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EDITORIAL

Editorial: "Ten Commandments" of Safe and Optimum Thyroid Surgery

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> The extirpation of the thyroid gland ... typifies, perhaps better than any operation, the supreme triumph of the surgeon's art.... A feat which today can be accomplished by any competent operator without danger of mishap and which was conceived more than one thousand years ago.... There are operations today more delicate and perhaps more difficult.... But is there any operative problem propounded so long ago and attacked by so many ... which has yielded results as bountiful and so adequate? [1]
> Dr. William S. Halsted, 1920

This statement of Halstead highlights the importance of thyroid surgery where the science and art of surgery is tested to the hilt. This surgery while being performed by almost any general surgeon, deserves and requires a special interest in the field. A detailed knowledge of the surgical anatomy and physiology of this region is mandatory before one embarks on this journey.

History and Evolution of Thyroid Surgery

The recorded history of thyroid surgery is as old as Billroth, Kocher and Halsted. They were responsible for development of the technique for thyroidectomy between 1873 and 1910. To be more precise, the modern thyroid surgery as we know it today began sometime in the 1860s at Vienna with the school of Billroth. In the last 20 years, major improvements and new technologies have been proposed and applied in thyroid surgery; among these are mini-invasive thyroidectomy, new devices for achieving hemostasis and dissection, regional anesthesia and intra-operative neuromonitoring. The essential objectives for thyroidectomy have however always been the conservation of the parathyroid glands, avoidance of injury to the recurrent and external laryngeal nerve nerves, an accurate hemostasis and an excellent cosmesis.

The mortality associated with thyroidectomy in the past was high, recurrent laryngeal nerve injuries were common, and tetany was thought to be caused by "hysteria." The parathyroid glands in humans were not discovered until 1880 by Sandstrom, and the fact that hypocalcaemia was the definitive cause of tetany was not wholly accepted until several decades into the twentieth century. By 1920, advances in thyroid surgery had reached the point that Halsted referred to this operation as a "feat which today can be accomplished by any competent operator without danger of mishap" [1–3].

Thyroid surgery can now be performed today with a mortality that varies little from the risk of general anesthesia alone. Unfortunately, decades later, complications still do occur. To obtain excellent results, surgeons must have a thorough understanding of the anatomy of head and neck and pathophysiology of thyroid disorders. They should be well versed in the pre-operative and post-operative care of patients; have a clear knowledge of the anatomy of the neck region; and use an unhurried, careful, and meticulous operative technique. Like in any head and neck surgery, surgeons operating by a clock have no place

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in thyroid surgery. A meticulous and organized approach is mandatory [3–5].

The "ten" commandments in thyroid surgery are by no means the only "golden pearls" that a surgeon is expected to adhere to but are perhaps some of the most essential aspects of this otherwise gratifying surgery (Table 1). On the lines of "ten commandments" of Moses for the Jews, these rules would help achieve the essential end points in thyroid surgery i.e. negligible or no morbidity and preservation of all the nerves (recurrent laryngeal and external laryngeal nerves), all the four parathyroids and complete clearance.

Commandment-1: Not Operating by Clock!!

The most essential aspect of thyroid surgery is demonstration of clear surgical anatomy and the dissection proceeds in a step wise manner through the natural or the "holy planes" of the neck ensuring minimal or no bleeding. Meticulous dissection techniques are tested in this surgery and a surgeon operating by clock has actually no business to be operating on thyroid. It is known that the anatomy of neck is by and large fixed and the anomaly would essentially be in the mind of the surgeon. It amounts to cutting on the dotted line [1–4].

