

The rationale of triangles in relation to thyroid surgery: A proposed unified 'area of danger' for safe thyroidectomy

Prem Kumar A

Assistant Professor, Dept. of Surgery, Bangalore Medical College & Research Institute, Bangalore, Karnataka, India

***Corresponding Author:**

Email: drpremk512@yahoo.co.in

Abstract

Introduction: Thyroid surgery defines a surgeon's precision. Even though as a surgery being performed regularly, thyroidectomy still carries considerable rate of morbidity which is dreaded. To solve this difficulty many triangles have been described like the Joll's triangle or triangles of concern. But how useful are these triangles in everyday practice remains obscure.

Design of study: Prospective questionnaire study

Materials and Method: 41 surgeons with 10 years of experience completed a questionnaire regarding their beliefs, awareness, usefulness and remarks about the triangles.

Result: The majority of surgeons believed that the triangles even though were anatomically correct lacked the completeness. Surprisingly many of the surgeons (~63%) didn't possess sufficient knowledge or awareness of all the triangles in relation to the thyroid surgery. Many suggested for an easier and comprehensive area where the surgeons need to be cautious.

Conclusion: Even though the triangles can be used during the surgery, the unified area of danger proposed by the author seems easier and practical.

Keywords: Thyroidectomy, RLN, Complication of thyroid surgery, Triangles in thyroidectomy.

Introduction

First described by Kocher in 1912, thyroidectomy has become a routinely performed surgery. It's a surgeon's responsibility to have a thoughtful, precise, and cautious approach during the procedure. With a good knowledge of surgical anatomy the morbidity of thyroid surgery has decreased to <1%.

Galen described the RLN. Surgeons including Billroth, Kocher, and Joll tried to avoid dissection near it; though others like Lahey favored to expose the RLN.

Recurrent laryngeal nerve (RLN) either way carefully should be preserved in every case. The RLN is most susceptible to injury in the last 2 cms of its course. Damage to recurrent laryngeal is a disaster

External branch of superior laryngeal nerve (EBSLN) is important in tensing the vocal cord, injury to this leads to issues with voice fatigue and loss of pitch.

The EBSLN is in close proximity to the superior pole of the thyroid. This nerve can be revealed in the Reeves space-avascular medial thyroid space, which may be difficult to dissect in cases of Hashimoto's and in malignancies.

The course of recurrent laryngeal nerve and superior laryngeal nerve are very variable. To help the surgeon various triangles have been described.

1. Beahr's Triangle or Riddle's triangle

This triangle is named after OH Behr. Also synonym with Riddle's triangle

The nerve is identified down in the tracheo-oesophageal groove. The nerve forms the third side of Behr's triangle. The other two sides are by the common carotid and inferior thyroid arteries.

2. Joll's Triangle

Synonym is sternothyrolaryngeal triangle.

This is used to identify external branch of superior laryngeal nerve which lies within this triangle.

Upper pole of thyroid gland and superior thyroid vessels forms the Lateral border.

Superiorly- Attachment of the strap muscles, Medial the landmark is the Midline, Floor is formed by Cricothyroid muscle.

3. Simon's triangle: This another triangle described to identify the RLN.

Anterior border is formed by the recurrent laryngeal nerve, posterior by the common carotid artery and base is formed by the inferior thyroid artery

4. Lore's Triangle

Described by Lore et al., to identify the RLN. Medial border is by the trachea / esophagus, laterally the carotid artery and superiorly the surface of inferior pole of thyroid.

5. Triangle of concern

The sites of bleeding during thyroidectomy are middle thyroid veins, inferior thyroid veins and branches of inferior thyroid artery in the vicinity of RLN.

6. Cricothyroid space of reeves

This is an avascular space between the upper pole of the thyroid and the cricothyroid muscle which is useful in dissection and helps in avoiding injury to the surrounding important structures like the superior laryngeal nerve.

