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Research Article

Patient Perception of Swallowing after Thyroidectomy in the Absence of Laryngeal Nerve Injury

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Keywords
Thyroidectomy · Swallowing disorders · Laryngeal nerves · Thyroidectomy · Quality of life

Abstract
Introduction: Swallowing and voice alterations may manifest in patients with thyroid disease, especially after thyroidectomy. ***Objective:*** To identify the prevalence of patients with complaints of swallowing disorders after thyroidectomy and to evaluate patients' perceptions regarding swallowing before and after the procedure. ***Methods:*** A prospective longitudinal study was performed with 26 consecutive patients undergoing a private service thyroidectomy, in which the presence of swallowing dysfunction was evaluated using validated questionnaires that addressed the perception of swallowing by patients before (on the day of surgery) and after the surgery (on the first postoperative day). ***Results:*** Of the 26 patients, 18 (69.2%) were subjected to total thyroidectomy and 8 to partial thyroidectomy. Analysis of the domains of the Swallowing Handicap Index questionnaire showed higher scores when evalu-

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ated on the first postoperative day, demonstrating a significant worsening in swallowing after the procedure. The same result was demonstrated for the final score of swallowing perception, with 15.3 and 30.8% of patients reporting moderate alterations before and after the thyroidectomy, respectively, and 11.5% reporting the alterations as severe. Swallowing and vocal symptoms on the first postoperative day were more prevalent in the procedure than previously mentioned. Eight patients (30.8%) noted swallowing alterations before the procedure, compared with 80.8% (21 cases) after thyroidectomy. ***Conclusion:*** There was a prevalence of 42.3% in swallowing complaints on the first postoperative day, regardless of the lesion in the laryngeal innervation, and this prevalence was significantly higher than that prior to the procedure.

Introduction

Knowledge of physiological thyroid gland changes and the advancement of diagnostic imaging render the detection of thyroid diseases increasingly possible. Conditions such as suspected malignancy, confirmed malignancy, substernal goiter, tracheal or laryngeal compression, clinically uncontrolled hyperthyroidism, and compromised esthetics are some of the most frequent indications for total or partial thyroid gland resection, a procedure known as thyroidectomy [1].

Thyroidectomy is a safe procedure with low complication rates, with dysphonia due to laryngeal nerve injury and hypocalcemia being the most frequent complications [2]. Recent studies have shown that even in cases of preservation of the superior and recurrent laryngeal nerves, complaints of voice changes and difficulty and/or discomfort during swallowing are still observed [3–9]. In most cases, these symptoms may be transient [10], but there is a persistence of symptoms in some patients [11–13].

Dysphagia is possibly a fairly prevalent symptom, but it is rarely assessed or valued in the postoperative period. Thus, it is important to know the rate of this complaint post-thyroidectomy, as well as to study its causes. In addition, few studies have evaluated this symptom early, on the first postoperative day [14–16], which is perhaps the period of greatest patient complaint after this surgery, thus demonstrating the importance of researching this subject.

Thus, the objectives of the present study were to evaluate the patient perception of swallowing before and after thyroidectomy and to identify the prevalence of patients with complaints of swallowing changes post-thyroidectomy without involvement of the laryngeal nerve or any structure that may affect swallowing.

Methods

This was a prospective longitudinal study of consecutive patients undergoing thyroidectomy in a private service setting, in whom the presence of swallowing dysfunction was evaluated through the application of validated questionnaires that address the patient's perception of swallowing before (on the day of the surgery) and after (on the first postoperative day) the surgery.

All patients included in the study underwent laryngoscopy before the surgery and on the first postoperative day to evaluate laryngeal and vocal fold mobility using a 70° rigid telescope (Karl Storz®, Baden-Württemberg, Germany).

