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Cohort Study

Evaluation of one-year incidence of vocal dysfunction and associated demographic factors in thyroidectomy patients: A descriptive analytical study

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ABSTRACT

Background: Voice changes are common complaint following thyroidectomy that might or might not be associated with laryngeal nerve damage. Objective: The aim of this study is to evaluate the effect thyroidectomy on voice alteration and its association with gender and age.

Methods: In this descriptive analytical study, patients who underwent thyroidectomy at (XXX) without laryngeal nerve damage were included. These patients were evaluated based on subjective (self-reported) and objective (videostroboscopy) voice assessment. The data was collected immediately after the surgery and 6 months after the surgery during the follow-up.

Results: Of 76 patients included, the mean age of patients was 46.3 year. 25 (43.4%) were males and 51 (56.6%) were female. 28.9% patients were presented with apparent damage to the vocal cords, of which 8 (10.5) had voice changes. There was no statistically significant difference between sex and postoperative vocal cord dysfunction ($P = 0.592$). However, in male gender, late postoperative voice changes were significantly more, $p = 0.013$. The age was also not associated with immediate or late postoperative changes and damage to vocal cords, $p > 0.05$.

Conclusion: Our study reported that male gender can be an important factor in deterring voice changes after thyroidectomy nonetheless, it can not predict the risk of vocal cord damage. Furthermore, age might not a risk factor either. Studies with greater sample size are required to confirm these findings.

1. Introduction

In past three decade, the rate of thyroid surgery has surged to three times. Recurrent laryngeal nerve injury is one of the most common complications of the surgery [1]. Alteration in voice, hypoparathyroidism and swallowing difficulties are common problem following thyroidectomy [2]. Provided that thyroidectomy is the most frequently performed endocrine surgery, these dysfunctions are reported in a large number of patients [3]. Alterations in voice after the surgery may or may not be related to the nerve injury and it incidence varies from 25 to 87% [4]. These changes can be in the form of transient voice fatigue and permanent dysphonia [2]. Inability to produce high pitch sound, huskiness, and reduced voice pitch are seen in the form of voice alteration after the surgery [5]. Compared to immediate postoperative outcomes, voice complaint may reduce in these patients within the course of 6 months [6].

A recent study conducted on 2297 patients showed that loss of pitch is associated with advanced age, increased body mass index, female gender, short stature and greater positive lymph node ratio [7]. A number of assessment tool are designed patients to determine voice-related problems after the surgery such as thyroidectomy-related voice questionnaire [8], acoustic voice analysis, voice handicap index, voice symptom scale and dysphonia severity index [9–11]. In order to measure short term voice alteration post-thyroidectomy, several objective and subjective methods are utilized [12]. Some studies have shown that robotic thyroidectomy has superior outcomes in terms of acoustic

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parameters and alteration in the voice [13].

The aim of this study is to evaluate voice changes among patients who underwent thyroidectomy and associated demographic factors.

2. Methods

In this descriptive-analytical study, all patients with thyroid disease who referred to (XXX) from January 2019–December 2019, and underwent total thyroidectomy were included in the study after obtaining written consent. Inclusion criteria were patients who were indicated for thyroidectomy after diagnosis of thyroid disease. Patients must have had surgery within the six months of the study period. At the end of each surgery, all patients were evaluated by the surgeon by direct laryngoscopy for damage to the vocal cords, and the presence of any possible injury removed the patient from the research cycle. Patients with speech disorders or history of speech disorders, and history of neck surgeries were excluded from the study.

We examined the subjective and objective methods. In the subjective evaluation, questions related to speech problems, such as change of tone, splitting, or lowering of the voice were evaluated. We invited patients to the speech center where they underwent videostroboscopy by a speech therapist. The results of this step were classified as objective changes.

Patients with laryngeal injury for any reason other than thyroidectomy, history of neck surgery, intubation, tracheostomy and neck trauma after the surgery and those with speech problems and aphonia before surgery were excluded.

All patients were thoroughly examined by a surgeon and their history and paraclinical information were recorded in the file. The required information, like any positive or negative laryngoscopic report obtained during surgery, was collected from the patients' files in the archives of the hospital. Laryngoscopic report before and after surgery, patients' history and examination results were carefully compared with stroboscopic results. The demographic information of the patients along with the clinical data, history, and paraclinical and stroboscopic results were entered into the checklist by the researcher.

