Anatomical Considerations of the Recurrent Laryngeal Nerve and its Vulnerability during Surgical Procedures of the Neck

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Introduction

- The recurrent laryngeal nerve (RLN) is a branch of the vagus nerve that innervates the intrinsic muscles of the larynx.

- The RLN shows variability in its course and branching pattern, making it vulnerable during surgical procedures of the neck.¹,²

- Lack of knowledge and ignorance of potential anatomical variations may have significant clinical consequences compromising the safety of surgical procedures of the neck, causing patients to experience post-operative symptoms of hoarseness of voice or trouble swallowing.

- Accurate knowledge of variability can prevent iatrogenic injury to the RLN and potentially improve patient outcomes.
Methods

❖ The present study aims to assess the anatomical variations of the RLN which potentially make it vulnerable to injury, compression, or stretch during surgical procedures of the neck. The study also assesses the rationale behind considerations of side preferences during surgical procedures of the neck.

❖ The study was done on 55 (28 male and 27 were female) formalin-fixed cadavers used for dissection as part of the Gross Anatomy courses at Oakland University William Beaumont School of Medicine from 2016-2018.

❖ After critical observation and careful dissection, cadavers with anatomical variations were photographed and the data was analyzed quantitatively and in a descriptive method.

❖ The majority of previous studies performed assessing the RLN’s anatomical variations and landmark structures described only one aspect of the nerve and considered smaller sample sizes. This study tries to address this drawback by considering a comprehensive anatomical approach to show the larger perspective of RLN and its relationship with the surrounding structures using a large sample size of cadavers.
Results:
Extra-laryngeal Branching Patterns

No branching  Bifurcation  Trifurcation  Multiple Branches
Results:
Extra-laryngeal Branching Patterns

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<tr>
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<th>Right side</th>
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<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
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<tr>
<td>Branches</td>
<td>89.09</td>
<td>74.55</td>
</tr>
<tr>
<td>Bifurcation (2)</td>
<td>22</td>
<td>40.00</td>
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<tr>
<td>Trifurcation (3)</td>
<td>15</td>
<td>27.27</td>
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<tr>
<td>Multiple (≥4)</td>
<td>12</td>
<td>21.82</td>
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<tr>
<td>No Branches</td>
<td>6</td>
<td>10.91</td>
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The findings indicated that the branches coming off of the RLN on both the right and left sides, innervating both the esophagus and the trachea in some instances.

On the right side, 89.1% demonstrated anywhere between 2-5 extralaryngeal branches, and 74.6% demonstrated branches on the left.

Using the Fisher’s Exact Test, and following data analysis, it was determined that there is a statistically significant difference in the branching pattern between the two sides.
Results:
Relationship of RLN with the Inferior Thyroid Artery

Posterior

Anterior

In-between
The relationship of the RLN with the inferior thyroid artery was also examined. The nerve was discovered to have a varying relationship with inferior thyroid artery, and can be seen anterior or posterior to it, and even sometimes in between the branches of the artery. 67.9% of right RLN’s were related anteriorly, while 32.1% were related posteriorly. The opposite values were true for the left side, with 67.9% related posteriorly and 32.1% related anteriorly. On the right side, 3.6% of nerves crossed in between branches of inferior thyroid artery, while 5.4% of left RLN’s were found crossing between branches of the inferior thyroid artery.

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<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
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<td>%</td>
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<tr>
<td>Anterior</td>
<td>36</td>
<td>67.92</td>
<td>17</td>
<td>32.08</td>
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<td>2</td>
<td>3.57</td>
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<td>5.36</td>
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Discussion and Conclusion

- The findings demonstrate a significant amount of variability in the course and branching pattern of the RLN, along with its relationship to the inferior thyroid artery.

- The information gained in this study emphasizes the need of special considerations during neck surgeries, including side preference, in order to preserve the extralaryngeal branches of the RLN.

- Anatomical consideration of the variations is essential to:
  - Minimize complications associated with surgical procedures of the neck
  - Determine which approach is the safest. We would recommend preferentially utilizing the left sided approach for anterior cervical spine surgery and being mindful of the proximity of the recurrent laryngeal nerve branches to the anterior thyroidal artery.
Summary Points

- The RLN shows a wide variability in its course and branching pattern, and is not typically dissected and visualized during most of the surgical procedures of the neck, which is why patients might experience postoperative symptoms of hoarseness due to damage or compression to the nerve.

- Accurate knowledge of anatomical variability of the RLN provides information for preventing inadvertent intraoperative injury, improving patient safety, optimizing clinical outcomes, and ultimately guiding best clinical and surgical practice.

- There is a significant amount of variability in the RLN between the right and the left sides, whether it is the course, branching pattern, or relationship to other structures.

- Our hope is to increase awareness of medical professionals on clinically relevant anatomical variations, and how these variations can have implications during surgical procedures. We encourage the identification/localization and intraoperative neuromonitoring of clinically relevant anatomical variations along with ultrasound guidance to prevent iatrogenic injury of the RLN.
References


