



DISCUSSION

In this study a total of 60 patients underwent thyroid surgery, of which drains were placed in 30 patients and in 30 patients drains no were placed.

Age group

In our study, 33.3% patients in whom drain was placed were in the age group of 21 to 30 years, followed by 26.7 % patients in the age group of 31 to 40 years. In the no drain group, 26.7 % patients were present in each of the three age groups: 21 to 30 years, 41 to 50 years and 51 to 60 years. The probability of patients to be in any particular age group is not statistically significant (p=0.327).

Daou reported the age range to be 16 to 72 years in his study of 150 consecutive patients undergoing thyroidectomy without drains(26).

Mean age

In our study, the mean age in the drain group was 37.6 years and in the no drain group was 43.1 years. The probablity of patients in either drain or no drain group to be of particular age is not statistically significant (p= 0.166). Several other studies have also reported similar results (36, 42, 48).

Ahluwalia et al reported that in their study, patients in each group exhibited a mean age of 49 years (38).

Gender

In our study, 86.7% patients in the drain group were females, while in the no drain group this percentage was 83.3 %. The probability of patients in either drain or no drain group to be of particular gender is not statistically significant (p= 0.718). Our results are in line with the results obtained in several other studies [36,48].

Daou et al. reported a sex ratio of 126 F/124M in 150 consecutive patients in no drain group(26). Ahluwalia et al. reported a male to female ratio of 1 : 9 in both the groups(38). In a study by Musa et al. the sixty seven patients recruited for the study were made up of 60 females (89.6%) and 7 males (10.4%)[42].

Diagnosis

In the drain group, 90 % patients were operated for STN and 10% for MNG. In the no drain group, 93.3 % patients had STN and 6.7 % had MNG. The probability of patients in either drain or no drain group to have a particular diagnosis is not statistically significant (p= 0.64).

Similar to our study, in a study by Debry, Renou and Fingerhut (1999) (30) a series of 100 consecutive unselected patients undergoing all types of thyroid surgery--including even those inducing large dead space e.g. substernal goitre and carcinoma thyroid with recurrent nerve dissection--were randomly allotted to either receive drainage (n = 43) or not (n = 57) and there was no statistically significant difference with regard to the indication and drain or no drain group.

In Daou’s study on 150 patients without drainage, the indication for surgery was: solitary nodule (16), multinodulargoiter (56), Graves' disease (21), toxic nodular goiter (34), cancer (8), retrosternal goiter (13), thyroiditis (2) [26]. Defechereux’s retrospective study of 1789 thyroidectomies included toxic goiters, large plunging compressive goiters, bilateral and redo procedures in both the drain as well as non drain groups[27].

Type of thyroidectomy: In our study, 70 % patients in the drain group and 76.7% patients in the no drain group underwent hemi-thyroidectomy. 10 % of the patients in the drain group and 3.3 % of the patients in non drain group underwent subtotal thyroidectomy. 20 % patients in both the groups underwent total thyroidectomy. There was no statistically significant difference with regard to the type of thyroidectomy and drain or no drain group (p=0.58).

Our finding corroborated with Lee et al. who reported that drain group (n = 101) consisted of 41 hemithyroidectomies (HT), 28 total thyroidectomies (TT), and 32 total TT with CND while No-drain group (n = 97) consisted of 42 HT, 18 TT, and 37 TT with CND(36). But there was no significant difference between the groups with regards to type of operation. A similar result was obtained by Wihlborg et al[20].

Daou reported that out of 150 consecutive patients who underwent thyroidectomy without drainage, 15 underwent total lobectomy + isthmusectomy, 42 patients underwent total lobectomy + subtotal controlateral thyroidectomy, 84 patients underwent bilateral subtotal thyroidectomy, and 9 patients underwent total thyroidectomy[26].

Complications

90 % patients in the drain group (B) had no complications as compared to 93.3 % patients who had no complications in the group A. 10 % patients in the drain group had hypocalcemia, while only 3.3 % had hypocalcemia in the no drain group. Not a

single person reported seroma in the drain group, while 3.3 % patients reported seroma in the no drain group. There was no statistically significant difference with regard to the complications and drain or no drain group (p=0.365).

Our results are in line with several other studies reported in literature. Kristoffersson, Sandzen and Jarhult reported that complications were few in either group and the rate of subjective discomfort from the collar incision was equally low in both groups[19].

Wihlborg , Bergljung and Martensson also reported complications like reoperation due to bleeding (2/150), permanent nerve palsies (2/150), permanent hypocalcemia (1/150), minor hematomas (10/150), wound infection (1/150) and lymphatic leakage (1/150) but no difference was seen between the drain and no drain group[20].