Stroboscopic method is used to objectively evaluate patients' vocal-laryngeal injuries. Videostroboscopy is one of the laryngeal imaging methods that can be used to accurately photograph the movement of the vocal cords. In this specialized method, the vibration of the vocal cords is evaluated. High-speed, controlled light flashes are used to assess the patient's voice frequency. The images obtained through these light flashes provide us the slow motion of the vibrations of the vocal cords during the production of sounds. Because the vibrations of the vocal cords are the main source of our sound production, the stroboscope is the best tool for assessing the presence of lumps or irregularities in the vocal cords (such as the presence of reciprocal neurological disorders). Videostroboscopy is by far the best tool for examining disorders such as polyps, nodules, cysts, scars, and other lesions that affect the vibrations of the vocal cords.

After collecting the required information, descriptive statistics, calculation of central indicators and dispersion for quantitative and frequency variables and percentage for qualitative variables were used to describe the data. Relative risk and 95% confidence were calculated using logistic regression. All statistical tests were performed using SPSS software version 22. $P < 0.05$ was considered as a significant level.

This study was approved by the Research Ethics Board of (XXX).

The work has been reported in line with the STROCSS criteria [14].

3. Results

In this study, 76 patients underwent thyroidectomy. The mean age of patients was 46.3 years (20–80 years). Of total patients, 25 were male (43.4) and 51 were female (56.6). Other clinical and demographic characteristics are shown in Table 1.

28.9% of the people who underwent thyroidectomy had damage to the vocal cords, of which 8 (10.5) had a voice change where 4 had mild changes, 2 had moderate voice changes and 2 had severe voice changes. All these patients were presented with the change in voice, 6 months after the study. No case of immediate change was observed (Fig. 1).

Table 1
Frequency distribution of demographic and clinical characteristics of the subjects.

Factors		Number	Percent
Age	45yr>	33	43.4
	45yr<	43	56.6
Sex	Male	25	32.9
	Female	51	67.1
damage to vocal cords	Yes	22	28.9
	No	54	71.1
vocal cord dysfunction	Yes	8	10.5
	No	68	89.5

Chi-Square test was used to evaluate the relationship between independent variables (sex and age) and dependent variables (vocal cord dysfunction, change in sound, late damage to vocal cords). There was a statistically significant difference between sex and postoperative vocal cord dysfunction ($P = 0.013$) where the incidence was higher in men than women, 32% vs 25.5% (Table 2). Among patients aged below 45 and 45 and above, the subjective change in the voice was not significantly different, 27.3% vs 27.9%, respectively, $p = 1$.

There was a statistically significant difference between sex and late postoperative damage to the vocal cords ($P = 0.013$) and the incidence of vocal cord dysfunction was higher in men than women 24% vs 3.9% (Table 3). Among the two age groups, the incidence of late postoperative damage to the vocal cords was not significantly different, $p = 0.283$.

4. Discussion

The results of this study showed that patients who underwent thyroidectomy were more likely to suffer from late damage to the vocal cords (100% of all the cases). Studies have indicated that early voice change following thyroidectomy is common with the incidence of 41–47% [15,16].

Stojadinovic, Shaha [17] conducted a study evaluating voice function after thyroidectomy 54 patients. The outcomes of the study showed that 15% patients had subjective early postoperative voice changes whereas 14% patient developed late voice changes (3-month). The objective changes were more than 3 objective changes is associated with persistent voice change at 3-month. However, none of the patients had laryngeal nerve injury. In a study conducted on 46 patients who underwent total thyroidectomy, Sinagra, Montesinos [18] reported that

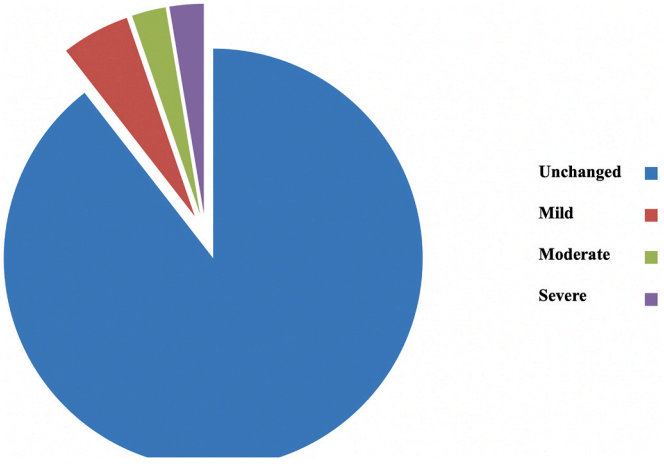

Fig. 1. The incidence of visual dysfunction and the quality of these changes.

