ORIGINAL ARTICLE

Anatomical variation in the origin of inferior thyroid artery and relation with recurrent laryngeal nerve

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ABSTRACT:
BACKGROUND: To identify the variations in site of origin of inferior thyroid artery and its relation with recurrent laryngeal nerve. MATERIAL AND METHOD: A study was undertaken on 33 donated cadavers and through dissection was performed in neck region and both sides of inferior thyroid artery were considered. RESULTS: in present study inferior thyroid artery arise from the thyrocervical trunk in all cases. While in 87.88 % cases the recurrent laryngeal nerve was found posterior to the inferior thyroid artery and in 12.12% cases the recurrent laryngeal nerve was found anterior to the inferior thyroid artery. CONCLUSION: From the present study it is concluded that the knowledge of variation will be useful as reference for surgical procedures like thyroidectomies and reconstruction of aneurysm where ligation of thyroid vessels is essential to prevent complications such as bleeding or damage to laryngeal nerves.

Key words: Inferior thyroid artery, Recurrent laryngeal nerve, Thyroid gland, Thyroid surgery, Variation.

INTRODUCTION
Thyroid gland is the largest endocrine gland. It is highly vascular endocrine gland that plays an important role in the maintenance of the basal metabolic rate of the body.
The inferior thyroid artery normally arises from the thyrocervical trunk which is a branch of first part of subclavian artery. Past studies have reported the incidence of origin of the inferior thyroid artery from the vertebral artery and internal thoracic artery. Absence of inferior thyroid artery (unilateral or bilateral) have also been reported in previous studies. Identification of arterial variation related to the thyroid gland is of great importance in formulating planned surgical approaches to the thyroid gland in alerting the surgeons to avert inadvertent injuries to the vital anatomical structures in this area. Additionally, a detailed knowledge of these explicit arterial variations is extremely helpful while carrying out procedures like carotid angiographies, neck dissections and thyroid resections. The implications of arterial variations of thyroid gland may be important for academic and clinical purposes.

This study was undertaken in an attempt to know the relative frequency of variations in arterial pattern and to compare with similar work done by others.
The aim of the present study was to assess the anatomical variation in the origin of inferior thyroid artery and its relation with recurrent laryngeal nerve.

MATERIAL AND METHODS
This study was conducted on 33 cadavers of known age and sex in the dissection laboratory, department of anatomy, Medical College, Baroda, Gujarat, India. The cadavers were embalmed through carotid arterial perfusion or femoral arterial perfusion. The specimens were studied by gross anatomical dissection. The body was in supine position with neck slightly extended.

A skin incisions made from chin to sternum in midline, the flap of skin reflected inferolaterally and platysma...
reflected upward. The fat and fascia removed from the superficial surface and margins of the sternocleidomastoid. Now the sternocleidomastoid retracted and the deep fascia removed from the anterior belly of diagastric to expose the infrathyroid inferior laryngeal artery trunk/Vertebral thyroid thyroid both The thyroid reach process anterior traced scalenus subclavian thyrocervical muscle its them. jugular expose thyr muscles. Anterior Inferior Recurrent nerve process between the thyrocervical trunk; Inferior thyroid artery was not found absent in any case.

Table-1: Relation Of Ita With Rln

<table>
<thead>
<tr>
<th>Inferior thyroid artery</th>
<th>Right side (n=33)</th>
<th>Left side (n=33)</th>
<th>Total (n=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior to RLN</td>
<td>30 (90.91%)</td>
<td>28 (84.85%)</td>
<td>58 (87.88%)</td>
</tr>
<tr>
<td>Posterior to RLN</td>
<td>03 (9.09%)</td>
<td>05 (15.15%)</td>
<td>08 (12.12%)</td>
</tr>
<tr>
<td>RLN between branches of ITA</td>
<td>00(00%)</td>
<td>00(00%)</td>
<td>00(00%)</td>
</tr>
</tbody>
</table>

muscles. Following reflection of infrathyroid muscles, Sternocleidomastoid muscle was displaced laterally and thyroid gland was exposed. Fascia removed from the lobes of the thyroid gland, exposing its arteries and veins. Fat and carotid sheath removed to expose common carotid artery and internal jugular vein. Vagus nerve found between them. Vagus nerve exposed to find the recurrent laryngeal nerve arising from it as it cross the subclavian artery. The internal thoracic artery and thyrocervical trunk and its branches from first part of the subclavian artery traced. scalenus anterior muscle Pulled laterally to expose thyrocervical trunk, arise from first part of subclavian artery at medial margin of scalenus anterior. Inferior thyroid artery traced along the medial border of scalenus anterior muscle. Just below the transverse process of 7th cervical vertebra it turn medially in front of vertebral artery to reach middle of posterior surface of thyroid gland.