The inclusion criteria were the following: patients over 18 years of age, of both sexes, who underwent thyroidectomy using the conventional Kocher technique. The exclusion criteria were as follows: patients who did not agree to participate in the study or who refused to sign the informed consent form and those aged over 75 years, as well as those who had a previous neck surgery, a goiter greater than 60 cc (cubic

centimeters) and/or substernal/intrathoracic goiter, hyperthyroidism, uncompensated hypothyroidism at the time of surgery, compressive symptoms (dysphagia, odynophagia, globus pharyngeus, choking and regurgitation), injury of any laryngeal nerve during surgery (documented macroscopically or by loss of signal during neurophysiological monitoring) and/or any complications that could affect swallowing (e.g., cartilage resection or neck hematoma), intraoperative complications that could generate exaggerated manipulation of the surgical bed (e.g., the need for tracheostomy), preoperative laryngeal nerve involvement and/or any change in laryngeal mobility that could impair swallowing as evaluated by preoperative laryngoscopy, previously diagnosed neurological abnormalities and/or difficulty understanding simple orders that may impair the patient's ability to correctly complete the questionnaire, a history of gastroesophageal reflux disease and use of drugs to treat this condition or of dyspepsia, and signs of pharyngolaryngeal reflux on preoperative laryngoscopy (laryngeal hyperemia or edema, especially of the interarytenoid space, arytenoids, and posterior commissure). Patients who had altered laryngeal mobility on the first postoperative day (paresis or paralysis), evaluated by laryngoscopy, were also excluded from the study.

Demographic and anthropometric data, extent of surgery, need for neck dissection of the central compartment, thyroid size on ultrasound, indication for thyroidectomy, histological diagnosis, use of a neck drain, and postoperative evolution were documented.

Questionnaires

The questionnaires were filled out by the patients themselves without the help of third parties. While the questionnaires were being completed, the researcher was available for clarification of any concerns related to the instructions and questions, without influencing the answers. The questionnaires were administered on the day of the thyroidectomy before administration of the preanesthetic medication and on the first postoperative day (approximately 20–24 h after the procedure). As analysis tools, the following questionnaires were used:

Dysphagia Handicap Index (DHI)

Developed by Silbergleit et al. (2012) [17] and validated for Portuguese by de Souza (2014) [18], the DHI identifies success or failure in swallowing rehabilitation. It has a total of 25 items subdivided into three domains: emotional (7 items), functional (9 items) and physical (9 items). The score in each domain was calculated by summing the scores of the questions. Each item has three options: never (0 points), sometimes (2 points), and always (4 points). In addition to this evaluation, there is also an item in which the patient evaluates his or her difficulty swallowing on a scale of 1–7, corresponding to normal (scores 1 or 2), moderate problem (scores 3, 4, or 5) and severe problem (scores 6 or 7), i.e., the higher the score, the worse the quality of swallowing.

Upper Aerodigestive Symptoms Questionnaire Adapted for Pre-Thyroidectomy (UADS)

This is a specific questionnaire, developed by Silva et al. (2006) [4, 19], that covers the main symptoms after thyroidectomy. In this questionnaire, upper airway symptoms post-thyroidectomy are divided into two groups: vocal symptoms and swallowing symptoms. It contains 16 questions on the grade of symptoms (6 related to the voice and 10 related to swallowing). The complaints presented by the patient were classified as not a problem, a minor problem, a moderate problem, or a major problem. Upper airway symptoms classified as "not a problem" or a "minor problem" were considered symptoms associated with a low degree of discomfort. Symptoms classified as a "moderate problem" or "major problem" were considered symptoms associated with a high degree of discomfort. There is no overall score calculation for the questionnaire. In the present study, the version adapted by Oliveira (2015) [20] was used to determine if these symptoms were already present before the thyroidectomy.

Perioperative Care

All patients were evaluated by the same anesthesiologist and received 0.75 mg/kg of intramuscular midazolam administered 30 min prior to the procedure.