Commandment-2: Positioning Correctly & Making the Right Incision

Positioning correctly is the most essential aspect of any head and neck surgery. The aim is to ensure adequate exposure and reduced bleeding. The classical "Rose" or "Barking dog" or Kocher's position requires keeping the patient in reverse Trendelenberg's position (head end of the table is up by about 15*) with the neck extended by keeping a sand bag or a "Dunhill" pillow under the shoulder (Fig. 1). Keeping the head end of the table up reduces the venous congestion and ensures adequate exposure of the neck making the thyroid swelling more prominent. The flip side of the entire scenario is that it also increases the risk of air embolism by reducing the negative pressure in the neck veins. The right technique is to ensure that the veins are ligated before they are cut and if there are any air bubbles visible in the internal jugular vein the air can be aspirated using a syringe. The classical incision is in the skin crease and most surgeons prefer to make it about 2–3 cm from the clavicle attachment of the sternocleidomastoid muscle(SCM). However, it is essential to take in to consideration various other aspects and especially in ladies with heavier breasts, it is advisable to make this incision a little higher so that the subsequent scar is not dragged down on to the anterior aspect of sternum, where it may form an ugly keloid (Fig. 2 and 3) [2–5].

Commandment-3: Raise the Flaps Adequately & Find the Midline

The flaps are raised in the sub-platysmal plane. This ensures that there is no or minimal bleeding and adequate blood supply to the flaps. The superior flaps must be raised up to the hyoid bone and the lower flap should expose the tendons of sternomastoid muscles (Fig. 4). Raising the flaps in this manner allows central neck dissection to be performed if planned. The comfort at subsequent dissection lies in raising the flaps optimally. One must remember that the platysma is absent in the midline and posteriorly. It is desirable, although not mandatory to find the midline after incising the investing layer of deep fascia. This helps in the adequate dissection of the strap muscles. The strap muscles may need transection if the gland is large. The muscles should be cut as high as possible as the nerve supply to these muscles (ansa cervicalis) is in the lower third [1–3].

Table 1 Ten commandments

Thou shall.....
1. Not operate by clock!!
2. Position correctly & make right incision
3. Raise the flaps adequately &find the midline
4. Search for middle thyroid vein before mobilizing the lobe
5. Perform medial dissection at superior pole for crico-thyroid space & dissect the superior pedicle for ligating the artery and vein individually
6. "Surely" look for ELN
7. Perform capsular dissection and not ligate the main trunk of Inferior thyroid artery.
8. Identify all the parathyroids and the RLN till its entry in to crico-pharyngeus muscle and demonstrate to the assistants.
9. Isolate the inferior pedicle and ligate the veins individually
10. Ensure the viability of parathyroid's, homeostasis and shall not routinely drain the bed

Fig. 1 Thyroid position or the Kocher's position or the "Rose" position ensures that the neck is extended increasing the space between the clavicles and the jaws. The head end of the operating table is kept raised by nearly 15* to reduce the venous congestion. This however predisposes the patient to increased risk of air embolism due to negative pressure being created in the neck veins. The trachea is shifted to the left side due to gross enlargement of the right lobe

Commandment-4: Search for Middle Thyroid Vein Before Mobilizing the Lobe

This short and wide vein may be absent in a minority of patients (10–15%). The vein is identified as it crosses the common carotid artery to enter in to the internal jugular vein (IJV). If an attempt is made to deliver the gland using finger dissection (blunt and blind), the vein may get avulsed and bleed. The resulting stump may retract and appear like a hole in the IJV. The vein therefore must be identified and doubly ligated in continuity (Fig. 5).

Fig. 2 Marking the incision with a silk thread or marking pen is desirable. The incision should be atleast 2–3 cm above the heads of both clavicles and should ideally fall in to a skin crease. Ladies with large breasts should be given incisions higher than normal as the weight of the breasts may lead to excessive scarring and bad cosmetic result