Ayyash et al reported seroma in 7/50 patients in the no drain group and 2/50 patients in the drain group[21]. However, the study did not provide any statistical report for routine use of drains. Of the 259 cases of non-drainage in thyroid surgery reported by Ariyanayagam et al, there was one thyroid storm and two cases of subcutaneous fluid collection, treated by needle aspiration but no cases of recurrent laryngeal nerve injury, airway obstruction or death were recorded[22].

Wax et al reported a major complication of hematoma requiring re exploration in 1/41 patients and a recurrent nerve palsy in 1/41 patient and minor complications of temporary hypocalcemia (three),seroma (one), and superior flap edema that resolved in 3 months[24]. Shaha and Jaffe also reported that drains had very little effect on the prevention of post operative hematoma or of a seroma[23]. Karayacin et al reported reoperation for bleeding in 12/520 patients in drain group and 2/537 patients in no-drain group($p<0.05$) whereas wound infection was observed in 7/520 patients in the drain group and 0/537 patients in no drain group ($p<0.05$)[25]. In Daou's study of 150 consecutive patients who underwent thyroidectomy without drainage there was no mortality, no suffocating hematoma, no reoperation and no laryngeal nerve paralysis. One patient developed a transient hypocalcemia that regressed one month later. Two patients developed a minor hematoma of which one disappeared after two weeks and the other drained spontaneously through the surgical incision on the seventh postoperative day (26). In Defechereux's retrospective study of 1789 thyroidectomies, severe life-threatening hematoma requiring re-exploration occurred in 0.9% drained patients vs. 0.4% in undrained patients. Minor postoperative wound hematoma were conservatively treated in 2.9% drained patients vs. 1.3 % undrained patients[27]. Debry, Renou and Fingerhut did not report any complications such as haematoma or seroma in the undrained group whereas only minor complications such as haematoma (n = 4/43) were noted in the drained group but none of the patients required re-exploration[30].

In the analysis of experience of Ardito et al with 1217 thyroidectomies with prophylactic routine drainage, 1.06% patients developed benign hematoma with spontaneous remission and in 0.50% patients bleeding was severe and compressive hematoma occurred which required surgical re-exploration, leading to the conclusion that when life-threatening hematomas did occur, which was seldom with experienced surgeons, they depended on various uncontrolled factors and drainage was often not helpful [31].

Pezzullo et al. also reported that there was no difference between the drain and no drain groups in terms of early or late postoperative complications [32]. Dimov et al reported that there were no hematoma or seroma in patients without drains and in the drain group two (2/43) of them were re-operated because of drain insertion into the operative wound in post op[33]. Khanna et al. reported that 1/47 patient in the drain group required needle aspiration for collection in thyroid bed but no patient in either group required re-operation for bleeding or haematoma[2].

Lee et al. reported no significant difference in overall perioperative complications between the drain and no-drain groups, even in cases of performing CND[36]. Herranz and Lattore also reported no differences between groups in terms of the presence of infections, seromas, or haemorrhage [37]. Ahluwalia et al reported that the difference in complication rates between drain and no drain groups was not statistically significant[38]. In a study by Colak et al, one case of hematoma, two cases of seroma and three cases of transient hypoparathyroidism occurred in the non-drained group (n=58), whereas one case of hematoma, two cases of seroma, two cases of wound infections and two cases of transient hypoparathyroidism occurred in the drained group(n=58), pointing to the fact that postoperative complications cannot be prevented by using drains after thyroidectomy[39]. In a retrospective review of no drain thyroidectomy of 104 patients, Prichard et al observed that cervical haematoma did not develop in any patient and no patient required re-operation[41].

Abboud et al reported that 5% patients developed postoperative hematoma and /or seroma, 23% patients had transient postoperative hypocalcemia, 1% had permanent hypothyroidism, 6% had transient postoperative hoarseness and 0.6% had permanent vocal cord paralysis in cervical neck dissection and thyroidectomy without drains[43]. Neary et al reported that there were four versus one wound infections in the drain versus no-drain groups but this finding was not statistically significant (P=0.154)(44). Abboud et al [45] reported that there was no significant difference between the groups in overall perioperative complications. Qian et al reported that there were no significant differences in postoperative complications, including permanent hoarseness and hypoparathyroidism, between two groups[46]. Several meta-analysis' have also reported that use of drain after thyroid surgery does not decrease reoperation rate or hematoma and seroma formation.

