

## Trials, tribulations and the emergence of total thyroidectomy - a Sri Lankan perspective

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### Abstract

The technique of thyroidectomy has emerged during the last 100 years, from a turbulent past<sup>1</sup>, due to the outstanding contributions made by many including the “Magnificent Seven” of thyroid surgery. The dissection of the gland, preservation Parathyroid function and protecting the Nerves are dealt with meticulously.

Total thyroidectomy is associated with complications of bleeding, permanent injury to Nerves and permanent hypoparathyroidism. Many centres have reported incidence of complications around 1-3%. This is the bench mark for surgeons world over.

Voice change is a major concern after thyroidectomy. A study has shown that RLN recovery much faster than the recovery of the EBSLN. The recovery will take up to 3 months in most patients.

Assessment of the surgical practices related to thyroid disease in Sri Lanka has shown that the practices have changed over the last decade. More total thyroidectomies are undertaken. Younger surgeons are undertaking more total thyroidectomies.

The quoted incidence of Incidental carcinoma is around 10-20% in the literature. In two studies done in the unit, an incidence between 8.8% and 11.38% was seen. This factor must be considered in surgical decision making for benign disease.

Most common cause of recurrences is the enlargement of embryological remnants of the thyroid and a modern thyroid surgeon must excise the embryological remnants meticulously.

Surgery for recurrent goitre is a difficult task. Data confirms that Lateral approach to the thyroid makes the task much easier.

Cosmetic issues and cost must also be considered in thyroidectomy. Data confirms that Mini incision open thyroidectomy is a safe cost effective alternative to endoscopic thyroidectomy The obituary of open total thyroidectomy shall not be written for a long time.

### Introduction and historical backdrop

Thyroidectomy has an unenviable record historically. It is probably the only operation which was banned as a procedure (1,2&3) and resurrected to new heights in the last 10 decades. This was mainly due to the efforts of the father of thyroid surgery, Theodore Kocher along with “magnificent Seven” of thyroid surgery namely, William Halsted, Charles Mayo, George Crile, Frank Lahey and Thomas Dunhill.

For a long time was subtotal thyroidectomy was the procedure of choice in most thyroid diseases. This was due to many reasons including the non-availability of replacement oral thyroxine and fear of complications. In the 20th century endocrine surgeons around the world were adopting the technique of total thyroidectomy (TT) due to high incidence of recurrence of goitre following subtotal surgery. This was based on the fact that recurrence was high with a subtotal procedure especially in MNG as the disease process affected the whole gland (4).


### *The evolution of the technique of thyroidectomy*

Many improvements in the technique of thyroidectomy have evolved over several decades. Fundamentally these changes can be divided into eras, before the 1970s and the 20th century after 70s. The changes are summarized in table 1.

The lateral dissection advocated the ligation inferior thyroid artery as laterally as possible, this endangered the blood supply to the parathyroids. In the previous era the Identification especially of the EBSLN was not undertaken properly. The RLN and the EBSLN are now identified meticulously.

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**Table 1** - The evaluation of the technique of the thyroidectomy

	<b>1970s</b>	<b>20<sup>th</sup> Century ( latter part)</b>
<b>Technique</b>	Lateral dissection	Capsular dissection
<b>Nerves</b>	Recurrent Laryngeal Nerve (RLN) “encountering” dissection External branch of Superior laryngeal neve (EBSNL)??	routine RLN&EBSLN identification
<b>Completeness</b>	Anatomical	Embryological Tubercle of Zuckerkandl Thyrothymic remnants (TR) & Pyramidal lobe (PL) Identified and excised
<b>Parathyroids</b>	Preservation	Auto transplantation in situ routinely
<b>Lymph nodes (for Malignancy)</b>	“Berry picking”	Selective Node dissection

The parathyroids were not dealt with adequately in the pre 70s era and the lymph nodes were dealt with inadequately in that era. The embryological remnants left behind gave rise to a significant number of recurrences. The newer technique of TT addresses all these issues properly.