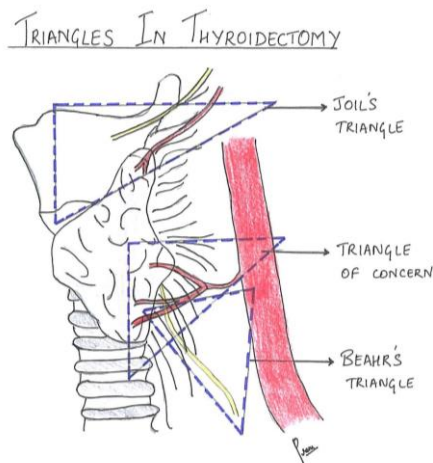


Fig. 1: Triangles in thyroidectomy

Objective

To assess the usefulness of the triangles described in relation to thyroidectomy.

Materials and Method

Approval of the Institutional Ethics committee was obtained

Design of study: Prospective questionnaire study

Inclusion and Exclusion Criteria

- All respondents were onco-surgeons, endocrine surgeons, or general surgeons.
- Surgeons' with minimum of 10 years of experience were enrolled for this study
- Residents were excluded from the study.

The study was done at Victoria hospital, Bangalore in April 2018.

A questionnaire was designed to assess inclination and usefulness of the thyroid triangles which have been described. It included four statement questions and one open ended question. The questionnaire enquired about the awareness or familiarity about these triangles. The usefulness of the triangles was enquired. Further an open ended question was also added to know about their opinion on the thyroid triangles and if any remarks.

Data Collection

The questionnaire was distributed to the surgeons and a week's time was given to respond to the question. Data also was collected regarding the number of thyroid surgeries being performed.

Statistical Analysis

All returned surveys were included in our study. Survey data was entered into an Excel spreadsheet for further analysis.

The answers to open ended question was read in detail and interpreted. A brief summary was prepared.

Results

A total of 41 surgeons participated in this survey on the usefulness of triangles classically described. The response rate was 100 % with all replying to the questionnaire.

(Table 1) With regards to the awareness about the triangles 26(63.41%) of the respondents stated that they had no knowledge. 11(26.8) surgeons had little or partial awareness about the triangles. 5(12.2) had good knowledge.

(Table 2) 9(21.95%) surgeons felt these triangles were very useful. 6(14.6%) surgeons considered the triangles useful. 22(53.65%) surgeons deemed the triangles not useful.

(Table 3) 36(87.8%) of the respondent opted to say that the triangles were not inclusive of all areas where the injuries can occur. Rest 5(12.2%) agreed on the triangles being comprehensive.

39 (95.12%) of the surgeons admitted on not using these triangles in their practice (Table 4). Only 2 surgeons were utilizing the triangles to identify the vital structures.

Table 1: Awareness/ knowledge about the triangles

Awareness / knowledge	Number of surgeons
No knowledge	26 (63.41%)
Partial knowledge	11 (26.8%)
Good knowledge	5 (12.2%)
Total	41

Graph 1

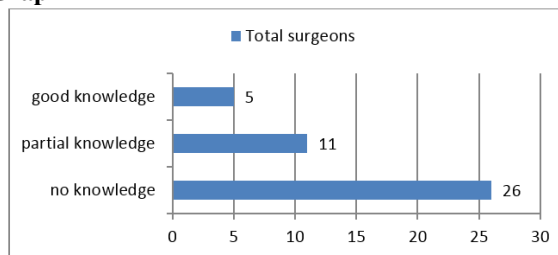


Table 2: Usefulness of the triangles

Usefulness of the triangles	Number of surgeons
Very useful	9 (21.95%)
useful	6 (14.6%)
Not useful	22 (53.65%)
Total	41

Graph 2

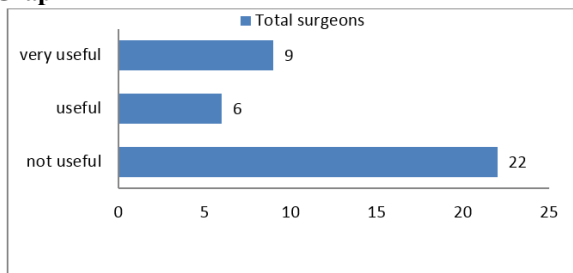


Table 3: Comprehensiveness of the triangles

Comprehensiveness of the triangles	Number of surgeons
Not complete	36 (87.8%)
complete	5 (12.2%)
Total	41

