



## Identification of Levator Glandulae Thyroideae under Loupe Magnification during Thyroidectomy- A Hospital-Based Cross-Sectional Study

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### ABSTRACT

*Levator glandulae thyroideae, an embryological remnant found in association with pyramidal lobe in the thyroid gland is often encountered during thyroidectomy. Complete removal of these structures will prevent the incidence of recurrence. In this context, we studied the use of a surgical loupe in increasing the identification rate of levator glandulae thyroideae. This cross-sectional study was conducted in the department of surgery in a tertiary care centre from February 2015 to July 2015 with data collected from randomly selected patients posted for thyroidectomy. Age, sex, presence of the pyramidal lobes and levator glandulae thyroideae were studied. Statistical analysis was done with R statistical programming software version 3.2.0. There were 45 patients in the study. The median age was 41 years (range 22-57). There were 9(20%) males and 36 (80%) females. Levator glandulae thyroideae was dissected out in 33(73.3%) of the patients. This was attached to pyramidal lobe in 31(93.94%) and only in 2(6.06%) cases it arose from the isthmus. In patients with pyramidal lobe present, 31(83.8%) patients had levator glandulae thyroideae and there was a statistically significant association between pyramidal lobe and levator glandulae thyroideae. This study showed that with the help of a surgical loupe, more than 73 percent of the levator glandulae thyroideae can be dissected out. Inclusion of a magnifying surgical loupe in the surgical armamentarium during routine thyroidectomy could potentially reduce the recurrence of goiter.*

**Keywords:** Loupe magnification, Levator glandulae thyroideae, Pyramidal lobe, Thyroidectomy, Cross-sectional study, Embryological remnant.

## INTRODUCTION

Embryologically thyroid gland is formed by the joining together of a median and two lateral thyroid anlagen<sup>[1]</sup>. The median anlage grows downwards from the tuberculum impar and gets recanalized and joins to the lateral anlage later in the embryological development. The lower part of the connecting stalk becomes the pyramidal lobe if it fails to regress. In many cases, there may be a fibrous band with occasional muscular component that extends from the apex of the pyramidal lobe to the body of the hyoid bone. These remnants, known as levator glandulae thyroideae are the persistent parts of the thyroglossal duct. The prevalence of levator glandulae thyroideae reported in the literature ranges from 43 percent to 50 percent<sup>[2, 3]</sup>. Knowledge about the presence of these remnants and its removal is important during thyroidectomy.

Total thyroidectomy is widely recognized as the procedure of choice in various diseases occurring in the thyroid gland like differentiated carcinoma thyroid, toxic goiter and benign conditions causing pressure effects or cosmetic disfigurement<sup>[4, 5]</sup>. Total thyroidectomy in turn includes removal of the both lobes of the thyroid glands and its embryological appendages<sup>[6]</sup>. Removal of these embryological remnants like pyramidal lobe and its connecting stalk called levator glandulae thyroideae are important from a surgical perspective.

As the levator glandulae thyroideae is not routinely dissected by the majority of surgeons and given the small dimensions, it may be left behind at the time of thyroidectomy. In this context, the importance of application of a surgical loupe in the dissection of these embryological remnants becomes significant. Magnification loupe was advocated in thyroidectomy as an instrument to better identify important structures, thereby reducing complications and recurrence<sup>[7][8][9]</sup>. However, there is no previous study that investigated the use of a loupe in the detection and dissection of

levator glandulae thyroideae. Moreover, most of the literatures about the prevalence of these structures were conducted in cadavers and during postmortem with no evidence from the surgical patients.

This study aims to examine the relevance of a magnification loupe in the intraoperative identification of levator glandulae thyroideae and to find out its identification rate under loupe magnification.

## MATERIALS AND METHODS

Before conducting the study, approval from the institutional ethics committee was obtained. The study was conducted following the declaration of Helsinki. We conducted this hospital-based cross-sectional study in a tertiary care teaching institution in 2015. This observational study is a part of a large study on embryological remnants of thyroid identified during thyroidectomy done under loupe magnification. Using a standard statistical equation, we calculated the sample size as 45 with enough consideration given for potential attrition<sup>[10]</sup>. We recruited all the eligible patients satisfying the inclusion and exclusion criteria randomly from the computerized admission registry. The inclusion criteria comprised patients aged between 13 to 90 years admitted to the department of surgery with various indications for thyroidectomy. Patients excluded were those with recurrent thyroid disease, and those admitted for completion thyroidectomy. Exclusion criteria also included patients admitted with anaplastic carcinoma and those with tracheal infiltration in the preoperative ultrasound or on clinical examination.