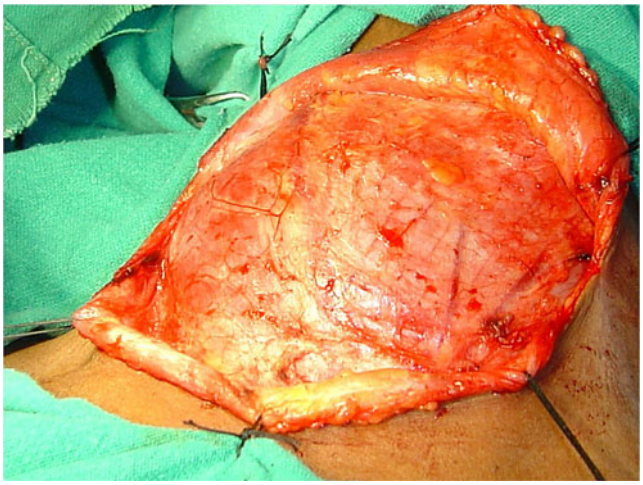

Fig. 3 The sub-platysmal flaps are raised and fixed above as well as below using silk sutures or Joule's self retaining retractors. The author uses silk sutures routinely as the exposure is arguably better

Commandment-5: Perform Medial Dissection at Superior Pole for Crico-thyroid Space & Dissect the Superior Pedicle for Ligating the Artery and Vein Individually

This is a critical step in order to avoid damage to the external laryngeal nerve (ELN). During this manouvere traction is given to the lobe in the downward and outward (lateral) direction leading to opening up of the cricothyroid space of Reeves (Fig. 6). This allows the medial dissection to be completed , thus separating the vascular pedicle i.e.

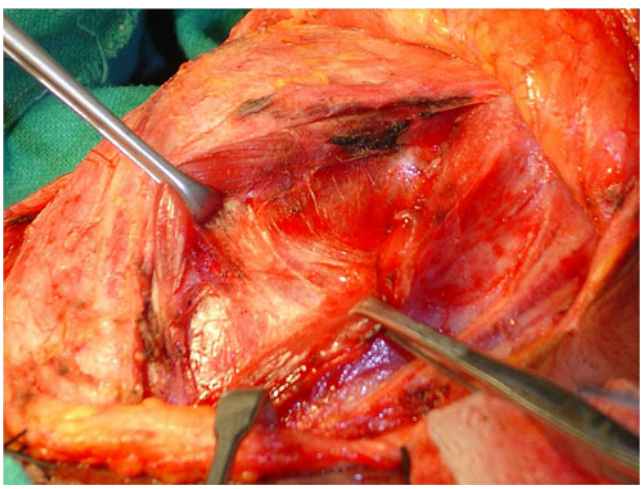

Fig. 4 Strap muscles are anterior to thyroid lobes. The strap muscles are being split in the midline and retracted. It is necessary to stay in the midline and this can be done without any bleeding using electro-cautery

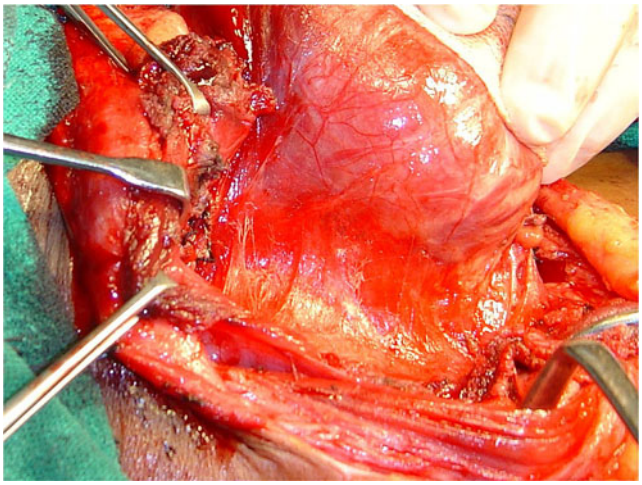

Fig. 5 The space between the gland and the carotid sheath is dissected to find the middle thyroid vein, if present. This vein is ligated and transected before mobilization of the lobe

superior thyroid artery, vein to be separated from the external laryngeal nerve. The superior thyroid artery and vein are dissected and ligated individually and separately. This helps in preventing the formation of A-V fistula and also in identification of external laryngeal nerve.

Commandment-6-"Surely" Look for ELN

An effort must be made to demonstrate this nerve in every case. It can be seen more often than is documented in the literature if an effort is made [6, 7]. Very often this nerve is ignored or neglected and damaged leading to poor pitch and timber of the voice that can be a serious handicap for singers, teachers and preachers etc. [7–9].