In 2002 the author and the unit adopted TT for benign disease. The initial results of total thyroidectomy for benign disease in was presented in 2003. The series consisted of 22 patients. It created a heated debate about the appropriateness of the procedure (5). Nearly 1000 total thyroidectomies have been performed by the author from 1999 to date, adopting the techniques forming the basis for the ensuing dissertation. Complications of thyroidectomy

Surgeons in Sri Lanka encounter goitres commonly in clinical practice. The possibility of complications is always uppermost in the minds of all who undertake thyroidectomy.

The rate of complications of total thyroidectomy reported world over is around 1-3% for nerve injury and permanent hypocalcaemia (6, 7 & 8), as depicted in Table 2.

Only a few scattered reports are available in the literature regarding post-operative complications of thyroidectomy in Sri Lanka.

*Complications of Thyroidectomy a Sri Lankan perspective*

A study was undertaken to assess the post-operative complications after total thyroidectomy for benign disease. Study was focused on the complications of Hypoparathyroidism and Nerve palsy as significant post-

**Table 2**- Complications of total thyroidectomy – from world literature

<b>Study</b>	<b>Permanent recurrent-Hypoparathyroidism%</b>	<b>laryngeal-nerve injury %</b>
Clark	0	1
Harsens	0.45	2.7
Reeve et al	0	0
Khadra	0.5	0.6
Liu et al	1	0

operative bleeding was not seen. The cohort study was from June 2005 to May 2009.

102 patients were eligible. The results were as follows:

- Fourteen patients (14) developed hypocalcaemia
- Twelve (12) – (11.7%) had transient and 2 (1.96%) had permanent deficiencies.
- Eight patients (8) developed hoarseness, of which seven (6.86%) had transient hoarseness and only one (0.98%) had permanent hoarseness.
- A mean thyroid weight of 91.78gm was observed in the uncomplicated group. Those who developed postoperative hypocalcaemia and transient hoarseness had a mean thyroid weight over 100 gm.
- One patient (1), with a thyroid weighing 195gm developed permanent hoarseness due to RLN injury. The surgery in this patient was undertaken for a recurrent goitre.
- It appears that the risk of permanent nerve injury increased if the gland weight is more than 10 times the normal size, but this must be interpreted cautiously as there is only one patient with permanent hoarseness in this study (9).

#### Voice change in total thyroidectomy

Since permanent voice change was one complication that was highlighted in the above study, a prospective cohort study was undertaken from Sept 2015 to assess the voice change in patients undergoing total thyroidectomy. All components of voice such as; Pitch, Intensity, formant and pulses may be affected in varying degrees with injury to RLN and EBSLN or both.

The main components of voice which affects subjective variation of voice are deemed to be intensity and pitch. It is generally accepted that the RLN injury is indicated more by the pitch and Intensity changes indicate damage to the EBSLN.

54 patients were assessed. Total thyroidectomy was done for both benign and malignant goitres. Careful intra-operative identification of RLN & EBSLN was done. Equipment used for assessment of voice was a standard microphone and voice recorder. All patients were asked to pronounce vowels (“a, e, i, o, u”) in the same order and the word (“Uswatakeiyawa”) during a prerecording rehearsal.

All recordings were limited to 6 seconds to simplify the analysis. Same vowels and the word was recorded before and after thyroidectomy. Same file format, venue (calm isolated

room) and position (sitting) of the patient was used to minimize errors.

Later, the voice was serially assessed using the same technique after two weeks, six weeks, three months and six months post-operatively. Recorded data were analyzed using standard voice analyzing open source software “PRAAT” which provides analyses of pitch and intensity.

Pre-operative and post-operative values were used for objective assessment of voice and statistical analysis was done with SPSS version 20.

#### The findings

- Eight (8) -(14.8%) patients failed to achieve pre-operative pitch at two weeks. The pitch improved in two (2) out of eight patients after six weeks.
- In contrast, 34 (62.9%) patients had low-voice intensity at two weeks, but 26 of them showed significant improvement at six weeks.
- This indicates that the recovery from possible neuropraxia of the RLN is much quicker than the recovery of EBSLN. These findings have not been recorded in previous studies.