Contrary to our findings, a few studies have reported that complications are significantly lower in the no drain group. Ozlem et al reported the rates of re-operations due to life-threatening postoperative hemorrhage and wound infections were higher in the drained group [35]. Schietroma et al reported that hematomas, seromas, wound infections, transient biochemical hypoparathyroidism, and transient damage of the recurrent laryngeal nerve occurred more frequently in the drained group than in the non-drained group[50]. Tabaqchali, Hanson and Praoud reported a significant increase in the rate of postoperative bleeding/haematoma in patients with a drain (8/314 versus 1/282, Fisher's exact, $P < 0.05$). Also, wound infection occurred only in the patients with a drain. But there was no difference in the incidence of airways obstruction between the drain and selective drain groups [29].

Mean duration of swelling

In our study, the mean duration of swelling in the drain group is significantly lower than in the no drain group (1.1 ± 0.9 vs. 1.9 ± 1.0, $p=0.003$).

Operation time

In our study, the difference in operation time between drain and no drain groups was not statistically significant ($p=0.619$).

A similar result was reported by several studies [20,36,39,46].

Mean post operative VAS pain score

In our study, the mean VAS pain scores at post operative day 2 was significantly lower in the no drain group as compared to the drain group (3.9 ± 0.4 vs. 4.4 ± 0.6, p=0.001). Our findings corroborate with several other studies. Colak et al reported the mean VAS score to be significantly low in the non-drained group patients in postoperative day (POD) 0 and POD 1 and the mean amount of intramuscular analgesic requirement was significantly less in the non-drained group [(39)]. Qian et al also reported that the mean VAS scores of neck comfort on POD0 and POD1 in drainage group were significantly high than those in non-drainage group(t = 2.67, P = 0.03 and t = 0.33, P = 0.006) (46). Nawaz, Naeem and Zeb also reported that the mean postoperative pain score 24 hours after surgery was 60.87± 7.06 SD in the drain group and 41.19± 4.18 SD in no drain group (p value < 0.05) [(48)]. Afzal, Ahmad and Naqi reported mean pain score of no- drain group (2.13±0.34) was significantly lower than that of the drain group (2.63±0.49) [(49)]. Schietroma et al reported that the postoperative pain scores were significantly lower in the non-drained group than in the drained group of patients at postoperative days 0 and at 1 [(50)]. Several Meta analyses have also reported that use of drain after thyroid surgery increased postoperative pain.

Contrary to our findings, Neary et al reported that the VAS score and analgesic requirement were not significantly different among the groups [(44)].

Drain fluid

In our study, the mean amount of fluid drained in ml in the drain group in the first 6 hours, day 1, day 2, day 3, day 4 and day 5 was 23.7±9.6, 43.3± 12.5, 28.3 ±10.4, 18.8

± 9.8 , 25.0 ±14.7 and 17.5 ± 3.5 respectively. Most of the drains were removed on the 3rd day. If the drain volume was more than 20 ml, they were retained till 4th or 5th day till the drain volume dropped to 20ml. In 26 patients drains were removed on 3rd day.

Khanna et al reported that there was no significant difference in collection of thyroid bed assessed by USG on D1 & D7 in the drain and non drain groups (p = 0.313) [(34)]. Musa et al reported that in their study, the highest volume of drainage of 35ml was from a woman with a big goiter (120g) and the average drainage was 17.7 +/- 6.9ml [(42)]. Neary et al observed that neck ultrasound revealed that there was significantly less mean fluid accumulated in the drain group on both day 1, 16.4 versus 25.1 ml (P-value=0.005), and day 2, 18.4 versus 25.7 ml (P-value=0.026), following surgery, but in the non-emergent setting there was no clinical benefit associated with it [(44)].

Length of hospital stay

In our study, the mean length of hospital stay in the no drain group was found to be significantly lower as compared to the drain group (4.6 ± 0.7 vs 5.6 ± 1.4, p=0.001).