Anesthesia induction was performed after 20-gauge peripheral venous catheterization and preoxygenation for 5 min with a 100% oxygen-inspired fraction (FiO_2) by face mask. Induction of anesthesia was performed with intravenous administration of a 20-μg/kg fentanyl bolus, 2.5 mg/kg propofol (slowly) and a 0.1-mg/kg cisatracurium bolus. After 10 min of facial mask ventilation and a bispectral index (BIS; neurological activity monitoring) below 40, tracheal intubation was performed. The mechanical ventilation param-

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eters were a tidal volume of 8 mL/kg, positive end-expiratory pressure of 5 mm Hg, respiratory rate to maintain capnography between 30 and 35 mm Hg, and FiO_2 of 50% (oxygen and air). Anesthesia was maintained by continuous infusion of propofol at a mean dose of 0.05 mg/kg/min and remifentanil 0.5 μg/kg/min to maintain the BIS below 60 and a mean arterial blood pressure of 10–20% below awake baseline levels. No additional doses of fentanyl or cisatracurium were administered. For intraoperative hydration, Ringer's lactate was infused at 5 mL/kg/h.

Following induction, the following intravenous medications were administered: pantoprazole 40 mg, cefazolin 2 g, ketorolac 30 mg, ondansetron 8 mg, and dexamethasone 10 mg. All patients underwent intraoperative neurophysiological monitoring of laryngeal nerves, stimulated with 0.5 mA.

At the end of the surgery, the patients were carefully extubated to avoid coughing and then transferred to the Post-Anesthesia Care Unit, where they were maintained with oxygen nebulization at 5 L/min, head elevation at 30°, and nalbuphine 0.15 mg/kg as needed for pain.

The prescription for the ward included a general diet, and the patient was free to request any food texture that he/she preferred, as well as the following intravenous medications: pantoprazole 40 mg once daily, dipyrone 1 g 8/8 h, nalbuphine 0.2 mg/kg 6/6 h for pain (visual analog scale over 3), and ondansetron 8 mg 8/8 h, as well as oral codeine 30 mg 8/8 h.

Sample Size Estimation

To calculate the required number of patients for the study, the study of Arakawa-Sugueno et al. (2015) [13] was used as the reference. In that study, the authors evaluated swallowing disorders in a sample of 54 consecutive patients comparing the preoperative indices with evaluations from the seventh postoperative day. Rates of 4 and 55.5%, respectively, were found for swallowing disorders in the preoperative period and 7 days after surgery. Thus, assuming that the rate of preoperative swallowing complaints is 10% (the selection criteria of the present study are more restrictive) and that these rates are even higher (approximately 60%) on the first postoperative day, because it was an earlier evaluation, we calculated a sample size of 26 patients by adopting a two-tailed test with 80% power and a 5% significance level.

Statistical Analysis

The results obtained in the questionnaire were analyzed in Microsoft Excel®. The distributions were defined as nonparametric by the Kolmogorov-Smirnov test. The values obtained by the study of each quantitative variable were organized and described using the mean and standard deviation, in addition to the median and interquartile range. For the qualitative variables, absolute and relative frequencies were used. The paired groups were compared by the Wilcoxon test for the quantitative variables and by the McNemar test for the qualitative variables. All analyses were performed in SPSS® version 17.0 (SPSS® Inc., Chicago, IL, USA), and a significance level of less than 5% ($p < 0.05$) was adopted.

Results

The present study included 28 consecutive patients undergoing thyroidectomy for nodular goiter with suspicion of malignancy or thyroid cancer. Two patients were excluded from the analysis, one due to a neck hematoma in the immediate postoperative period and another due to loss of unilateral signal in the inferior laryngeal nerve during the procedure and consequent vocal fold paralysis on the first postoperative day. Thus, the group consisted of 26 patients, in accordance with the required sample size.

The group consisted mainly of women between the fifth and sixth decades of life with a medium-volume goiter on ultrasound. The preferentially performed procedure was total thyroidectomy, and only one patient required concurrent central compartment dissection. No patient received neck drainage, and the mean surgical time was 1 h and 20 min. The descriptive data for all patients included in the study are shown in Table 1.