All patients were able to achieve preoperative intensity and pitch in three months, which indicates that there was no objectively demonstrable permanent injury to the EBSLN nor RLN (10). There isn't much information similar to the findings of this study in the world literature.

The main limitations of this study were amongst other things were the small number of patients, not evaluating other components of voice, no data regarding occupation of the patients. A larger study addressing these issues will provide more robust data.

#### Surgical practices in dealing with thyroid disease amongst Sri Lankan Surgeons

In order to find out the practices of other surgeons in the country regarding decision making and surgical practices in dealing with thyroid disease. Two studies were undertaken in 2008 and 2019 to ascertain practices regarding thyroid surgery

A pre-tested questionnaire was sent to more than 100 general and ENT surgeons, to assess the practice of thyroid surgery. The questionnaire was answered anonymously. The questions were specific for the practice of thyroid disease & surgery. Technical aspects were also assessed with specific questions.

In 2008 - 33 surgeons returned the questionnaire. In 2019 - 32 surgeons returned the questionnaire. The findings show clear indications of change of practice from 2008 to 2019. The comparative results are shown in tables 3.

There is a definite change in surgical practices between the two assessments and most surgeons seems to be aligning themselves with the current global trends. The younger surgeons seem to be doing more total thyroidectomies. Incidental/ Occult carcinoma of the thyroid (ITC) and implications for surgical decision making

An occult or incidental carcinoma is a carcinoma detected in the final histology report, when surgery is undertaken for a benign goitre.

The prevalence of occult carcinoma varies from 10-20% (11,12,13). With a significant prevalence of ITC, if a subtotal thyroidectomy is done, assuming that the goitre is benign, the surgeon is faced with the perplexing issue of how best to deal adequately with the cancer detected on the final histology report.

Two studies were conducted to assess the incidence of occult carcinoma in 2003 and 2015. The first study in 2003 was a prospective study consisting of 68 patients. Data was collected from January 2003 to December 2005. 68 patients

consisted of 67 females and 1 male, aged 28 to 67 years (mean 44.2 (SD=11.1) were eligible. The indications for surgery are depicted in table 4.

In 6 - (8.8%) patients, histological examination showed incidental carcinomas: 2 papillary, 2 medullary and 2 follicular carcinomas. There was no significant difference in age, clinical presentation and functional thyroid status of patients with incidental carcinomas and those with histologically confirmed benign diseases.

Since the incidence of ITC was significant, it added impetus to the argument to advocate total thyroidectomy even for benign disease in our patients (14).

In the second study done in 2015, 167 patients were assessed and all of them had a FNAC confirmed BethII/ Thy2 status prior to surgery. The Incidence of ITC was 11.38%. This has reinforced the argument for total thyroidectomy especially in MNG.

#### Recurrence of goitre and the role of total thyroidectomy

For about for about 100 years, Subtotal thyroidectomy was the standard operation for benign disease, such as MNG and Graves' disease. In the latter part of the 20th century and the early part of 21st century, surgeons had to deal with a large

**Table 3**

	<b>2008</b>	<b>2019</b>
Surgery for MNG	35%	97%
Non-Surgical Management of Graves' Disease	17%	59%
Non-Surgical Management of Hashimoto's Disease	76%	91%
Identification of RLN	92%	100%
Identification of EBSLN	9%	31%
Identification of parathyroids	22%	81%
Use of Drains routinely	90%	56%
Total Thyroidectomy for MNG	35%	70%
Years of experience	2-15years	5-25years

**Table 4-** Indications for thyroidectomy in the study population

Indication	Number of subjects	%
Multinodular toxic goitre	32	47.1
Multinodular non-toxic goitre	20	29.4
Thyrotoxicosis	9	13.2
Graves' disease	3	4.4
Colloid goitre	3	4.4
Thyroiditis	1	1.5
<b>Total</b>	<b>68</b>	<b>100</b>

number of recurrent goitres. This lead to reassessing the surgical options in benign disease of the thyroid as reoperation was definitely associated with increased morbidity due to scarring distortion of anatomy and friability of tissues (15, 16). Embryological remnants are a major cause of recurrent goitre (17 18). It is universally accepted that the embryological remnants must be carefully looked for and excised during thyroidectomy to prevent recurrence of goitre and would be a critical step in total thyroidectomy for a cancer.