Table 2
Relationship between independent variables (age/sex) and vocal cord disorders.

Type/Factors		vocal cord dysfunction		p-value
		Yes(N%)	No(N%)	
Sex	Male	6 (24)	19 (76)	0.013
	Female	2 (3.9)	49 (86.1)	
Age	45yr>	5 (15.2)	28 (84.8)	0.283
	45yr<	3 (7)	40 (93)	

Table 3
Relationship between independent variables (age/sex) and late damage to vocal cords.

Type/Factors		vocal cord dysfunction		p-value
		Yes(N%)	No(N%)	
Sex	Male	6 (24)	19 (76)	0.013
	Female	2 (3.9)	49 (86.1)	
Age	45yr>	5 (15.2)	28 (84.8)	0.283
	45yr<	3 (7)	40 (93)	

87% patients stated changes in their voice following the surgery, particularly when using loud pitch, or during singing. A study by Akyildiz, Ogut [11] showed that alterations in acoustic parameters are significant following thyroidectomy where these alteration are greater in female gender. Conversely, vocal cord dysfunction was significantly greater in men in our study. Sahli, Canner [19], in a recent study, indicated that voice changes after thyroidectomy was seen in 16% patients (148 from 924 total patients). The main findings of the study showed that age can play a significant role in these alterations. These results are not parallel with our findings. The sample size of our study was relatively smaller, which could suggest these differences. Findings from the relationship between late injury and gender showed that the incidence of late injury is higher in men than women (24% vs. 4%). Mohil et al. [20] also showed that women do not suffer long-term damage if the nerve is preserved during surgery. A study by Brockmann, Storck [21] showed that quieter phonation in men is associated with increased jitter and shimmer. Therefore, inability to control loudness might have contributed to increased incidence of dysfunction in men in our study.

Papadakis, Asimakopoulou [22] performed objective and subjective evaluation of speech alteration after thyroidectomy and reported that voice changes are significant following postoperative 1-week. These changes are seen in the form of GRBAS (Grade, Roughness, Breathiness, Asthenia, Strain) score and voice handicap index. The objective and subjective changes were significantly correlated. Furthermore, patients older than 40 years showed greater alterations in acoustic and aerodynamic parameters on 8th postoperative week. Our study does not report age-related difference in voice changes. Huang, Yu [23] also reported that age might not be associated with voice change post-thyroidectomy, however, female gender may be an important factor in determining the impairment.

Our study is limited to small sample size and limited number of parameters were recorded to evaluate speech alteration. We recommend study with greater sample size; control group and various other parameters should be conducted in this area.

5. Conclusion

From this study, it can be concluded that age cannot be a predictor of voice changes and dysfunction after thyroidectomy. However, the incidence of voice changes and vocal cord damage is significantly higher in men. Future studies including other demographic parameters like smoking and drug status and evaluating more parameter related to voice changes can provide better conclusion.

6. Provenance and peer review

Not commissioned, externally peer-reviewed.

Research ethics

This study was approved by the Research Ethics Board of Lorestan University of Medical Sciences (IR.LUMS.REC.1397.188). https://ethics.research.ac.ir/ProposalCertificateEn.php?id=50341&Print=true&NoPrintHeader=true&NoPrintFooter=true&NoPrintPageBorder=true&LetterPrint=true.

Ethical approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent to participate

From the under 16 years old was given by a parent or legal guardian.

Consent for publication

Not applicable.

Availability of data and material

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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Contributors' statement page

Dr. Morteza Azadbakht: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Saleh Azadbakht and Dr. Hossein Chitgarchari: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Ali Pooria: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

Registration of research studies

Name of the registry: Lorestan University of Medical Sciences.

Unique Identifying number or registration ID: IR.LUMS.REC.1397.188.

Hyperlink to the registration (must be publicly accessible): https://ethics.research.ac.ir/ProposalCertificateEn.php?id=50341&Print=true&NoPrintHeader=true&NoPrintFooter=true&NoPrintPageBorder=true&LetterPrint=true.

Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish Morteza Azadbakht.

Declaration of competing interest

The authors deny any conflict of interest in any terms or by any means during the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.01.020.

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