The analysis of the domains of the DHI showed higher rates when assessed on the first postoperative day, showing a clear worsening in swallowing after the procedure (Table 2). The same result was found for the final swallowing perception score; specifically, 15.3%

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Table 1. Characterization of the 26 patients regarding the demographic, clinical, and surgical variables

Variable	Result
Sex	
Male	3 (11.5)
Female	23 (88.5)
Age, years	46.5±11.9 (26–73)
Weight, kg	76.7±13.2 (56–103)
Height, m	1.64±0.08 (1.50–1.80)
BMI, kg/m^2	28.6±3.9 (21.5–36.8)
Goiter volume on ultrasound, cc	22.7±18.7 (6.2–59.0)
Indication for surgery	
Suspected malignancy	21 (80.8)
Thyroid cancer	5 (19.2)
Comorbidities	9 (34.6)
Surgery performed	
Total thyroidectomy	18 (69.2)
Partial thyroidectomy	8 (30.8)
Central compartment dissection	1 (3.8)
Use of neck drain	0 (0.0)
Surgery time, min	78.9±19.5 (40–120)

Data are presented as *n* (%) or mean ± standard deviation (min–max).

Table 2. Comparison of the Dysphagia Handicap Index (HDI) score before and after thyroidectomy

Domain	Before procedure	After procedure	*p**
Emotional	0.08±0.392 (0–2)	1.54±3.501 (0 -16)	0.008
Functional	0.77±2.046 (0–8)	4.31±6.240 (0–22)	<0.001
Physical	3.00±3.847 (0–12)	5.77±5.256 (0–20)	0.027
Overall perception	1.35±0.846 (1–4)	2.58±1.677 (1-7)	<0.001

Data are presented as mean ± standard deviation (min–max). * Wilcoxon test.

reported moderate problems, and no patients complained of severe problems with swallowing prior to the procedure, compared with 30.8 and 11.5% after thyroidectomy, respectively, or 42.3% in total (approximately 3-fold higher).

The presence of swallowing and vocal symptoms on the first postoperative day was more prevalent than previously reported (Fig. 1–3). Eight patients (30.8%) reported changes in swallowing before the procedure, compared with 80.8% (21 cases) after thyroidectomy ($p < 0.001$, McNemar test), including odynophagia, dysphagia, choking, dry mouth, or throat clearing (Table 3). Similarly, vocal complaints, such as vocal fatigue, hoarseness, or changes in voice pitch, were reported in 34.6% (9 cases) and 69.2% (18 cases) of patients, respectively, before and after the surgery ($p = 0.013$, McNemar test), although there were no changes in vocal fold mobility.

Associated changes in swallowing and voice were observed in 5 patients (19.2%) before thyroidectomy and in 17 patients (65.3%) after thyroidectomy; however, in the preoperative period, 3 patients (11.5%) presented only swallowing disorders, and 4 (15.3%) presented only vocal changes. After thyroidectomy, 4 patients (15.3%) presented only swallowing abnormalities, and 1 patient (4%) presented only vocal changes. Thus, in the vast majority of cases, the swallowing and vocal functions are associated (Table 3).