A study was undertaken in 2013 to assess the presence of embryological remnants in patients undergoing thyroidectomy. 100 consecutive patients were included in this prospective study. At thyroidectomy the presence of remnants and the location size etc. were carefully recorded. All specimens were numbered photographed for subsequent clarifications.

The findings were:

The pyramidal lobe (PL) was found in 50% of the patients, the Tubercle of Zuckerkandl (ZT) was found on one side in 94% of the patients and bilaterally in 64% of the patients. The

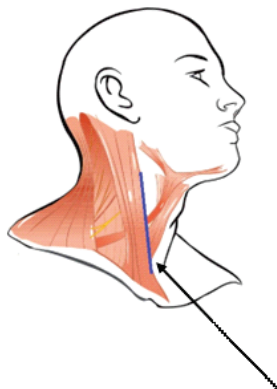
Thyrothymic remnant (TTR) was found in 30% of the patients. The implications of this findings in relation to total thyroidectomy (19).

*Travails of redo thyroid surgery – The lateral approach*

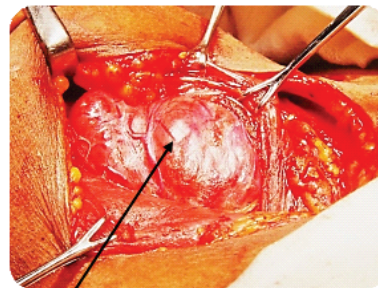
Redo -Total Thyroidectomy has been undertaken in more than 100 patients with recurrent goitres. The surgery is difficult and in the initial phase, the approach was midline exploration through the previous scar was utilized. The blood loss was usually about twice that of a first time thyroidectomy, due to scarring adhesions and difficulties of defining planes.

Due to the problems faced, in the last 7 years, we have practiced the use of the lateral approach. The lateral approach utilizes the previous scar till the deep fascia is reached. The deeper dissection is done in the natural plane between the strap muscles and the anterior border of the Sternomastoid muscle. This approach has the advantage that that there is no fibrosis or scarring and the dissection is in a 'virgin' plane. The plane of deep dissection is shown in Figures 2 & 3.

A study was done to assess the outcomes of the lateral approach in recurrent goitres in 2015. All patients who has a lateral approach for recurrent goitres from 2008 to 2015 were included.



**Figure 1**



**Figure 2**

**Dissection between Sternomastoid Muscle and the Strap Muscles**



The findings:

- 29 -(90.6%) females and 3 (9.4%) males. Age ranges between 28 and 61 (median 43.37).
- 28 Hemi thyroidectomies performed (87.5%)
- 9 -(28.1%) redo thyroidectomies for large goitres
- 18 -(56.2%) done with mini incision with lateral approach - small goitres
- Bilateral explorations on 3(9.4%) patients
- 4-(12.5%) lateral approaches done for completion thyroidectomies for follicular malignant lesions.
- 3 -(9.4%) operations for parathyroid explorations and one (3.1%) for redo parathyroid exploration.
- In terms of complications, transient clinical hypocalcaemia noticed in four (4)- (12.5%) patients and one (1)- (3.1%) developed hoarseness of voice, which was temporary.

No permanent nerve injury or hypoparathyroidism was noted. None of them had complications like haematoma and postsurgical stridor.

These rate of complication rates comparable with the rates described in the preceding part of this dissertation. The conclusion of the study was that the Lateral approach to thyroid is a good alternative to the standard approach for re-exploratory thyroid surgery (20).

Cosmetic Issues in total thyroidectomy & Mini Incision Total thyroidectomy/ Hemi thyroidectomy

Open thyroidectomy is a very safe time tested universally applicable operation. It is done with a cervical incision and for many years a large incision was used. While many patients had a cosmetically acceptable result, a few patients were left with an unsightly scar in the neck. This was a concern for younger patients.

