SURGICAL ANATOMY OF THYROID TUBERCLE OF ZUCKERKANDL

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ABSTRACT

BACKGROUND

The Tubercle of Zuckerkandl (TZ), a projection of thyroid tissue from the lateral thyroid lobe is a constant landmark while doing thyroid surgeries. It is actually a condensed part of parenchyma in thyroid gland. Its surgical importance lies in the fact that it has a constant anatomical relationship with the recurrent laryngeal nerve (RLN). RLN injuries, particularly when bilateral, cause airway obstruction necessitating tracheostomy. Iatrogenic injury of the nerve can be prevented by a thorough knowledge of its anatomy and its relation to TZ.

This study aims to find the incidence of TZ in patients undergoing total thyroidectomies, its size and its relation with RLN.

MATERIALS AND METHODS

It is a cross sectional study done in a tertiary care centre under the Department of General Surgery. In the present study, 153 patients who underwent total thyroidectomies in a single surgical unit were studied. The record obtained was entered in MS excel sheet for data analysis and mean and standard deviation was analysed.

RESULTS

Female patients formed the major portion of the study group; 127 of 153 cases. Bilateral occurrence of TZ was found to be 77.12%. Majority of cases showed anterior location of TZ in relation to RLN. Most of the cases were of Pelizzo's grade 2 and 3.

CONCLUSION

Tubercle of Zuckerkandl should be identified and dissected out in all cases of thyroidectomies to aid in identification and preservation of RLN, and to ensure completeness of total thyroidectomies.

KEYWORDS

Thyroid, Tubercle of Zuckerkandl, Recurrent Laryngeal Nerve, Landmark, Thyroidectomy.

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BACKGROUND

Thyroid diseases have increased in incidence exponentially since the last decades. The reasons may be various including hormonal imbalance, lifestyle changes, change in food habits and early detection. Due to this reason, thyroidectomy has become one of the surgeries which has evolved tremendously, with very high technical variations. The technique of thyroidectomy largely varies from surgeon to surgeon, although the basic principle remains the same.

In inexperienced hands, Thyroidectomy can become a limited surgery amounting to simple lobectomy or "superficial thyroidectomy". But it is now known that thyroid surgery has to be done meticulously removing the whole of thyroid gland, including pyramidal lobe and tubercle of Zuckerkandl.

Safety of thyroid surgeries require intimate knowledge of its anatomy. A Viennese anatomist, Emil Zuckerkandl in 1902 described the thyroid tubercle of Zuckerkandl, which has

become an important landmark in thyroid surgeries. It projects from the lateral lobe of thyroid as a posterior extension. It contains thyroid tissue only.¹ When enlarged, it may become nodular and lies lateral to the RLN which lies in the tracheoesophageal groove. Thyroidectomy is complete only with excision of TZ. Close proximity of recurrent laryngeal nerve (RLN) increases its surgical importance, and injury to it can cause complications. Visualising RLN reduces vocal paresis by 1-6 fold.² RLN palsies are not recognised intraoperatively.

Location of RLN using different landmarks have been proposed which includes Simon's triangle in relation with inferior thyroid artery at inferior pole of thyroid gland. Traction manoeuvre can also identify RLN. Berry's ligament is also an important landmark for RLN. Left RLN re-curves around aortic arch usually in tracheoesophageal groove, usually posterior or anterior to inferior thyroid artery. Right RLN re-curves around right subclavian artery at the root of neck slightly lateral to groove at lower border of thyroid and passes anterior or posterior to inferior thyroid artery or between its branches. Aberrant non-recurrent laryngeal nerve (0.5%) is a surgical hazard and arises directly from vagus and courses medially towards larynx.

TZ has been reported by many authors. It is an important landmark for identifying RLN.³ It is seen facing the tracheoesophageal groove.

TZ indicates the point of fusion of ultimobranchial body and principal median thyroid process. TZ is present in most of the thyroid lobes especially large thyroid lobes. Recognition and adequate excision is a necessity for total thyroidectomies.

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MATERIALS AND METHODS

This was a cross sectional study of 153 consecutive total thyroidectomies performed in a single surgical unit in a tertiary care hospital. Inclusion criteria were all cases of primary total thyroidectomies. Patients with re-operative surgery for treatment of recurrent goitre were not included.

All patients undergo a thorough ENT examination prior to surgery for evaluating the function of vocal cords. Thyroidectomies were performed by usual standard approach. After making Kocher's collar incision, subplatysmal flaps were raised and the strap muscles were separated in the midline and retracted laterally. The inferior thyroid vessels were identified in all cases. Capsular dissection was undertaken with ligation of vessels on the capsule. Parathyroid glands were identified and preserved. On retraction of the thyroid lobe medially, the TZ was identified when present. TZ was mobilised by freeing its attachments and then reflecting it medially, usually revealing the RLN and Berry's ligament.

The TZ was identified when present and measured in vivo using a graduated tape. The presence of the TZ was recorded intraoperatively only when a prominent projection was present. The anatomy of TZ and its relation with RLN were also recorded. The size of TZ was graded as per the classification by Pelizzo. Size of right TZ was compared with that of the left.

RESULTS

- Majority of patients with TZ were female; 83% of the study group were female and 19% were male.
- TZ was bilateral in 118 patients.
- TZ was identified on right side in 140 patients and on the left side in 123 cases.
- TZ was posterior and RLN anterior on the right side in one patient.