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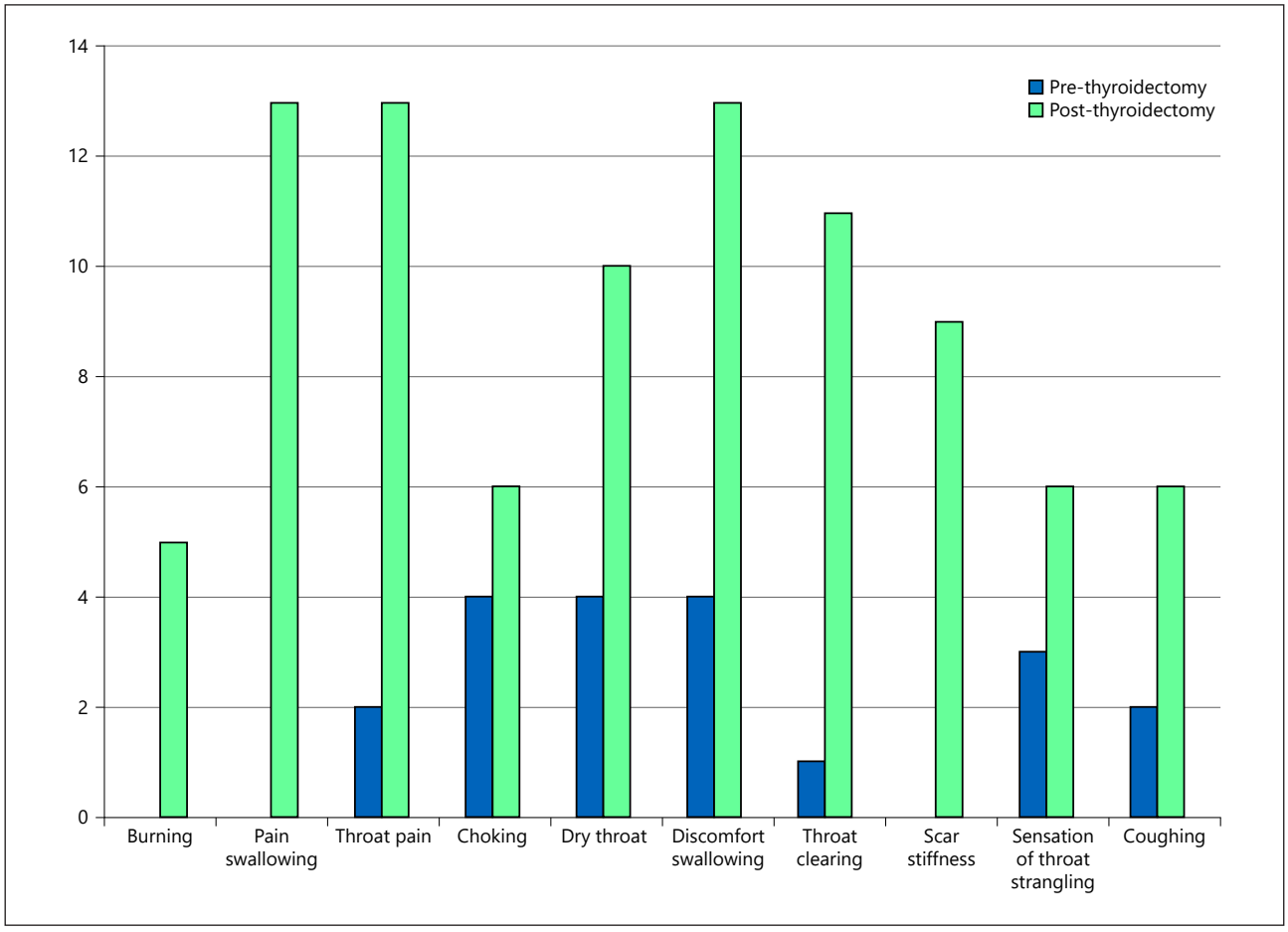

Fig. 1. Swallowing symptoms (upper aerodigestive pathways) before and after thyroidectomy.