At the start of the 21st century, several centres of the world reported thyroidectomy through a small cervical incision (3-4 CM) in order to overcome issues with the cosmetic result, improve patient comfort and reduce costs by shortening the hospital stay (21). The incision was placed on a suitable natural cervical skin crease to achieve the best outcome.

Mini incision has been practiced in the unit from 2007. A prospective cohort study was carried out on all patients undergoing MIT between 2008 to 2015 Patients with small size glands, nodules less than 2cm were included. Size of the gland was the main factor before deciding on a MIT.

Twenty-nine (29) MITs were performed

- Female - 26 Male -3
- Median age 34.26y (range 22 - 42yrs)
- Hemi-thyroidectomy- 18, Total thyroidectomy -11
- The commonest indication for total thyroidectomy - Small MNG
- The longest follow up - 7 years
- None had recurrent laryngeal nerve injuries or significant haematoma formation
- Transient Hypocalcaemia seen in 3% of total thyroidectomies
- The cosmetic outcome was excellent

Mini incision thyroidectomy is a safe, cost effective alternative to endoscopic thyroidectomy. Only caveat is that careful selection of patients must be done. It is not suitable for large goitres.

### Conclusion

The technique of thyroidectomy has evolved a great deal over the last 100 years. The dissection of the gland, preservation of the function of parathyroids and maintaining integrity of the RLN and the EBSLN are dealt with much more meticulously now. These developments have made open total **thyroidectomy** a safe acceptable, cost effective universal operation

One of the main issues related to total thyroidectomy is the associated complications. The common complications are bleeding, permanent injury to RLN & EBSLN and permanent hypoparathyroidism. The reported incidence of complications of total thyroidectomy world over is around 1-3%. This is the bench mark for surgeons' world over. In the studies conducted in the authors unit very similar results have been achieved. This may be considered a bench mark from a Sri Lankan perspective

In studies done on the surgical practices in Sri Lanka regarding thyroid disease/ surgery, it is clear that the practice has changed over the last decade. More total thyroidectomies are undertaken. Younger surgeons are undertaking more total thyroidectomies.

Incidental carcinoma has a significant incidence especially in endemic regions of the world. The quoted incidence is around 10-20%. In two studies done in the unit the incidence estimated has been between 8.8% and 11.38%. Surgeons must be cognizant of this in the decision making when surgery is undertaken for benign disease of the thyroid.

·Recurrence of Goitre is a 'throwback' from the past as subtotal thyroidectomy was the standard operation for more than 100 years. Dealing with recurrent goitres is a difficult task and most common cause of recurrences is the enlargement of embryological remnants of the thyroid. The remnants are the Pyramidal lobe, Tubercle of Zuckerkandl and the Thyrothymic remnants. The thyroid surgeons must identify & excise all embryological remnants meticulously.

Surgery for recurrent goitre is a difficult task. Likelihood of complications is higher. Lateral approach to the thyroid makes the task much easier. The data from a study has shown it be safe and effective. This may be considered another benchmark from a Sri Lankan perspective.

Cosmetic issues and cost must also be considered in thyroidectomy. Cosmetic issue becomes important especially in younger females. Data confirms that, mini incision open thyroidectomy, is a safe cost effective alternative to endoscopic thyroidectomy especially from a Sri Lankan perspective.

·The obituary of open thyroidectomy will not be written in the foreseeable future.

## Reference

1. Sarkar Saurav, Banerjee Swagatam, Sarkar Rathin, Sikder Biswajit A Review on the History of 'Thyroid Surgery' Indian J Surg (February 2016) 78(1):32–36
2. Riche Sara L, Kamani Dipti, Mihai Radu, Romanchisen Anatoly P, Randolph Gregory W. The History and evolution of techniques for thyroid surgery. doi:10.1055/b-0036-141891
3. Alam Hannan S. The magnificent seven: a history of modern thyroid surgery. International Journal of Surgery (2006) 4, 187-191.
4. Delbridge Leigh. total thyroidectomy: the evolution of surgical technique ANZ J.Surg.2003;73: 761–768
5. Siriwardana P.N., Fernando R. Total thyroidectomy in benign disease of the thyroid The Ceylon Medical Journal. 2005; 50 ( Supplement 1 ) : 56  
<http://repository.kln.ac.lk/handle/123456789/9947>
6. Wheeler Malcolm H Total thyroidectomy for benign thyroid disease Lancet. 1998 May 23;351(9115):1526-7. DOI: 10.1016/S0140-6736(05)61116-6.
7. Bellantone Rocco, Pin Lombardi Celestino et al Total Thyroidectomy for Management of Benign Thyroid Disease: Review of 526 World J. Surg. 26, 1468-1471, 2002 DOI 10.1007/s00268-002-6426-

