Aerodynamic Phonatory Pattern as a New Sign of Superior Laryngeal Nerve

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INTRODUCTION

Reduced quality of life after thyroid surgery is multifactorial and may include the need of lifelong different treatments. Studies have shown that subjective voice disturbance after thyroidecomy is very common, even without injury to the recurrent laryngeal nerves. One possible cause for postoperative dysphonia is injury to the external branch of the superior laryngeal nerve (EBSLN). The EBSLN supplies the cricothyroid muscle, which acts to lengthen the vocal folds during phonation. Postoperatively, patients with a lesion of the EBSLN typically complain of voice fatigue, problems reaching high-pitch sounds that were used to reach, and the need of an extra effort to speak; they can also complain of various rates of dysphagia. The awareness to these symptoms, that may be subclinical to common people, might be more evident to the so-called “professional speakers”.

Several studies have investigated post-operative rates of EBSLN injury varying from 0 to as much as 58% a result that reflects the need for standardized protocol sloaking forward a more accurate evaluation of this complication, even if the impairments coming from such lesions are the less prone to be improved with specific postoperative treatments. Currently, videostroboscopy and/or electromyography of the cricothyroid are the only instrumental tools that might allow to achieve good diagnostic standards although both are invasive methods, responsible for some discomfort to the patients. The purpose of this study is to describe aerodynamic phonatory features in vocalized patients in order to determine what mechanisms are involved in voice changes in these patients and what are the best rehabilitative options.

METHODS AND MATERIALS

We studied 58 thyroidectomized patients with neither apparent neural cause of thyroidectomy-related dysphonia nor recurrent laryngeal nerve injury nor external branch of the EBSLN injury. The patients were asked to produce sustained vowels, syllables, and sentences. Three items were recorded in upright and sitting positions. We ask every patient for a sustained phonation of Spanish vowels /a/ & /i/. The syllables: /pa/ & /pi/ and two sentences: “Papá pinta la pared de color púrpura con la pintura que compró por la tarde” “El domingo por la mañana voy a la bodega de mi hermano, a mediodía mi hermano y yo bebemos vino”.

During each task the subject held the pneumotachograph mask (Rothemerg Mask) firmly in place over the nose and mouth with the pressure tube between the lips (Figure 1). Acoustic and aerodynamic measurements were made: fundamental frequency, jitter, shimmer, intensity, harmonic/noise ratio, spectrographic analysis, subglottic pressure, mean transglottic flow, and laryngeal resistance (Figure 2).

Maximum phonation time, speech rate and articulation rate were also registered. All measurements were made using Voice Plus from Alamed Corporation software. Recording was done in the Voice Research Laboratory (a quiet non-sound treated room approximately 5’4”) at the Otolaryngology Head and Neck Surgery Department of the University of Navarra. The four Signals pressure, flow, sound pressure-microphone, electrogito-tograph were digitized by an A/D converted board (DT 2821). The digitized signal was imported to the Alamed Voice Plus Analysis System on a PC for the aerodynamic study. The acoustic analysis was ma-de with SoundSope on G4 Mac computer. Intensity was evaluated with a sonometer or sound level meter. STATA software was used to analyze variables.

RESULTS

We describe 2 different groups (Figures 3 & 4) of patients with different aerodynamic pattern in voice production that correlate with voice quality. In 66% of patients there was no change (group A) and in 34% (group B) the glottal pressure and laryngeal resistance decreased as a result of lower tension in the vocal fold as a consequence of an injury of the EBSLN (Table 1).

<table>
<thead>
<tr>
<th>Subglottic pressure (mm H₂O)</th>
<th>Mean</th>
<th>Std-error</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Thyroidectomy</td>
<td>93.27</td>
<td>4.48</td>
<td>84.26</td>
<td>120.29</td>
</tr>
<tr>
<td>Post Thyroidectomy</td>
<td>72.43</td>
<td>4.22</td>
<td>63.94</td>
<td>80.93</td>
</tr>
</tbody>
</table>

Table 1. Group B subglottal pressure values. P<0.02

DISCUSSION-CONCLUSIONS

Postoperative voice changes may be an important part of the outcome of the patients undergoing thyroidectomy. Deterioration and amelioration of acoustic parameters can be observed, and those changes may occur differently among male and female patients. Physicians should take the patient’s sex into consideration when informing the patient about possible voice alterations after thyroidectomy. Preoperative and postoperative acoustic and aerodynamic analyses may be helpful in revealing any voice abnormality already present before the surgery and any possible alteration occurring after the surgery. Aerodynamic phonatory pattern characterizing by subglottal pressure and laryngeal resistance decreased as a result of lower tension in the vocal could be a new sign of EBSLN injury.

REFERENCES