Similar results were reported in a few other studies. Khanna et al observed that the hospital stay was significantly reduced in the non-drain group (p = 0.007) [(34)]. Ozlem et al. also observed that the average postoperative hospital stay of the drained group was significantly longer than that of the non-drained group(35). Lee et al. reported that the time of hospital discharge after operation was significantly shorter in the no-drain group than the drain group (P < .05) [(36]). Herranz and Lattore also reported that the mean hospital stay was longer in patients with drains than in patients without drains (1.8 days vs. 1.2 days) [(37)]. Ahluwalia et al reported modal and median length of hospital stay to be 2 and 2 days respectively (range 2-3 days) in no drain group and 3 and 3 days (range 2-4 days) in drain group , and this difference was statistically significant (P = 0.0006) [38]. Colak et al reported the mean hospital stay to be significantly shorter and the satisfaction of patients was superior in the non-drained group (39). Morrissey et al. reported a 1.12-day reduction in hospital stay (p < .01), with no increase in postoperative complications which translated into a cost savings of $ 2177 per patient [40]. Abboud et al. reported that the postoperative stay for all groups of cervical neck dissection and thyroidectomy without drains was 1 day in 91 per cent of the cases [43]. Qian et al reported that the mean postoperative hospital stay time of non-drainage group (1.9 ± 0.3) was significantly shorter than that of drainage group (2.6 ± 0.6) d (t = 1.45, P = 0.02) (46). Nawaz, Naeem and Zeb reported that the mean duration of hospital stay was 3.63 days ± 0.707 SD in drain group and 1.19 days ± 2.145 SD in no drain group (p value<0.05) [48]. Afzal, Ahmad and Naqi reported mean hospital stay of no- drain group (1.27±0.19 days) was significantly lower than that of the drain group (1.85±0.59) [49]. Schietroma et al. reported that the mean hospital stay was significantly shorter in the non-drained group than in the drained group [50]. Several Meta analyses have also reported that use of drain after thyroid surgery increased the length of stay in the hospital.

In Daou’s study of 150 thyroidectomy patients without drainage, the patients left the hospital on the first or second postoperative day [26]. In Ardito et al’s experience with 1271 thyroidectomies with drainage, they never observed wound infections and patients were discharged within 72 hours [31].

However, some studies have reported that there is no difference between the two groups according to length of hospital stay. [20,30,33,44,45].

CONCLUSION

In our study, the mean VAS pain score on post operative day 2 was significantly lower in the no drain group as compared to the drain group ($p<0.001$).

In our study, the mean length of stay in the hospital was significantly lower in the no drain group as compared to the drain group ($p=0.001$).

A lower pain score accompanied by a lower length of hospital stay considerably reduces the requirement of analgesics and hospital costs. Elimination of drains also improves the cosmosis of the operative site.

We may conclude that adequate surgical technique and meticulous haemostasis are the key factors for avoiding haemorrhage and haematoma formation.

Drains may be used only for extensive dead space, intrathoracic or retrosternal goiters, and in cases of excessive tissue manipulation or wet operative field. The limitation of wound infection associated with drain insertion can thereby be eliminated.

SUMMARY

Thyroid surgery is most common surgical procedure practised by both Otolaryngologists and General Surgeons alike with a lot of precision and care to avoid the cause of morbidity and mortality, as this highly vascular area is most crucial for dissection. Though the incidence of post operative haemorrhage/neck hematoma is very less (0.3-1%), even a minor haemorrhage can result in serious complications which could be life-threatening such as venous oedema of the airway, which necessiates emergency decompression, which would otherwise lead to fatal consequences. Hence, it has been common practice in some hospitals to drain wounds routinely after thyroid surgery, but the question of routine wound drainage of thyroid bed after surgery remains controversial.

Placement of drain increases the operating time by 5 to 10 minutes and also leaves an extra scar at the drain site which might not acceptable due to cosmetic reasons. It also increases the length of the stay at the hospital and even increases the rate of wound site infections especially drain site.

In this study, we allocated 30 patients each to the drain and no-drain group for subjects undergoing thyroidectomy and the efficacy of placement of drains was evaluated.

We found that the mean VAS pain score on post operative day 2 was significantly lower in the no drain group as compared to the drain group ($p<0.001$). Also, the mean length of stay in the hospital was significantly lower in the no drain group as compared to the drain group (p=0.001). A lower pain score accompanied by a lower length of hospital stay considerably reduces the requirement of analgesics and hospital costs. Elimination of drains also improves the cosmosis of the operative site. We conclude that with meticulous dissection and proper haemostasis during the surgical procedure, most of the post operative complications can be prevented.

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ANNEXURES

ETHICAL CLEARANCE CERTIFICATE

B.L.D.E. UNIVERSITY'S

SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103

INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 04-10-2016 *at* 02-pm *to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.*

Title "Role of drains in thyroid surgeries"

Name of P.G. student Dr. Kothuri Srickaran Raj
Dept of Surgery

Name of Guide/Co-investigator Dr Aravind .V. Patil
Prof of Surgery

DR.TEJASWINI. VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization
1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

SAMPLE INFORMED CONSENT FORM

TITLE OF THE PROJECT	:	**ROLE OF DRAINS IN THYROID SURGERIES.**
PG GUIDE	:	**DR. ARAVIND V PATIL** M.S. (GENERAL SURGERY) PROFESSOR OF SURGERY DEPARTMENT OF GENERAL SURGERY
PRINCIPAL INVESTIGATOR	:	**DR. KOTHURI SRICHARAN RAJ**

PURPOSE OF RESEARCH:

I have been informed that this study is conducted to compare the efficacy of thyroid surgeries without placement of drains and with the placement of drains.