Chart 1

Number of surgeons

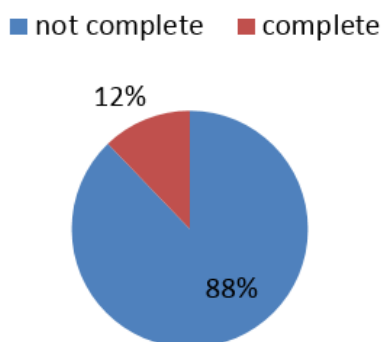
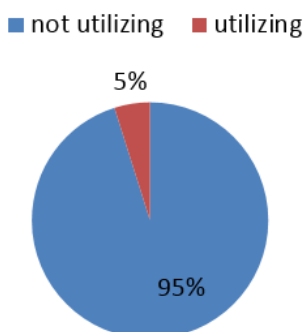


Table 4: Utilization of the triangles in practice

Utilization of the triangles	Number of surgeons
Not utilizing	39 (95.12%)
Utilizing	2 (4.87%)
Total	41

Chart 2

Number of surgeons



Summarizing the open ended question or remark, many surgeons believed these triangles were not practical. They felt that remembering many triangles is difficult. They opined that in some cases like huge goiter or malignancy identifying or defining the triangles might be awfully difficult. 2 surgeons who are performing trans-oral thyroidectomy endoscopic (including the author) wondered the future of these landmarks in the era of endoscopic approaches where the pointers and perspective are different.

Discussion

The Existing various triangles were described in the early phase of the evolution of thyroid surgery. These were considered very helpful and were followed with the fear of the morbidity. With the advancement of the techniques and instruments like harmonic and nerve monitors the triangles sort of lost the role it used to play earlier.

A lacuna is the area to identify Non –recurrent nerve is not described in any of the triangles. The triangles are very specific in nature. With this mind the author proposes a unified 'area of danger' as shown in the figure. The boundary of this area superiorly is the superior thyroid artery, inferiorly the inferior thyroid artery. Medially the trachea and laterally the carotid sheath. This area encompasses all the danger zones which might injury the nerves and vessels. This area is made comprehensive or total, so that the operating surgeon can be cautious in this zone. Since this is a single area it is easy for the surgeon to remember during the procedure.

The author feels we may need to have some triangle/landmark suggestion for the newer endoscopic techniques.

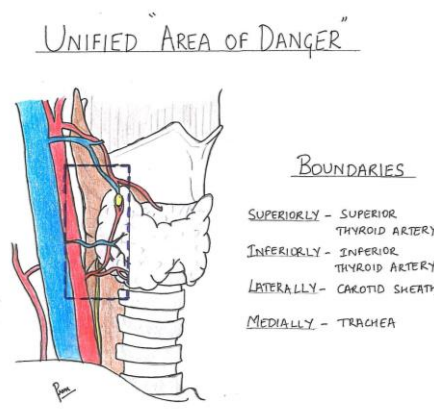


Fig. 2: Unified area of danger

Conclusion

The triangles described to assist the surgeons are no doubt precise and helpful, but lack in being complete. The partial caution might lead to injuries. And remembering a single area of danger is much easier to the surgeon.

References

1. Dr T Balu's book of otolaryngology.
2. https://www.researchgate.net/publication/274082336_Assessing_the_Usefulness_of_Simon's_and_Joll's_Triangles_in_Thyroidectomy.
3. Jain v bearh's triangle:the surgical anatomy world. *J Endoc* 2017;9(1):35.
4. Identification of external branch of superior laryngeal nerve during thyroid surgery: a prospective study Ekhar VR et al. *Int J Otorhinolaryngol Head Neck Surg* 2018;4(1):228-32.
5. A Closer Look at Laryngeal Nerves during Thyroid Surgery: A Descriptive Study of 584 Nerves P. V. Pradeep, B. Jayashree, and Skandha S. Harshita *Anatomy Research International* Volume 2012, Article ID 490390, 6 pages.