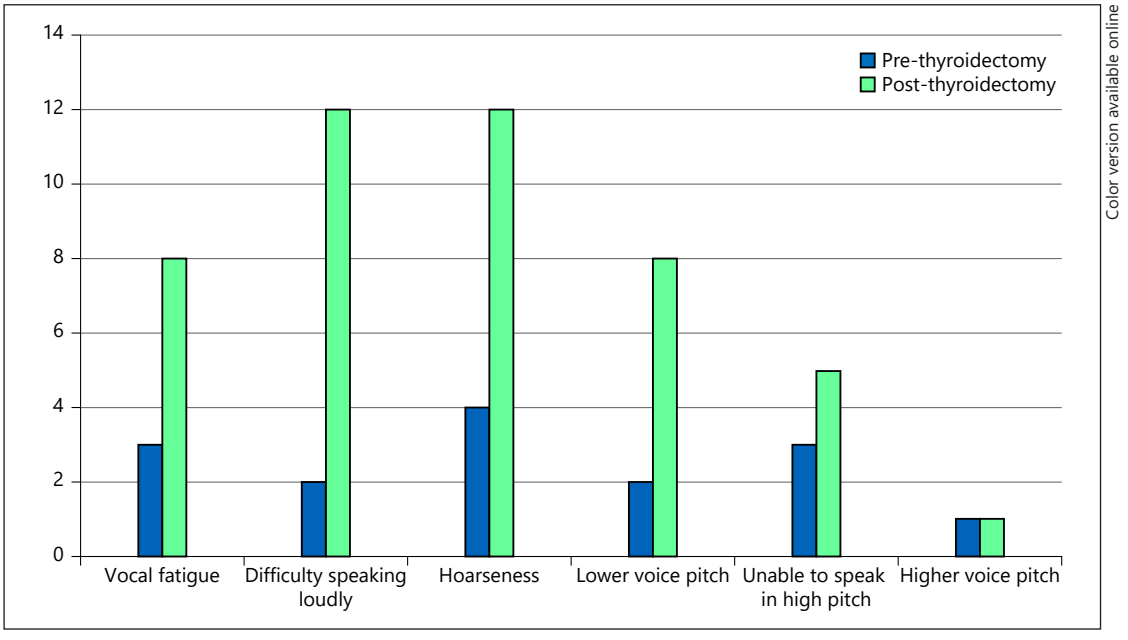

Fig. 2. Vocal symptoms (upper aerodigestive pathways) before and after thyroidectomy.

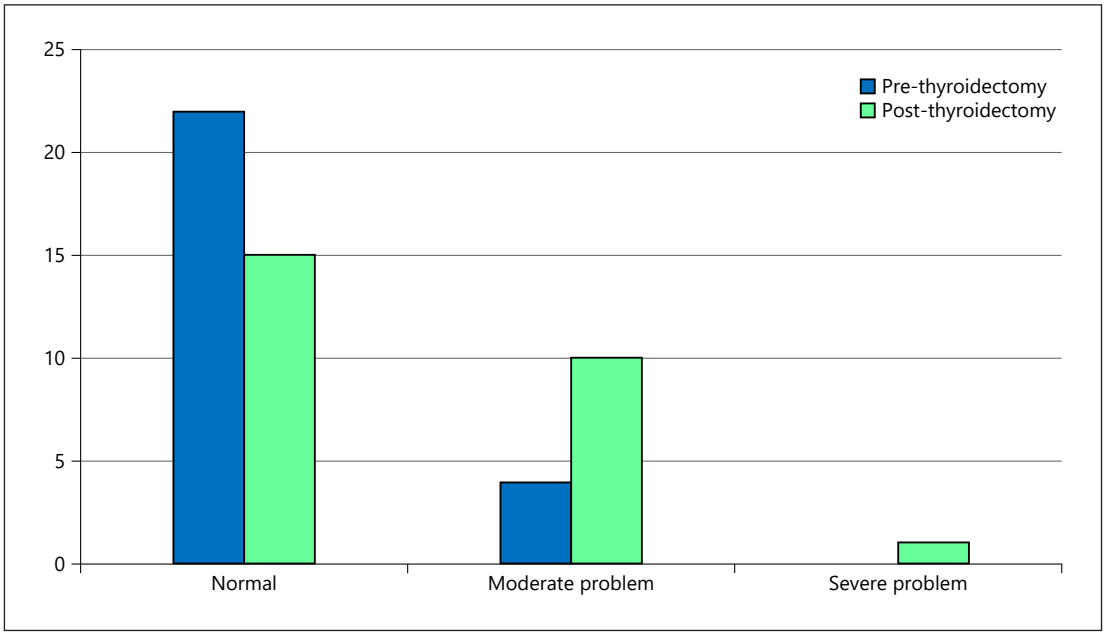

Fig. 3. Severity of swallowing difficulty according to the Dysphagia Handicap Index (DHI) before and after thyroidectomy.