Preoperative assessment included detailed clinical examination of the patients and ultrasonological assessment of thyroid and neck. All patients underwent routine preoperative investigations, including thyroid function tests and preoperative vocal cord assessment to document the functional status of the recurrent laryngeal nerves. All patients underwent total thyroidectomy following a capsular approach with removal of the

embryological remnants as described by Delbridge et al<sup>[11][6]</sup>. We followed all steps of the operation in a standardized sequence with the aid of a surgical loupe of magnification 2.5 manufactured by Heine. All patients were operated under general anesthesia. Incisions were made two-finger breadth above the sternal notch preferably in a skin crease line. Upper and lower skin flaps were elevated with help of surgical diathermy in a subplatysmal level. Midline was entered after separating the strap muscles. Lateral lobes were then mobilized. Cricothyroid space was subsequently developed and external laryngeal nerves identified. Superior thyroid vessels were individually clipped or ligated. Tertiary branches of the inferior thyroid artery were sequentially tackled with bipolar diathermy close to the thyroid lobes starting high on the surface of the thyroid gland. Parathyroid along with their vascular supply were kept intact. The recurrent laryngeal nerves were encountered. Zuckerkandl tubercles were identified and removed on both sides. The pyramidal lobes were dissected out when present, and its connection with the thyroid was noted. The levator glandulae thyroideae were explored for. Its presence or absence, origin and attachment were noted. All embryological remnants were meticulously searched and removed. Complete hemostasis were attained and wound closed in layers with a drain. A well-structured case report form was used to collect the data with the help of residents duly trained in data collection. The outcome variables documented were presence or absence of the pyramidal lobes, that of levator glandulae thyroideae, origin and attachment of levator glandulae thyroideae. Demographic variables like age, gender, preoperative diagnosis, fine-needle aspiration biopsy results and pathology were noted. Outcome data were summarized as proportion and percentage of levator glandulae thyroideae identified. Continuous data were summarized with mean and standard deviation. Statistical analysis was performed with R statistical programming

software version 3.2.0<sup>[12]</sup>. T-test and chi-square test with Yates correction were applied for testing the difference and association. All statistical tests were done with p value less than 0.05 as significant. Association between pyramidal lobe and levator glandulae thyroideae was studied.

## RESULTS

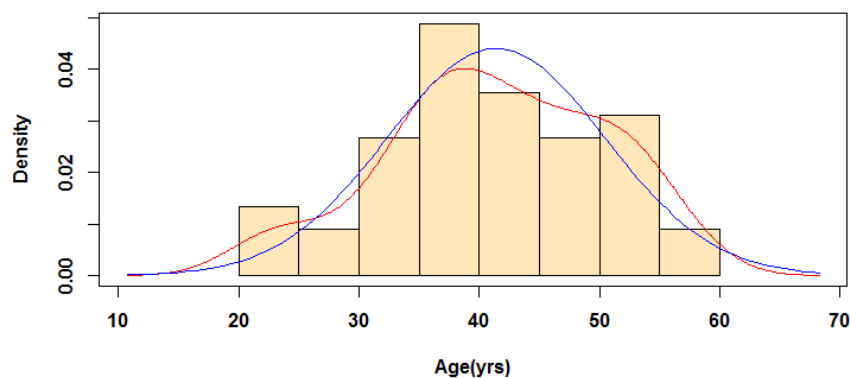
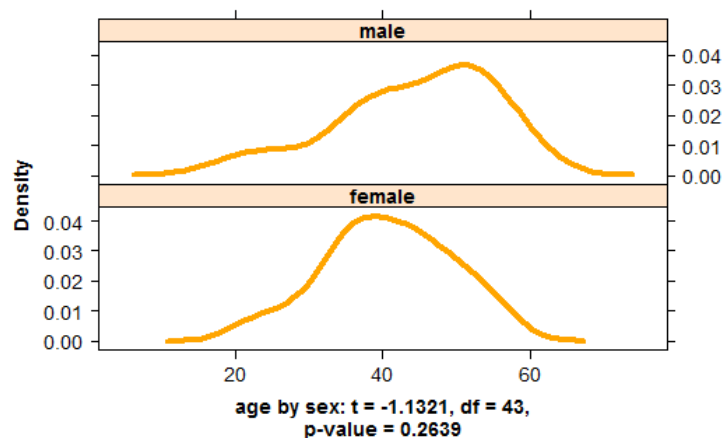
Table 1 shows basic demographic characteristics and preoperative findings of the total patients included in the study. There were 45 patients. The median age and interquartile range was 41+/\_ 12. (Table 2). There were 36(80%) females and 9(20%) males. Levator glandulae thyroideae was present in 33(73.3%) of the patients and absent in 12(26.7%) of the thyroidectomies (Table 3). In these patients, 31(93.94%) had levator glandulae thyroideae arising from the pyramidal lobe and only in 2(6.06%) cases it arose from the isthmus. The mean and standard deviation of age in females were 40.64+/\_ 8.6 and 44.44+/\_10.65 years in males. The mean age of patients with levator glandulae thyroideae present was 40.7+/\_ 9.45 years. The mean age of those with levator absent was 43.33+/\_ 7.8 years.