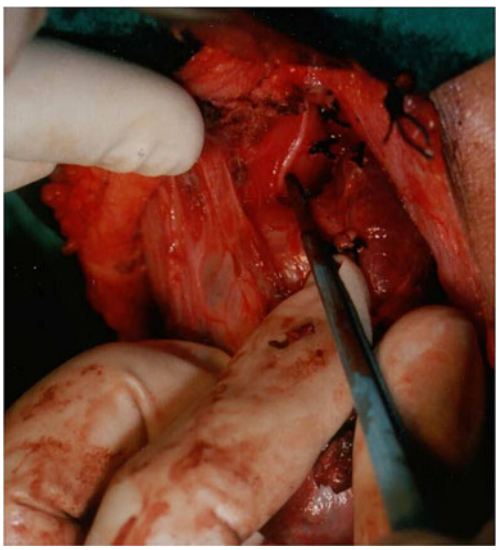

Fig. 6 External laryngeal nerve-and the space of Reeves

Commandment-7 -Perform Capsular Dissection and not Ligate the Main Trunk of Inferior Thyroid Artery

Contrary to what was usually taught and believed in the past, inferior thyroid artery (main trunk) is never ligated unless injured. Only capsular branches (after the parathyroids have received their blood supply), should be ligated and transected. This "orange peel or capsular dissection" ensures that the recurrent laryngeal nerve (RLN) and the blood supply to parathyroids are not affected. Bipolar diathermy is very useful for capsular dissection as most of the dissection proceeds very close to the recurrent laryngeal nerve (Fig. 7) [9–11].

Commandment-8: Identify all the Parathyroids and the RLN Till its Entry in to Crico-pharyngeus Muscle and Demonstrate to the Assistants

Regarding the identification of RLN and its preservation, it is now believed that the "*nerve not seen is damaged*" rather than "*seen is damaged*" as was earlier believed. It is mandatory to dissect and demonstrate this nerve to the assistants. The nerve can be identified best as it enters the neck. On the right side it enters at an angle while on the left side it lies in the tracheo-esophageal groove. All four parathyroids must be identified and demonstrated to all assistants each time. These are hardy glands but should be handled and preserved carefully. They are identified by their location (the superior glands are by and large fixed in their position, while the inferior glands can sometimes descend

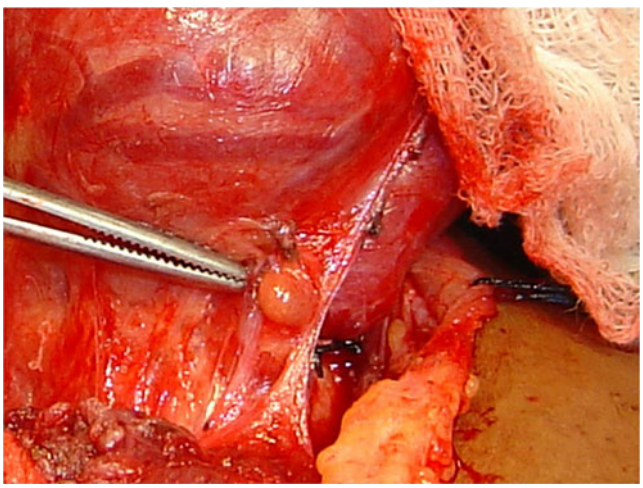

Fig. 7 Inferior parathyroid gland is usually located within 1 cm of the lower pole of thyroid below the inferior thyroid artery. Notorious for being unpredictable in location. Identification by locating the sentinel pad of fat, colour and change in colour on handling is a reasonable approach to localization. It may often be found along the thyro-thymus ligament

down along with thymus during embryonic development. The missing inferior parathyroid glands are sometimes found in the thyro-thalamic ligament at the lower pole. In about 5% individuals five rather than four glands may be seen [4, 9–11]. The parathyroids are golden yellow in colour and author finds the attached "*sentinel pad*" of fat a very reliable pointer to the gland (fig.). Handling the gland makes it get congested (the gland getting angry!!) unlike the fatty tissue and warns against proceeding with the dissection very close to the gland. This can be a very useful warning signal to avoid damage to the gland which is mostly ischemic in nature. (Figs. 8 and 9) [4].

