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ORIGINAL ARTICLE

The Occurrence, Causes, and Prognosis of Dysphonia and Repeated Injury to the Laryngeal Nerve after Anterior Cervical Spine Surgery

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ABSTRACT

Background: There is a chance of dysphonia and recurrent laryngeal nerve (RLN) injury with anterior cervical spine surgery (ACSS), although it is a successful treatment for many cervical spine problems.

Objective: Aim was to determine the incidence, risk factors, and outcomes of recurrent laryngeal nerve injury and dysphonia following anterior cervical spine surgery.

Methods: Total 164 patients of recurrent laryngeal nerve injury and dysphonia were presented in this study, after getting informed written consent detailed demographics were recorded. All the patients were undergoing for anterior cervical spine surgery. Outcomes were recorded. SPSS 22.0 was used to analyze all data.

Results: There were 96 (58.5%) males and 68 (41.5%) females among all cases. Patients mean age was 48.13 years. Majority of the cases were married. 75 (44.6%) cases were educated. Frequency of RLN was found in 102 (60.7%) cases and dysphonia in 66 (39.3%) cases. Most common risk factor for dysphonia was throat infections and smoking and for RLN was anatomical variations in the nerve's path, thyroid cancer, large goiters and previous neck surgery. Mean duration of surgery in RLN was 112.4 min and in dysphonia was 76.8 minutes. Frequency of complication in RLN was 31 (30.4%) and in dysphonia was 17 (25.8%).

Conclusion: We concluded in this study patients with RLN and dysphonia had high frequency of complications. Most common risk factors were anatomical variations in the nerve's path for RLN and throat infection for dysphonia.

Keywords: RLN, Dysphonia, Anterior cervical spine surgery, Risk factors

INTRODUCTION

Specifically, the vertebral body situated between C3 and T1 has been accessible to surgeons using the anterior approach for the last 70 years[1]. The subaxial cervical spine is best treated with anterior cervical spine surgery (ACSS) because of technological improvements that incorporate imaging and microscopes into surgical treatment, retraction devices, internal fixation, and instrumentation[2]. The trachea, esophagus, cervical sympathetic trunk, superior laryngeal nerve, RLN, auxiliary spinal nerve, and more have all been proposed as possible participants in this approach[3]. Learn more about the anatomy and neuropathy of the larynx to better comprehend laryngeal issues following ACSS[4].

We still don't know what causes RLN palsy after ACDF. A higher frequency of RLN palsy is linked to a right-sided approach. This may be because the RLN is shorter and more oblique on the right side[5], and other risk factors include longer intraoperative periods[6] and female sex. Studies on left- and right-sided ACDF surgeries have revealed conflicting results, with some finding differences and others unable to detect any alterations at all. Similarly, several studies have found a correlation between the frequency of RLN palsy and the number of levels performed. Although several of these studies focus on cervical spine surgery in general rather than ACDF specifically, others have failed to replicate the association[7].

The wide range of reported rates of RLN injury and dysphonia is highlighted in this meta-analysis that drew on research using both subjective and objective techniques of RLN assessment[8]. Dissimilarities in surgical methods, patient populations, and diagnostic criteria are the primary drivers of this diversity. Some studies have utilized subjective symptoms, such as hoarseness or breathiness, to diagnose RLN injury[8–10], while other research have utilized objective procedures, such as laryngoscopy, to demonstrate vocal cord paralysis .The Voice Handicap Index and acoustic analysis are two objective validated tools that are used to assess dysphonia, in addition to subjective patient accounts. The parameters used to assess if an RLN injury is temporary (resolving within six to twelve months) or permanent vary between sources, leading to inconsistent reporting[11]. Although there have been some investigations into possible RLN injury causes, there has been surprisingly little research on factors such as operation duration, implant type, and specific motion segments. Additionally, most research focus on acute concerns, therefore there is a dearth of data regarding the voice's long-term impacts[12]. Objectives include researching the long-term effects of RLN damage and dysphonia on quality of life and identifying risk variables like number of motion segments, implant materials, and surgical time.

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MATERIALS AND METHODS

This randomized controlled was conducted at Department of Orthopedic Surgery Jhalawan Medical College, Khuzdar during July 2022 to March 2023 and comprised 164 patients. After getting informed written consent detailed demographics were recorded. All the patients had RLN and dysphonia and undergoing for anterior cervical spine surgery were included. Patients <20 years of age, patients with any other severe medical injury were excluded.

The patients were gently intubated using a video laryngoscope after they were positioned supine on the operating table. If any abnormalities were found in the vocal chords before intubation, the patient was withdrawn from the study. It was taken care not to bend or extend the patient's neck too much while intubating them. We recorded the ETCPs, or endotracheal tube cuff pressures. If the cuff pressure was 20 mmHg or below, the ETT would record it.

The study just examined the anteromedial approaches. It is common procedure to utilize hand retractors to mobilize sufficient soft tissues, retract the trachea and esophagus medially, and laterally the sternocleidomastoid muscle and carotid sheath up to the prevertebral fascia. This is done to prepare the surgical field following precise dissection. The tracheoesophageal groove and sharp dissections were both avoided. The RLN went unnoticed

throughout. Palpation of the vertebral body enabled the subperiosteal release of the longus colli muscle by delicately separating the prevertebral fascia and anterior longitudinal ligament from the midline. Our clinic frequently makes use of two ACSS automatic retractor systems: Caspar (Aesculap) and Cloward (Codman). The retraction types provided by these systems are specified. The procedure that followed the insertion of the retractor was inflating the ETT cuff to a pressure below 20 mmHg after deflating it. Patients undergoing anterior cervical discectomy and fusion (ACDF) procedures may or may not have had corpectomy with an anterior plate. During the surgery, the surgeon made note of the surgical method as well as the structural variations in the cervical spine of the patients. After the operation, we looked over the results.