8. Delbridge L, Guinea Ana I., Reeve Tom S. Total Thyroidectomy for Bilateral Benign Multinodular Goiter Effect of Changing Practice Arch Surg. 1999;134(12):1389-1393. doi:10.1001/archsurg.134.12.1389
9. Fernando R, Chandrasinghe PC, Bandara M, Renuka MBS, Athulugama NS. Hypocalcaemia and Hoarseness Following Total Thyroidectomy for Benign Disease: Relationship of Incidence to the Size of the Gland. World Journal of Endocrine Surgery, January-April 2011;3(1): 1-3.
10. D M C D Dissanayake, R Fernando, B N L Munasinghe, S B Thilakarathne, D P Pinto, U A Urugoda Pre and post-operative assessment of voice changes in patients undergoing total thyroidectomy Ceylon Medical Journal 2017; 62 115-116. DOI:<http://doi.org/10.4038/cmj.v62i2.8481>
11. Mishra A, Agarwal A, Agarwal G, Mishra SK. Total thyroidectomy for benign thyroid disorders in an endemic region. World Journal of Surgery 2001; 25: 307-10.
12. Giles Y, Boztepe H, Terzioglu T, Tezelman S. The advantage of total thyroidectomy to avoid re-operation for incidental thyroid cancers in multinodular goitre. Archives of Surgery 2004; 139: 179-82.
13. Boucek J, Kastner J, et al. Occult thyroid carcinoma. Acta Otorhinolaryngol Ital. 2009 Dec; 29(6): 296–304
14. Fernando R, Mettananda D S G, Kariyakarawana L. Incidental occult carcinomas in total thyroidectomy for benign diseases of the thyroid CMJ Vol. 54, No. 1, March 2009:4-5
15. Medas Fabio, Tuveri Massimiliano et al. Complications after reoperative thyroid surgery: retrospective evaluation of 152 consecutive cases. Updates Surg. 2019 Dec; 71(4):705-710. DOI: 10.1007/s13304-019-00647-y.
16. Lefevre J, Tresallet C, Leenhardt L et al. Reoperative surgery for thyroid disease. Langenbecks Arch Surg. (2007); 392: 685-691
17. Snook KL, Stalberg PL, Sidhu SB, Sywak MS, Edhouse P, Delbridge L. Recurrence after total thyroidectomy for benign multinodular goitre. World J Surg. 2007; 31:593–8
18. Dhalapathy Sadacharan, Mahadevan Shriram et al. Prevalence and implications of thyroid related embryological remnants: A prospective study of 1118 total thyroidectomies. J Family Med Prim Care. 2020 Feb; 9(2): 632–636. DOI: 10.4103/jfmpe.jfmpe\_1141\_19
19. Fernando Ranil, Rajapaksha Anuradha, Ranasinghe Narada, Gunawardana Duminda. Embryological Remnants of the Thyroid Gland and their Significance in Thyroidectomy. World Journal of Endocrine Surgery, September-December 2014;6(3):110-112
20. Dissanayake Duminda DMC, Fernando Ranil, Dissanayake Iresha J. Lateral approach to Thyroid (LATT): A

Good Technique for Re-Operative Thyroid Surgery. World Journal of Endocrine Surgery, May-August 2016;8(2):1-2

21. Alvarado Raul, McMullen Todd, Sidhu Stan B, Delbridge Leigh W, Sywak Mark S. Minimally invasive thyroid surgery for single nodules: an evidence-based review of the lateral mini-incision technique. World J Surg. 2008 Jul; 32(7):1341-8. DOI: 10.1007/s00268-008-9554-4.