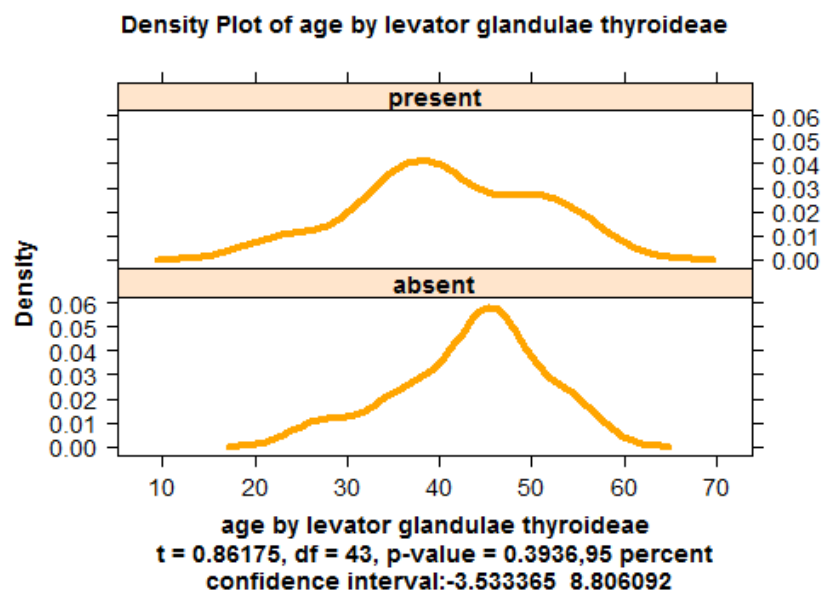
In patients with pyramidal lobe present, levator glandulae thyroideae was present in 31(83.8%) patient and absent in 6(16.2) patients. In those with pyramidal lobe absent, levator glandulae thyroideae was absent in 6(75%) of thyroidectomies and present in 2(25%) of patients. The fibrous band took origin from the isthmus in these two patients who were both females. Levator glandulae thyroideae took origin from pyramidal lobe in the other patients. There was no statistically significant association between age and levator glandulae thyroideae (figure 3). There was a statistically significance association between pyramidal lobe and levator glandulae thyroideae (table 5). There was an association between the presence of levator glandulae thyroideae and pyramidal lobes. The Pearson's Chi-squared test with Yates' continuity correction was 8.81 with p value 0.0029

**Table 1.**Patients'characteristics(percentages in Brackets Unless Stated Otherwise)

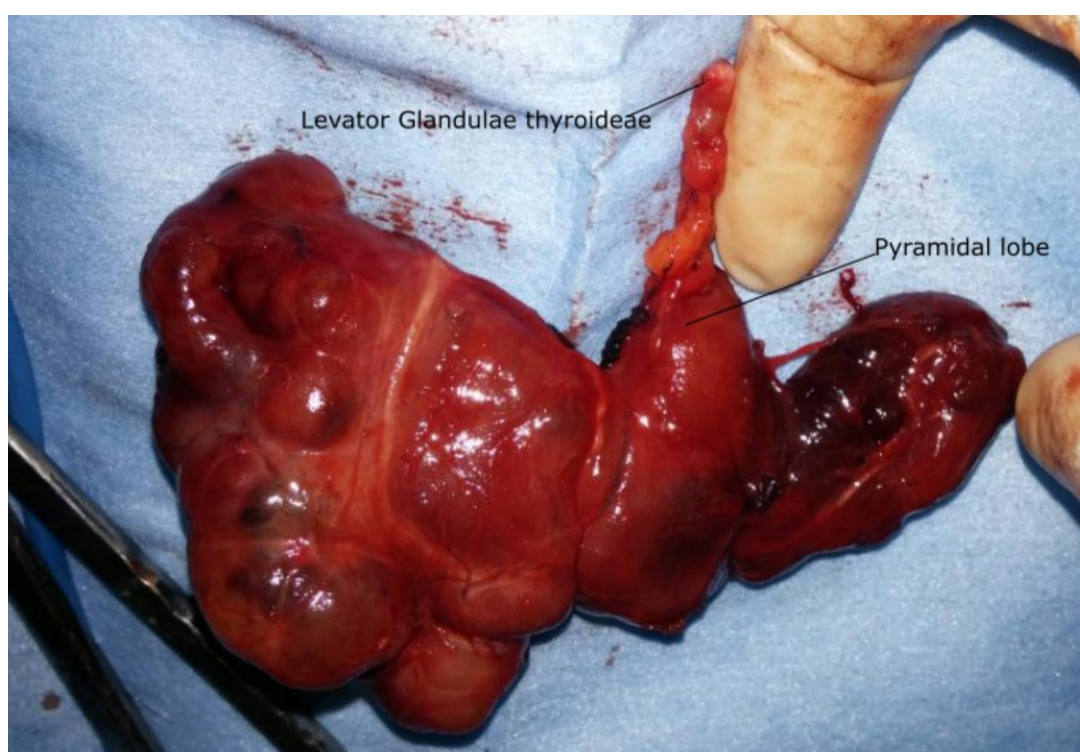
Number of patients	N=45
Gender	
Male	36(80)
female	9(20)
Age,median(IQR <sup>1</sup> )	41(12)
Peroperative data	
Pyramidal lobe	37(82.2)
Origin of pyramidal lobe	
From left	26(70.3)
From isthmus	8(21.6)
From right	3(8.1)
Levator glandulae thyroideae(LGT)	33(73.3)
Origin of levator glandulae thyroideae	
From pyramidal lobe	31(93.9)
From isthmus	2(6.1)