Table 3. Characterization of vocal and swallowing symptoms before and after thyroidectomy

Symptoms	Before procedure	After procedure	*p**
Vocal	9 (34.6)	18 (69.2)	0.013
Swallowing	8 (30.8)	21 (80.8)	<0.001
Combined speech and swallowing symptoms	5 (19.2)	17 (65.4)	<0.001

Data are presented as *n* (%). * McNemar test.

Discussion

Damage to the superior or recurrent laryngeal nerves is a possible complication after thyroidectomy, which can lead to vocal and/or swallowing changes [6, 21, 22].

Many hypotheses have been raised to explain the presence of symptoms without the apparent involvement of the nerves, such as surgical trauma, change in vascularization and venous drainage of the larynx, localized neck pain, cricothyroid muscle dysfunction, malfunctioning of the muscles in the region or thyroid nerve plexus injury, intraoperative injury of the thin anastomosis branches connecting the inferior laryngeal nerve and the external branch of the superior laryngeal nerve and/or one of its anastomoses with the sympathetic cervical chain, laryngotracheal fixation with vertical movement impairment, and psychological reaction to surgery. Some studies relate the sensation of discomfort in the neck and the presence of swallowing complaints with the presence of the nodule and its respective size. The manipulation of the perithyroid muscles, as well as intubation and healing, may be the possible causes of vocal and swallowing worsening in the immediate postoperative period [12, 13, 19, 23–26].

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In the present study, 30.8% of patients (8 patients) had dysphagia in the preoperative period, and 80.8% (21 patients) presented dysphagia in the immediate postoperative period, values close to those found by Krekeler et al. (2018) [27], who found dysphagia in 80% of patients (20 cases) after 2 weeks, in 42% (11 patients) at 6 weeks, and in 17% (4 individuals) at 6 months in a qualitative study with 26 patients. These rates were lower than those found by Senise et al. (2009) [21], who found an incidence of dysphagia of 87.5% 12 days after thyroidectomy. Compared with the study by Arakawa-Sugueno et al. (2015) [13], a higher incidence of swallowing disorders was found in our study, as that study reported dysphagia in 44% of the sample 7 days after surgery and in 25% 60 days after surgery.

Most studies in this population are still focused on the preservation of vocal function, with few articles on swallowing disorders in the pre- and post-thyroidectomy periods. Furthermore, there is significant variability in the methods employed, especially with regard to the most adequate period for performing the evaluations [8, 13, 27, 28]. It is evident that, regardless of how long after surgery the postoperative evaluation occurs – 2 h; 1 day; on the 7th, 12th, or 60th day; 1, 3, or 6 months; or 4 years [6, 15, 24, 27, 29, 30–35] – the presence of upper airway, vocal and/or swallowing sensory disorders is found, suggesting that this alteration is not directly related to the existence of complications due to intubation, although Peppard and Dickens (1983) [36] and Pereira et al. (2003) [24] reported that swallowing function can be altered due to the modification of the sensitivity of the intraoral, pharyngeal, and laryngeal region resulting from intubation.

In the analysis of the DHI, which considers the physical, functional, and emotional domains, it was also found that, in most cases, the difficulty presented in the preoperative period remains in the postoperative period, but in a more intensified manner, as also mentioned by Lombardi et al. (2009) [11], who reported that in the first postoperative week, the symptoms are significantly greater compared with those in the preoperative period and that, in the long term, the changes gradually decrease. These data support the proposal that patients should be evaluated earlier, on the first postoperative day or even during hospitalization.