The data collected during dissection on both sides includes the absence of inferior thyroid artery, site of origin of inferior thyroid artery. (fromThyrocervical trunk/Vertebral artery/Subclavian artery/Internal thoracic artery) and relation of inferior thyroid artery to the recurrent laryngeal nerve (anterior or posterior).

RESULTS
In present study,on the right side the inferior thyroid artery found to be anterior to recurrent laryngeal nerve in 90.91% cases and posterior in 9.09% cases. On the left side the inferior thyroid artery found to be anterior to recurrent laryngeal nerve in 84.85% cases and posterior in 15.15% cases. (Photographs-1,2). No recurrent laryngeal nerve was found in between the branches of the inferior thyroid artery on either side.

No variation found in origin and course of inferior thyroid artery. In all cases inferior thyroid artery originated from thyrocervical trunk. Inferior thyroid artery was not found absent in any case.

Photograph-1: Origin of inferior thyroid artery photograph-2: Anterior location of inferior from thyrocervical trunk and posterior location of inferior thyroid artery in relation to recurrent inferior thyroid artery in relation to recurrent laryngeal nerve laryngeal nerve

Abbreviations: Rt.-Right; Lt.-Left; ITA-Inferior thyroid artery; RLN-Recurrent laryngeal nerve; TCT-Thyrocervical trunk; SCA-Subclavian artery.

DISCUSSION
The inferior thyroid artery typically arises from the thyrocervical trunk, less
Anatomical variation in the origin of inferior thyroid artery

frequently from the vertebral artery or internal thoracic artery. One of the typically occurring variations of inferior thyroid artery is its absence, which have been previously reported that may be unilateral or bilateral. In each case the gland was supplied by either a least thyroid artery or a variant descending branch of the superior thyroid artery. Table-2 shows incidence of absent inferior thyroid artery.

Jonathan H. Sherman et al.5 during dissection of an adult male cadaver revealed an absence of the left inferior thyroid artery; its usual area of distribution to the thyroid gland was supplied by the right inferior thyroid artery. The inferior thyroid artery arises commonly from the thyrocervical trunk, passes posterior to the carotid sheath and supplies the inferior pole of the corresponding lobe of the thyroid gland.

Rao TR et al.10 reported a rare case of ectopic thyroid tissue in subhyoid region. In the same case a vascular anomaly was found. The median thyroid tissue was supplied by right and left superior thyroid arteries arising from the respective external carotid artery. The inferior thyroid artery were found to be absent on both sides.

Another variation described is a double inferior thyroid artery. Jiri Sedy4 reported a case of doubled inferior thyroid artery on the right side. He also found an accessory thyroid artery arises from subclavian artery. In present study no such variation was observed.

Table-2 Incidence of absent inferior thyroid artery.

<table>
<thead>
<tr>
<th>Author</th>
<th>Right side</th>
<th>Left side</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases examin ed</td>
<td>Absent artery</td>
</tr>
<tr>
<td>Chandrakal et al[2]</td>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>H Sunanda et al[3]</td>
<td>26</td>
<td>00</td>
</tr>
<tr>
<td>Gandhi O.P[13]</td>
<td>50</td>
<td>1(2%)</td>
</tr>
<tr>
<td>Bowden15 et al.</td>
<td>30</td>
<td>00</td>
</tr>
<tr>
<td>Present author</td>
<td>33</td>
<td>00</td>
</tr>
</tbody>
</table>

The knowledge of the relationship between the recurrent laryngeal nerve and the inferior thyroid artery is also important for the exteriorization of the thyroid lobe. Most authors recognize 3 types of relationships between the inferior thyroid artery and the recurrent laryngeal nerve, as follows:

Inferior thyroid artery anterior to recurrent laryngeal nerve, Inferior thyroid artery posterior to recurrent laryngeal nerve and recurrent laryngeal nerve between branches of inferior thyroid artery.

Table-3 shows position of inferior thyroid artery in relation to the recurrent laryngeal nerve in various studies.

Campos BA et al.1 studied the anatomical relationship between the recurrent laryngeal nerve and the inferior thyroid artery in 76 embalmed corpses, 8 females and 68 males. In both sexes, the recurrent laryngeal nerve lay more frequently between branches of the inferior thyroid artery; it was found in this position in 47.3% of male corpses and 42.8% of female ones. On the right, recurrent laryngeal nerve was found between branches of the inferior thyroid artery in 49.3% of the cases, anterior to it in 38.04%, and posterior in 11.26%. On the left, the recurrent laryngeal nerve lay between branches of the inferior thyroid artery in 44.45%, posterior to the inferior thyroid artery in 37.05%, and anterior to it in 18.05% of the cases.

Patel JP et al.8 conducted Study in 50 patients. The right recurrent laryngeal nerve was posterior to the inferior thyroid artery and its branches in 76% of dissected nerves, while 24% was anterior. The left recurrent laryngeal nerve was posterior to the inferior thyroid artery and its branches in 90% of dissected nerves, while 10% was anterior.

Ozer Makay et al11 observed that on left side, the nerve trunk runs posterior in 71.5%, anterior in 19% and between the branches of inferior thyroid artery in 5.4% cases. On right side, the nerve trunk runs posterior in 64%, anterior in 24% and between the branches of inferior thyroid artery in 7.6% cases.
TABLE-3: Position of ITA in relation to the RLN in various studies

<table>
<thead>
<tr>
<th>Quoting author</th>
<th>Right side (%)</th>
<th>Left side (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anterior</td>
<td>Posterior</td>
</tr>
<tr>
<td>Campos BA et al.[1]</td>
<td>11.26</td>
<td>38.04</td>
</tr>
<tr>
<td>Patel JP et al. [18]</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>Ozar Makay et al.[11]</td>
<td>64.1</td>
<td>24.1</td>
</tr>
<tr>
<td>Present study</td>
<td>90.91</td>
<td>9.09</td>
</tr>
</tbody>
</table>

CONCLUSION
A profound knowledge of the anatomic characteristics and variation of the inferior thyroid artery such as its origin, course and branching patterns is an important value for a safe attempt in suitable position for catheterization and approach for surgeons in planning and performing procedure in neck region. During radical neck surgery, the most feared complication is the rupture of the thyroid vessels and its branches. Iatrogenic injury can be avoided with this knowledge as well as possible anatomic and pathological variation that may exist. The awareness of anatomic variation of the thyroid arteries may also warn the surgeons that during thyroid surgery, external carotid artery ligation in uncontrollable bleeding will not always be sufficient to stop bleeding.

The knowledge of relationship of superior thyroid artery to external superior laryngeal nerve & inferior thyroid artery to recurrent laryngeal nerve is very important for surgeons during thyroid surgeries to avoid injuries to above nerves while ligating superior thyroid artery and inferior thyroid artery.

Description of arterial variations, especially if they are of rare occurrence is important for interpretation within the scope of modern imaging techniques. The surgeon planning a thyroidectomy must be prepared to find variations like ectopic thyroid nodules around the normally-located thyroid gland. Proper identification of vessels is very important in order to avoid major complications. Hence a thorough knowledge of the thyroid anatomy and its associated anatomical variations is very much essential, so that these anomalies are not overlooked in the differential diagnosis.

Some procedures that may result in injury to the recurrent laryngeal nerve are: thyroidectomy, parathyroidectomy, excision of Zenker’s diverticulum, esophagectomy, tracheoplasty, neck dissections, correction of a patent ductus arteriosum, mediastinoscopy, and others.

To avoid the risk of nerve damage during thyroid surgery, a good knowledge of the variations of the recurrent laryngeal nerve is essential. This is important to achieve an undisturbed quality of life for the thyroid patient.

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