1: IQR inter quartile range

**Histogram of age with Density Plot Overlay(Red) and Normal Curve(Blue)****Figure 1 :** Distribution of age compared to normal distribution curve**Density Plot of age by gender****Figure 2 :** Distribution of age by gender



**Figure : 3** Distribution of age in patients with levator glandulae thyroideae present and absent



**Figure 4 :** thyroidectomy specimen showing levator glandulae thyroideae

**Table 2:** prevalence of levator glandulae thyroideae in the literature

Studies	Study medium	No of patients	Prevalence of LGT <sup>1</sup> In percentage
Ranade <sup>[2]</sup>	cadaver	105	49.5
Sultana et all <sup>[3]</sup>	Post mortum study	60	43.33
Lehr <sup>[13]</sup>	cadaver	203	49
Rajini <sup>[14]</sup>	cadaver	70	32.8
Joshi <sup>[15]</sup>	cadaver	90	30

1 LGT levator glandulae thyroideae



## DISCUSSION

The purpose of this study of the study was to find out the prevalence of the levator glandulae thyroideae in patients undergoing thyroidectomy under loupe magnification. The present study showed that thyroidectomy done under magnification will result in identification and dissection of levator glandulae thyroideae in more than seventy percent of the cases.

The present study was done in surgical patients whereas most of the other studies were anatomical or done in cadavers. The study in cadavers by Ranade et al reported the prevalence of levator glandulae thyroideae as 49.5% <sup>[2]</sup>. The study conducted by Sultana et al in postmortem specimens identified levator glandulae thyroideae in more than 43 percent of the patients <sup>[3]</sup>. The increased identification rate could be due to peroperative use of a magnification loupe. The changes in the tissue postmortem and in cadavers may be other reasons.

Our study demonstrated most of the levator glandulae thyroideae are attached to the pyramidal lobe in more than 93% of the patients. There was a significant association between the two structures. This is consistent with other studies. In studies conducted by sultana et al, levator glandulae thyroideae were found attached to pyramidal lobe in more 80% of the patients <sup>[3]</sup>. The novelty of this study lies in its use of a magnification loupe in the dissection of the embryological remnants like pyramidal lobe and levator glandulae thyroideae. This resulted in increased identification rate of levator glandulae thyroideae. To our knowledge, this is the first study conducted in surgical patients to find out the prevalence of levator glandulae thyroideae with the aid of loupe magnification.

We identified three limitations in our study. This study was conducted as an observational study. This could be a source of potential bias. Presence of missing values in some of the variables is another limitation of this study. It may have influenced the results. The total number of patients included in this study was relatively

smaller compared to other studies. However, we had done a formal sample size calculation before conducting the study.

Intraoperative use of loupe magnification during routine thyroidectomy helps identify and dissect out levator glandulae thyroideae in more than Seventy percent of the benign thyroidectomies. Hence we suggest that adoption of a surgical loupe into the operative workflow during routine thyroidectomy will better identify these embryological structures. It could potentially reduce the recurrence in patients undergoing thyroidectomy. We recommend comparative studies with and without use of a surgical loupe in multicentric setting to quantify the increase in the detection rate with magnification compared to the conventional thyroidectomy.

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