In the UADS questionnaire, there was a lower incidence of vocal and/or swallowing complaints both in the preoperative period and on the first postoperative day (except for the symptoms of "throat clearing") compared with that found in the study of Araújo et al. (2017) [8], who used the same protocol but with 12 patients. In our study, the vocal symptom with the highest incidence in the preoperative period was "hoarseness" (15.3%), which had an incidence of 46.1% in the postoperative period. Regarding swallowing symptoms, the most frequent preoperative complaints were "choking," "dry throat," and "swallowing discomfort," detected in 15.3% of patients. In the postoperative period, the highest incidence was found for "throat clearing," observed in 42.3% of patients. In the study by Araújo et al. (2017) [8], the symptom with the highest incidence in the preoperative period was "vocal fatigue" (41.7%; 33.3% in the postoperative period). "Hoarseness" was found in 33.3% of patients (4 patients) in the pre- and 50% in the postoperative period. Regarding swallowing, the symptom with the highest incidence was "sensation of foreign body in the pharynx" (41.7% pre- and 25.0% postoperatively). The percentage of "throat clearing" was 41.7% in the pre- and 25% in the postoperative period. Although there is a difference in the postoperative evaluation time between the analyses of approximately 89 days between the present study and the work of Araújo et al. (2017) [8], there was practically no difference between the findings, supporting the reasoning that intubation is not the only causal factor associated with swallowing changes. This conclusion was also mentioned by Silva et al. (2006) [4] and Pereira et al. (2003) [24], who stated that symptoms manifested in the long term after thyroidectomy are not due to orotracheal intubation.

The findings of the present study suggest that greater attention should be paid to patients in the preoperative period and especially in the early postoperative period (first day), thus

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preventing further discomfort. Proper preoperative guidelines regarding the most adequate food consistency, airway protection maneuvers, and reduction in vocal effort may provide greater patient safety and comfort, as swallowing and vocal changes are often associated.

It should be emphasized that the purpose of this study was to evaluate patient perception of swallowing and to identify the prevalence of change in this function; thus, a priori clinical or objective speech-language assessment through videofluoroscopy or any other technological resource was unnecessary.

Although the DHI was developed to evaluate the success or failure of the speech-language therapy process, it was used in this study to also evaluate its applicability in diagnosis before and after surgery. It was found that it is also effective in evaluating worsening in swallowing, although it was developed for this purpose. Supporting this suggested use is the finding that the results obtained through this protocol were similar to those found with the UADS questionnaire.

The fact that this study did not have a control group limits the conclusions regarding the actual cause of swallowing disorders after thyroidectomy, given that other surgeries, such as spine, lung, cardiac, esophageal, gastric, bariatric, or posterior fossa surgery, may also result in swallowing dysfunction due to other factors, according to a review of the literature by Vansant et al. (2016) [37]. For this reason, a future study will be performed with a control group not undergoing surgery in the neck region to avoid this potential bias.

It is suggested that patients should be advised of the possibility of vocal changes prior to surgery, regardless of the occurrence of laryngeal nerve damage during thyroidectomy, a suggestion also made by Tedla et al. (2016) [33]. In addition to the guidelines on vocal aspects, the present study also reveals the importance of orienting patients regarding swallowing aspects, as several studies, including the present study, indicate that there is a possibility of dysphagia in this population [6, 28, 29, 31, 38, 39].

Conclusion

Through the results of the present study, it can be concluded that swallowing changes can occur before and/or after thyroidectomy, regardless of injury to the laryngeal nerves. The most frequent swallowing changes found in this study were odynophagia, dysphagia, choking, dry mouth, and throat clearing.

There was a prevalence of 42.3% of swallowing complaints on the first postoperative day of thyroidectomy, regardless of injury to laryngeal nerves, and this rate was significantly higher than that in the period before the procedure.

Statement of Ethics

All patients enrolled in the study signed an informed consent form after approval was granted from the Research Ethics Committee of the Faculdade de Medicina do ABC (No. 79215817.1.0000.0082).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Nivia Maria da Silva Martins: study conception and manuscript writing. Elaine Shizue Novalo-Goto and Isabel Cristina Maldonado Diz-Leme: patient recruitment and study monitoring. Tais Goulart: responsible for anesthesiological care. Rodrigo Perez Ranzatti: responsible for postoperative care. Ana Kober Nogueira Leite: responsible for laryngoscopies. Rogério Aparecido Dedivitis: study conception and manuscript review. Leandro Luongo Matos: study conception, statistical analysis, and manuscript writing.

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