Commandment-9: Isolate the Inferior Pedicle and Ligate the Veins Individually

The inferior pole vessels are individually dissected and also doubly ligated. Mass ligatures should be avoided as there can be accidental inclusion of RLN or damage to the inferior parathyroids (Fig. 10) [9–11].

Commandment-10: Ensure the Viability of Parathyoids, Hemostasis and Shall not Routinely Drain the Bed

The wound is thoroughly irrigated using normal saline and hemostasis is ensured. The colour of the parathyroids is re-assessed. It is vital to know that all black parathyroids are not dead and all normal yellow looking glands are not viable. Author likes to perform a knife test on such glands i. e. making an incision using number 15 blade. This test exposes the viable gland and if the viability is doubtful re-implantation in to the SCM is recommended. [The *suspicious gland is removed and sliced in to the thinnest possible pieces that are kept in the ice cold saline before implanting them in to a pocket created in the sterno-cleidomastoid muscle on the same side*. Routine drainage of the thyroid bed following routine thyroid surgery is not recommended (author and his colleagues demonstrated in a randomized controlled clinical study that routine drainage following thyroid surgery is not recommended, on the contrary drain is responsible for more drainage) [13]. It is mandatory to achieve perfect hemostasis and drainage is not a substitute for poor dissection. There is, however an

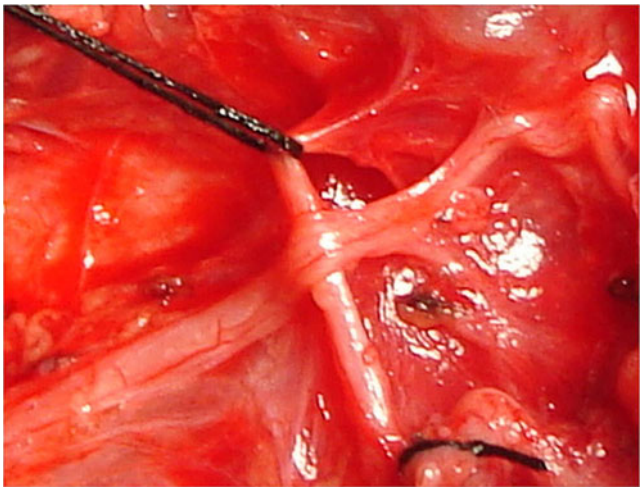

Fig. 9 The central compartment nodes lie in close proximity to the nerve and one has to be slow and meticulous during dissection

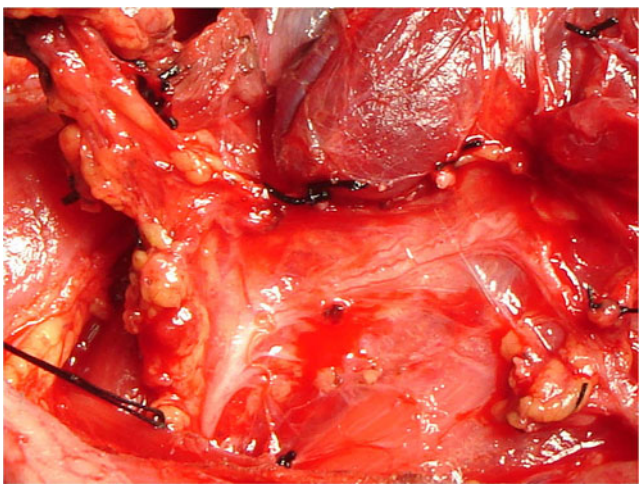

Fig. 8 The RLN could be traversing in between the branches of the main trunk of inferior thyroid artery (ITA-hooked here). One can appreciate that the central neck dissection is in progress for a medullary cancer. It can not be over emphasized that the main trunk of the ITA should never be ligated in order to preserve the vascularity of parathyroids