PROCEDURE:

I am aware that in addition to routine care received I will be asked series of questions by the investigator. I have been asked to undergo the necessary investigations and treatment, which will help the investigator in this study.

Patients who met the inclusion criteria were randomly assigned a study group (Group A) or control group (Group B).

RISK AND DISCOMFORTS:

I understand that I may experience some pain and discomforts during the examination or during my treatment. This is mainly the result of my condition and the procedures of this study are not expected to exaggerate these feelings which are associated with the usual course of treatment.

BENEFITS:

I understand that my participation in the study will help to predict to evaluate the efficacy of placement of drains in the thyroid surgeries and to compare it without placing drains.

CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of hospital records and will be subject to the confidentiality. Information of sensitive personal nature will not be part of the medical record, but will be stored in the investigations research file.

If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs will be used only with special written permission. I understand that I may see the photograph before giving the permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study to **Dr. Kothuri Sricharan Raj** in the Department of General Surgery who will be available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation. A copy of this consent form will be given to me to keep for careful reading.

REFUSAL FOR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice. I also understand that **Dr. Kothuri Sricharan Raj** may terminate my participation in the study after he has explained the reasons for doing so.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study, if such injury were reported promptly, the appropriate treatment would be available to me. But, no further compensation would be provided by the hospital. I understand that by my agreements to participate in this study and not waiving any of my legal rights.

I have explained to ____the purpose of the research, the procedures required and the possible risks to the best of my ability.

______________________ ______________________

Dr. Kothuri Sricharan Raj Date
(Investigator)

STUDY SUBJECT CONSENT STATEMENT:

I confirm that **Dr. Kothuri Sricharan Raj** has explained to me the purpose of research, the study procedure, that I will undergo and the possible discomforts as well as benefits that I may experience in my own language. I have been explained all the above in detail in my own language and I understand the same. Therefore I agree to give consent to participate as a subject in this research project.

______________________________	______________________________
(Participant)	Date
______________________________	______________________________
(Witness to signature)	Date

PROFORMA

SL NO

Name

Age	IP NO
Sex	UNIT
Religion	DOA
Occupation	DOD

Address:

Mobile No:

Associated Co-morbidities (if any):

CHIEF COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

PERSONAL HISTORY:

GENERAL PHYSICAL EXAMINATION:

Built: Well/Moderate/Poor

Nourishment: Well/Moderate/Poor

Temperature:	Pulse:
B.P:	Respiratory Rate:

Eye signs:

LOCAL EXAMINATION:

SYSTEMIC EXAMINATION:

Per Abdomen

Respiratory System

Cardio Vascular System

Central Nervous System

PROVISIONAL DIAGNOSIS:

LABORATORY TESTS

Haemoglobin% :

Total Count :

Platelets :

Differential Count

Neutrophil :

Lymphocytes :

Eosinophils :

Basophils :

Monocytes :

Blood Urea :

Serum Creatinine :

Thyroid profile :

$T_{3:}$ Sr.Ca^{++}:

$T_{4:}$

TSH:

HIV :

HBsAg :

HCV :

BT/ CT :

Electro Cardiogram :

Chest X-ray :

-(as and when necessary)

OTHERS :

- X-Ray Neck:
- USG Neck:
- FNAC:
-

DIAGNOSIS:

OPERATIVE AND POST-OPERATIVE OUTCOMES:

Type of thyroidectomy:

Operating time:

Peri Operative complications:

Post Operative bleeding:

Post Operative pain assessed by Visual Analogue Scale (VAS)

- Post Operative day 0:
- Post Operative day 1:
- Post Operative day 2:
- Post Operative day 3:
- Post Operative day 4:
- Post Operative day 5:

Post Operative Indirect Laryngoscopy:

Post Operative respiratory distress:

Post Operative hypocalcaemia:

Placement of drain:

Amount of fluid drained: (Group B patients only)

- first 6 hours after operation:
- post operative day 1:
- post operative day 2:
- post operative day 3:
- post operative day 4:
- post operative day 5:

Wound infections:

Length of hospital stay:

Need for reoperation:

Change in voice:

Tingling sensations/carpopedal spasm:

Presence of local complications:

- Haematoma:
- Haemorrhage:
- Seroma:

Histopathology Report: