Superior Thyroid Artery: its Origin, Length, Relations and Branches

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ABSTRACT

Material and Method: The material for the study comprised of thirty properly embalmed adult human cadavers of either sex procured from the Department of Anatomy, Government Medical College, Amritsar. Thus the study consisted of 60 arteries, 30 from the right side and 30 from the left. Aim: The main aim of the study was to identify the variations in the site of origin, the level of origin, length and its relation with the external laryngeal nerve. Knowledge of these variations is important for planning and conducting surgical procedures on the thyroid gland.

Results and Conclusion: The superior thyroid artery was consistently present in all 30 cadavers on both right and left sides. It was found to be normal in 8 (26.6%) cases, whereas in 22 (73.3%) cases, it was variant in one or the other form. The average length of the superior thyroid artery was 3.56 cm on the right and 3.66 cm on the left side. In a maximum number of cases, the length was observed in the range of 3.0-4.0 cm.

Keywords: Superior Thyroid Artery, Anatomy, Branches

1. INTRODUCTION

The thyroid gland is a unique endocrine gland being largest, having highest rates of blood flow i.e. 5 ml/gm/min under conditions of extreme stimulation(1). This high blood flow is mainly achieved by paired superior and inferior thyroid arteries and anastomotic vessels(2). The superior thyroid artery is the first anterior branch of the external carotid artery just below the greater cornu of the hyoid bone. In some cases, it may arise from the common carotid artery just before its bifurcation in the internal and external branches. Although this is of no consequence in itself, it may confuse the surgeon, resulting in inadvertent ligation of common carotid artery instead of an external carotid artery in certain operations(3). Awareness of this particular anatomical variation may also warn the surgeon that during thyroid surgery the external carotid artery ligation in uncontrollable upper pole bleeding will not always be sufficient to stop hemorrhage(4). Norland(1930) laid stress on the fact that all the arteries supplying the thyroid gland are accompanied by motor nerves to the larynx and thus are in jeopardy during ligation of the thyroid blood supply during thyroidectomy. As the superior thyroid artery descends towards the apex of the lateral lobe of the thyroid gland, it is accompanied by the external branch of superior laryngeal nerve. The nerve is at risk because of its close association with the artery(5). The relation of the external laryngeal nerve to the superior pole of the lateral lobe of the thyroid gland and superior thyroid artery is extremely variable(6). High ligation of superior thyroid artery places the external laryngeal nerve in jeopardy and some cases the superior laryngeal nerve as well. Division of the external laryngeal nerve may produce dysphonia because it denervates the cricothyroid muscle, which assists in the regulation of the pitch. If the superior laryngeal nerve is divided, there is in addition to the motor deficit of external laryngeal nerve palsy, a sensory deficit affecting the distribution of superior laryngeal nerve also occurs which is clinically very
important(3). Securing and ligation of the chief channels of blood supply to the thyroid gland are one of the most important steps in thyroidectomy(7). So an understanding of various anatomical variations in relation to its blood vessels is mandatory. The present study was undertaken to find out the anatomical variations of superior thyroid artery.

2. METHODS

Thirty properly embalmed adult human cadavers of either sex from the material for the study. The cadavers were labeled 1-30 and with suffix ‘M’ for male and ‘F’ for female. The arteries supplying the thyroid gland were cleaned from their origin, with related nerves and following observations were made:

1. The number of superior thyroid artery was noted i.e. whether it is single or double.
2. Origin of superior thyroid artery was noted.
3. The length of artery after straightening was determined by placing an unbraided silk thread along the course of the artery and making the thread with Indian Ink at the two designated points
   a. The midpoint of the width of the artery at its origin.
   b. The point of bifurcation of the artery into its anterior and posterior terminal branches
   c. The thread was then removed from dissection area, was placed along a graduated scale and its length was measured in cm.
4. The level of origin of superior thyroid artery in relation to carotid bifurcation was noted.
5. The course of superior thyroid artery was studied.
6. A number of terminal branches were noted.
7. The length of the anterior branch was measured.
   a. From its point of origin
   b. To a point where its anastomosis with the fellow of opposite side.
8. Termination of the anterior branch was noted.
9. The length of the posterior branch was measured as in the case of anterior branch, and its termination was studied.
10. The relation of superior thyroid artery with external laryngeal nerve was studied.

3. RESULTS

Table (1): showing the source of origin of superior thyroid artery

<table>
<thead>
<tr>
<th>SOURCE OF ORIGIN</th>
<th>NUMBER OF CASES</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) External carotid artery</td>
<td>29</td>
<td>48.33</td>
</tr>
<tr>
<td>b) Carotid bifurcation</td>
<td>21</td>
<td>35.00</td>
</tr>
<tr>
<td>c) Common carotid artery</td>
<td>9</td>
<td>15.00</td>
</tr>
<tr>
<td>d) Thyrolingual trunk</td>
<td>1</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Table (2): showing the level of origin of superior thyroid artery in relation to carotid bifurcation

<table>
<thead>
<tr>
<th>Relation with carotid bifurcation</th>
<th>No. of cases</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Carotid bifurcation</td>
<td>21</td>
<td>35.00</td>
</tr>
<tr>
<td>b) Distal to carotid bifurcation</td>
<td>29</td>
<td>48.33</td>
</tr>
<tr>
<td>c) Proximal to bifurcation</td>
<td>9</td>
<td>15.00</td>
</tr>
<tr>
<td>d) as thyrolingual trunk distal to the carotid bifurcation</td>
<td>1</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Table (3): showing the length of superior thyroid artery, its anterior and posterior branch