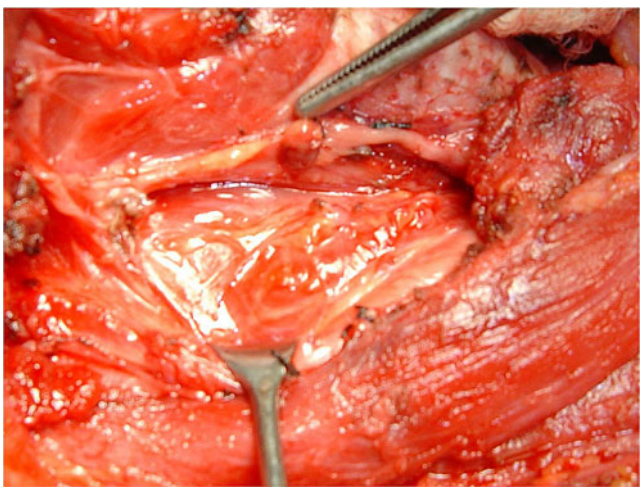

Fig. 10 Superior parathyroid gland is usually found adjacent to the posterior surface of middle part of thyroid lobe often just anterior to the recurrent laryngeal nerve (RLN) as it enters the larynx. Sentinel fat pad is often a good indicator of its presence and author has found this to be a very reliable first pointer to the gland. The gland is golden yellow in colour and gets congested on handling (getting angry !!) to differentiate it from a lymph node or fat

indication for drainage if some type of neck dissection is performed along with thyroidectomy.

These are in no way the only way to perform this surgery and there can be many more commandments for performing an optimum and safe thyroid surgery, the bottom line however is to learn one correct way of doing it and performing the procedure with no haste paying special attention to the surgical anatomy.

References

1. Miller FR, Otto RA (2003) Disorders of the thyroid. Otolaryngol Clin N Am 36:1–7
2. Monfared A, Gorti G, Kim D (2002) Microsurgical anatomy of laryngeal nerves as related to thyroid surgery. Laryngoscope 112:386–392
3. Sanders I, Wu BL, Mu L et al (1993) The innervation of human larynx. Arch Otolaryngol Head Neck Surg 119:934–939
4. Miller FR, Netterville JL (1999) Surgical management of thyroid and parathyroid disorders. Med Clin North Am 83:247–259
5. Weisberg NK, Spengler DM, Neterville JL (1997) Stretch induced nerve injury as a cause of nerve injury secondary to the anterior cervical approach. Otolaryngol Head Neck Surg 116:317–326
6. Cerna CR, Ferraz AR, Nishio S et al (1992) Surgical anatomy of the external branch of superior laryngeal nerve. Head Neck 14:380–383
7. Friedman M, Lo Savio P, Ibrahim H (2002) Superior laryngeal nerve identification and preservation in thyroidectomy. Arch Otolaryngol Head Neck Surg 128:296–303
8. Hurtado-Lopez LM, Zaldivar-Ramirez FR (2002) Risk of injury to the external branch of superior laryngeal nerve in thyroidectomy. Laryngoscope 112:626–629
9. Akerstrom G, Malamaeus J, Bergstrom R (1984) Surgical anatomy of the human parathyroid glands. Surgery 95:14–20
10. Wang CA (1976) Anatomic basis of parathyroid surgery. Ann Surg 183:271–278
11. Chintamani (2005) Step by step neck dissections. Vol. 1. Ist edn. Academa publications
12. Chintamani (2005) Mini atlas of neck dissections. Vol. 1, 1st Edn. Jaypee publications, Chaper
13. Khanna J, Mohil RS, Chintamani BD, Mittal MK, Sahoo M, Mehrotra M (2005) Is the routine drainage after surgery for thyroid necessary? A prospective randomized clinical study [ISRCTN63623153]. BMC Surg 5:11