RESULTS

There were 96 (58.5%) males and 68 (41.5%) females among all cases. Patients mean age was 48.13 years. Majority of the cases were married. 75 (44.6%) cases were educated. (Table 1).

Table-1: Baseline information of the presented cases

Variables	Frequency	Percentage
Mean age	48.13	
Gender		
Male	96	58.5
Female	68	41.5
Marital Status		
Married	115	68.5
Unmarried	53	31.5
Education status		
Educated	75	44.6
Non-educated	93	55.4

Frequency of RLN was found in 102 (60.7%) cases and dysphonia in 66 (39.3%) cases.(fig 1)

Mean duration of surgery in RLN was 112.4 min and in dysphonia was 76.8 minutes.(Table 1)

Table-2: Duration of surgery

Duration of surgery	Frequency
RLN	112.4
dysphonia	76.8

Most common risk factor for dysphonia was throat infections and smoking and for RLN was anatomical variations in the nerve's path, thyroid cancer, large goiters and previous neck surgery.(table 3)

Table-3: Risk factors among all cases

Variables	Frequency	Percentage
RLN		
anatomical variations in the nerve's path	42	41.2
thyroid cancer	25	24.5
large goiters	20	19.6
previous neck surgery	15	14.7
Dysphonia		
throat infections	25	40.3
smoking	19	30.6
vocal cord problems	18	29.03

Frequency of complication in RLN was 31 (30.4%) and in dysphonia was 17 (25.8%).(Table 4)

Table-4: Complications among both groups

Variables	RLN (102)	Dysphonia (62)
Complications		
Yes	31 (30.4%)	17 (25.8%)
No	71 (69.6%)	45 (76.2%)

DISCUSSION

Concerns about RLN destruction are significant for patients with ACSS[13,14]. Surgical exposure and traction-induced neuropraxia are the two most common causes of RLN injury. Incorrect retractor configuration, excessive laryngeal retraction, postoperative edema, and nerve entrapment by the inflated endotracheal tube cuff are some of the causes of traction injuries, which can lead to localized ischemia. Our research shows that looking at a lot of risk factors is important for understanding what causes RLN injury. Careful attention to these factors can improve surgical outcomes and patient care[15].

From a low of 0.1% to a high of 4%, published research on RLN injuries shows an average incidence of 3.41%. Weaknesses in our assessment methods may account for the large range of RLN injury and dysphonia rates observed in the literature. It is likely that more RLN injuries will be identified in research that employ laryngoscopy to check the neck more extensively compared to studies that rely solely on patients' accounts of symptoms. To address this, we have highlighted the significance of consistent evaluation methodologies for meaningful cross-study comparisons by indicating, if RLN injury was evaluated objectively or subjectively. The results should be interpreted with care because to the wide range, which indicates significant differences between trials. Perhaps due to variations in the patients they evaluated or a smaller sample size, Beutler et al.[16] discovered a lower CI. Apfelbaum et al.[17] offered more comprehensive risk data with over 900 patients compared to Aydın et al.[18] with only 46 people. According to the results heterogeneity, larger patient populations in studies appear to paint a more accurate picture of the hazards of RLN injuries[19]. Larger studies may have overestimated or underestimated these risks. Due to the scarcity of consistent data among studies, it is essential to examine each one according to its unique context and limitations. These variations must be considered in a comprehensive meta-analysis for valid findings to be drawn[20]. Consider that many RLN injuries do not show symptoms until a considerable amount of time has passed. Only cases with a very strong clinical presentation are typically diagnosed following ACCS because routine endoscopy is not performed. This suggests that this is probably a common problem. One of the most consistently demonstrated features across research is that RLN injury is more likely to occur with longer operation durations, particularly those above two hours. The dangers of long-term soft tissue retraction surrounding the RLN, as pointed out by Gokaslan et al. and Beutler et al.[21], include ischemia and nerve damage. Longer operation times are associated with an increased risk of RLN injury, as demonstrated by Apfelbaum[22]. Other factors, such as the surgeon's skill, the patient's anatomy, and the complexity of the operation, are just as important as the amount of time spent in surgery as a risk factor. Take, for example, the correlation between longer surgical times and lower rates of RLN injuries among surgeons with more experience. This finding implies that skill mitigates the risks associated with longer procedures. An increase in the risk of nerve damage is associated with each additional hour of surgery, as shown in Figure 3, which correlates with the overall operation length. These findings are consistent with those, who also discovered that multilevel surgeries posed a higher risk compared to single-level procedures. The amount of time tissues must be retracted during multilayer surgeries increases the danger of nerve ischemia and injury. Defining single-level and multilevel methods more precisely might help with this issue. When considering multilevel surgery for patients, surgeons should proceed with caution, especially for individuals with preexisting conditions that increase the risk of nerve damage[20].

Though cadaveric studies like Rajabian et al.[7] and Heller et al.[9] shed light on anatomy, they don't provide information about clinical results. Although they were omitted from clinical problem-related statistical analyses, their incorporation enhances our anatomical comprehension of the RLN's vulnerability during anterior cervical spine procedures. While this anatomical information may not have a direct correlation with patient outcomes, it does bolster clinical findings by highlighting structural

risk factors that could increase the likelihood of RLN injury in some patients.

CONCLUSION

We concluded in this study patients with RLN and dysphonia had high frequency of complications. Most common risk factors were anatomical variations in the nerve's path for RLN and throat infection for dysphonia.

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