<table>
<thead>
<tr>
<th>RANGE</th>
<th>Superior Thyroid Artery</th>
<th>Anterior Branch</th>
<th>Posterior Branch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of cases</td>
<td>%age</td>
<td>No. of cases</td>
</tr>
<tr>
<td>0-1</td>
<td>R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>1-2</td>
<td>R</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>-</td>
<td>21</td>
</tr>
<tr>
<td>2-3</td>
<td>R</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>30.0</td>
<td>4</td>
</tr>
<tr>
<td>3-4</td>
<td>R</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>50.0</td>
<td>2</td>
</tr>
<tr>
<td>4-5</td>
<td>R</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>16.66</td>
<td>1</td>
</tr>
<tr>
<td>Above 5</td>
<td>R</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>3.34</td>
<td>-</td>
</tr>
</tbody>
</table>
Table(4): showing the relation of superior thyroid artery with external laryngeal nerve

<table>
<thead>
<tr>
<th>Relation of nerve with artery</th>
<th>No. of cases</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Posteromedial to artery</td>
<td>51</td>
<td>85.00</td>
</tr>
<tr>
<td>b) Anterior to artery</td>
<td>6</td>
<td>10.00</td>
</tr>
<tr>
<td>c) Intermingled with branches</td>
<td>3</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Fig-1 showing the right superior (RSTA) arising from carotid bifurcation (CB)

Fig -3 Right Superior Thyroid Artery (RSTA) arising as common thyrolingual trunk (CTLT) from external carotid artery

Fig-2 showing a) origin of left superior thyroid artery (LSTA) from a common carotid artery (CCA). b) left external laryngeal nerve (LELN) is passing posterior to left superior thyroid artery (LSTA)

Fig-4 left superior thyroid artery (LSTA) is coming up to left lower pole
4. DISCUSSION

The superior thyroid artery was consistently present in all 30 cadavers on both right and left sides. It was found to be normal in every respect in 8 (26.6%) cases, whereas in 22 (73.3%) it was variant in one or the other form. It arose from the external carotid artery in 29 (48.33%) from carotid bifurcation in 21 (35%), and from common carotid artery in 9 (15%) cases. In one case (1.67%) the superior thyroid artery arose as a common thyrolingual trunk from the external carotid artery. The average length of the superior thyroid artery was 3.56 cm on the right and 3.66 cm on the left side. In a maximum number of cases, the length was observed in the range of 3.0-4.0 cm.

Superior thyroid artery was seen to be arising at a mean distance of 1.5 cm (range of 0.5-3.0 cm) distal to the carotid bifurcation in 29 (48.33%), at the level of carotid bifurcation in 21 (35%) and at a mean distance of 1 cm (range 0.5-1.5 cm) proximal to bifurcation in 9 (15%) cases. In one case (1.67%) case, it arose from the common thyrolingual trunk arose at a distance of 3.0 cm distal to the carotid bifurcation. The origin of superior thyroid artery proximal to the carotid Bifurcation was seen maximum on the left side.

Superior thyroid artery had three terminal branches i.e. anterior, posterior and lateral in 12 (20%), two terminal branches i.e. anterior and posterior in 54 (90%) cases. The average length of the anterior and posterior branch was 2.4 cm and 1.0 cm respectively on the right side and 2.0 cm and 1.26 cm respectively on the left side.

In 70% cases, anterior branches of both right and left sides anastomosed with each other at the upper border of the isthmus resulting in the formation of supra isthmic arch, which may serve as a collateral pathway for the brain in cases of occlusion of the common carotid artery. In 20% cases on the right and 16.6% on the left side, the anterior branch terminated directly in the substance of the gland. In remaining 10% on the right and 13.3% on the left side, the anterior branch went up to the lower pole of the gland to supply it.

The average length of the posterior branch of the superior thyroid artery was 1.0 cm on the right and 1.26 cm on the left side. In 38 (70.4%) cases posterior branch entered the substance of the gland, in 6 (11.1%) it reached up to the lower pole of the gland and in 10 (18.5%) cases it went on the posterior aspect of the gland up to its middle to anastomose with the branches of the inferior thyroid artery thereby resulted in the formation of the longitudinal anastomotic arch.

The external laryngeal nerve at the apex of the thyroid lobe was posteromedial to the superior thyroid artery in 51 (85%), anterior to the artery in 6 (10%) and intermingled with the branches of the artery in 3 (5%) cases. The nerve was safer in cases in which it was posteromedial to the artery while in others where it was either anterior or intermingled with the branches of the artery was in the most dangerous position.

5. CONCLUSION

A thorough knowledge of anatomical variations such as its origin, course, branching pattern and its relation with the external laryngeal nerve is important for surgeons for planning any procedure in the neck region. During radical neck surgery, the most feared complication is rupture of superior thyroid artery and its branches. So, an iatrogenic injury can be avoided with this knowledge. Origin of the superior thyroid artery from the common carotid artery is of no consequence in itself, but it may confuse the surgeon, resulting in inadvertent ligation of the common carotid artery instead of the external carotid artery in certain operations leading to excessive hemorrhage. The knowledge of the relationship of superior thyroid artery to the external laryngeal nerve is very important.
The nerve was safer in cases in which it was posteromedial to the artery while in others where it was either anterior or intermingled with the branches of the artery was in the most dangerous position. So individual ligation of the glandular branches of the superior thyroid artery is recommended as it decreases the risk of the nerve inclusion.

REFERENCES