Grade 0	Unrecognisable
Grade 1	<5 mm
Grade 2	6-10 mm
Grade 3	>10 mm

Table 1. Grading of Tubercle of Zuckerkindl by Pelizzo

Grade	Right TZ	Left TZ
Grade 0	7.84%	18.30%
Grade 1	8.50%	7.19%
Grade 2	31.30%	45.10%
Grade 3	49%	27.45%

Table 2

In 12 cases, there was no tubercle on the right side and it was absent on the left side in 28 cases. Tubercles less than 5 mm were seen on the right side in 13 cases and in 11 cases on the left. Majority of the tubercles seen were of grade 2 and grade 3 on both sides (Table 2).

Tubercle of Zuckerkindl	Mean Size (mm)
TZ Right Side	11.26
SD (Right)	6.016
TZ Left Side	7.87
SD (Left)	5.37

Table 3

Mean size of Zuckerkindl tubercle in our study was 11.26 mm and 7.87 mm on the right and left sides respectively (Table 3).

Mobilisation of a prominent tubercle has surgical importance in nerve identification and completeness of thyroid surgeries.

Figure 1. Recurrent Laryngeal Nerve Running Posterior to Tubercle (Fig. 1) on the Trachea

Figure 2. Intraoperative Measurement of TZ (Fig: 2)

DISCUSSION

"Posterior horn of the thyroid" was described by Otto Wilhelm Madelung in 1857 and "processus posterior glandulae thyroideae" by Emil Zuckerkindl in 1902.^{4,5} Awareness of development of thyroid and its pyramidal remnants and abnormalities associated with TZ is an important requirement for completeness of thyroid surgeries.⁶ Localisation of tubercle has now become mandatory for the completion of total thyroidectomies. Intraoperative identification of tubercle once present is not a difficult task in experienced hands. Due to close proximity of tubercle, superior parathyroid gland may be mistaken for tubercle of Zuckerkindl. It can be differentiated on close verification. The shape, size and location of TZ can vary. Radiological methods are seldom done for localising TZ.

The positioning of the patient is important for surgery to identify the tubercle, which is situated posterolateral to thyroid lobes. Neck should be extended well for easy visualisation of tracheoesophageal groove. The major

relations of the tubercle are the recurrent laryngeal nerve and the inferior thyroid artery and its branches.

Identification of relationship of RLN to TZ is essential for the safety of thyroid surgeries.^{7,8,9} There is a shortage of information of TZ when compared to the quantum of thyroidectomies performed. An enlarged TZ associated with goitre has more surgical importance as it makes the posterior extension in intimate relation with RLN and inferior thyroid artery.¹⁰

Presence of TZ in patients is confirming the importance of TZ as a common anatomical part of thyroid gland. Incidence of TZ in more than 50% patients have been reported by many authors. Mohapatra et al 68%,¹¹ Kaisha et al 59%,¹² Hisham and Lukman 55%, Gauger et al 63% (Grade 3 as 45%). But Page et al have identified TZ in only 7%.¹³

Bilateral incidence of TZ was seen in 118 patients (77.12%) in our study of total thyroidectomy cases. Gauger et al have reported bilateral TZ in 15% of their patients. Patients being operated in our institution usually have large thyroids which may explain the higher incidence of bilaterality in our study. Therefore, in majority of cases this tubercle can affect the completeness of thyroidectomies, especially in the less experienced.

TZ develops from the posterolateral projection of the lateral thyroid rudiment. Delbridge states that completeness or resection can be assured by moving from an anatomically based approach to an embryologically based approach.

Recurrent laryngeal nerve in an uncommon position may affect the safety of thyroid operations. Therefore, surgeons must be aware of this variation to prevent injury to the nerve. Simon's triangle is one of the landmarks utilised for preoperative localisation of RLN, which is bounded by common carotid artery laterally, tracheoesophageal groove medially, and inferior thyroid artery superiorly. But identification of this triangle is not usually easy during difficult thyroid surgeries. In such situations, identification of tubercle of Zuckerkandl has been described as a useful and consistent method for locating the RLN. Anterior course of RLN has the highest risk of injury. In studies by Hisham, RLN was on anterior aspect of tubercle in 6% of dissection. According to Gauger et al, RLN was medial to tubercle in 93% of enlarged TZ and lateral to it in remaining 7% patients. To prevent nerve injury, meticulous dissection around the tubercle is mandatory.

Enlarged TZ can elevate the RLN anteriorly increasing the risk of injury.¹⁴ Superior and inferior parathyroid glands may be elevated anteriorly and is at risk of inadvertent removal or devascularisation.¹⁵

Sherrif et al reported 90.5% women and 9.5% men with TZ in their study¹⁶ whereas it is 83% females and 17% males in our study.

The mean size of TZ, when present, was 11.2 mm on right side and 7.5 mm on the left according to Mehanna et al¹⁷ which coincides with our study where mean size on the right side is 11.26 mm and 7.87 mm on the left side. This indicates that the tubercle of Zuckerkandl when present is prominent and larger on the right side.

CONCLUSION

TZ was found in majority of cases studied. Identification of RLN was done in all cases. A common relationship was observed in all the cases studied except for the right side in

one patient. TZ could be used as an effective landmark for identification of RLN whenever it was present. Excision of TZ should be done carefully to avoid injury to RLN. TZ excision is a necessity for completeness of total thyroidectomies.

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