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FLEXIBLE FIBREOPTIC LARYNGOSCOPY VERSUS SIMPLE VOICE ASSESSMENT IN A ROUTINE CLINICAL SETTING TO PREDICT VOCAL CORD PARALYSIS AFTER THYROID SURGERY

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Abstract

Backgrounds: Thyroid disease has a high prevalence in the general population, with a female predominance. Thyroidectomy is a very frequently performed surgical procedure for the treatment of benign and malignant nodules. The intricate and delicate anatomical structures for voice production lie in proximity to the thyroid gland and are vulnerable during operations on the thyroid.

Aims and objectives: To find predictive value of vocal cord palsy as observed by simple voice assessment following thyroid surgery using flexible fibreoptic laryngoscopy as gold standard.

Materials and Method: This was a prospective observational study. 42 diagnosed cases of thyroid swelling that were undergone different modalities of thyroidectomy from February 2009 to January 2010

were enrolled in study. Age, sex, geographical distribution, vocal cord status and post operative voice changes at 5th and 30th days were recorded and analyzed.

Results: Age range was 15 to 63 yrs. Female to male ratio was 5:1. Sensitivity, specificity, positive predictive value, negative predictive value of subjective and objective voice change to predict vocal cord palsy at 5^{th} postoperative day were 70% and 80%, 75% and 81.3%, 46.67% and 57.14%, 88.89% and 92.85% respectively, at 30^{th} postoperative day were 71.42% and 85.71%, 88. 57% and 85.71%, 55% and 54.54%, 93.93% and 96.77% respectively.

Conclusions: Prediction of postoperative vocal cord palsy could not be done with simple voice assessment.

Key words: laryngoscopy, recurrent laryngeal nerve, thyroidectomy, voice change

INTRODUCTION

Thyroidectomy is a very frequently used surgical procedure for the treatment of benign and malignant nodules. Approximately 80,000 thyroid surgeries are performed each year in the United States. Thyroid disease has a high prevalence in the general population with a female predominance. The intricate and delicate anatomic structures for voice production lie in proximity to the thyroid gland and are vulnerable during operations on the thyroid [1]

The recurrent laryngeal nerve (RLN) must be identified and dissected completely in the thyroid region during surgery, in order to preserve it from iatrogenic injury. Since the most frequent post thyroidectomy complication is RLN injury, the routine exposure and preservation of this important structure should become a standard procedure during thyroidectomy[2].

Preoperative and postoperative laryngoscopy is considered by many authors to be a standard preoperative assessment in all patients who undergo thyroid surgery[3-5]. Preoperative laryngoscopy should confirm normal vocal fold (VF) mobility and detect other pathologies that may be amenable to treatment before thyroidectomy. Postoperative laryngoscopy is recommended mainly for diagnostic and medico-legal reasons. Moreover, postoperative laryngoscopy is advocated to assess the rate of RLN palsies as one of the main criteria for surgical quality[6].

The German Society of Surgeons advocates the routine use of a preoperative and postoperative laryngoscopy in all patients who undergo thyroid surgery[7]. Preoperative and postoperative voice changes can be considered to be clinical signs of VF palsy (VFP); though, a unilateral VFP may be detected in asymptomatic patients as well[7].

Postoperative laryngoscopy can diagnose a temporary or permanent vocal cord injury, which clearly helps the thyroid surgeon to recognize intraoperative complications and make efforts to avoid similar events in the future. This approach also helps the operating surgeon to analyze his or her nerve injury-related complication rate[8].

Based on prior reports, recurrent laryngeal nerve injury varies from 1.8%[15] to 13.3%[9] and the external branch of superior laryngeal nerve injury varies from 5% to 28% [10-12]. However, other alterations in voice quality can be found even in the cases with preserved function of laryngeal nerves [13-15]. In such cases, previous studies reported that voice alteration after thyroidectomy could be secondary to laryngeal edema, vocal fold bowing, orotracheal intubation trauma, extralaryngeal strap muscles damage or temporary malfunction of these muscles, and laryngotracheal fixation, which impairs the larynx vertical movement [16-21]. The most usual complaints are roughness, volume alteration, and vocal fatigue, which may have an important impact on the patient's professional and social life.

METHODOLOGY

This prospective observational study was conducted in Department of Otorhinolaryngology and head and neck surgery, B. P. Koirala Institute of Health Sciences, Dharan, during a period of one year from January 2009 to January 2010.

Patient's selection:

A total of 42 patients diagnosed clinically as thyroid goiter, who were subjected to surgery, were taken up for this study. These patients were picked up randomly who were admitted in Otolaryngology and Head and Neck Surgery ward. Written consents from the patients were obtained.

The patients included in the study were: 1) Patients diagnosed clinically as having Thyroid goiter (benign or malignant) 2) Patients with normal Thyroid Function tests 3) Patients of any age, sex and demographic distribution. The patients with history of previous surgery in the thyroid, parathyroid and larynx, history of irradiation in the head and neck region in the past, abnormal laryngeal examination i.e. vocal cords palsy preoperatively, voice changes preoperatively, maximum phonation time < 10 sec, hearing loss were excluded from the study.

Ethical approval:

Ethical approval was obtained from the ethical committee of B. P. Koirala Institute of health sciences.

Preoperative & postoperative assessment:

1. Subjective Voice assessment:

All patients were informed to note their voice preoperatively and postoperatively. Patients were assessed by standard voice questionnaire prior to surgery and again on the 5th and 30th postoperative day, if either the patient or examiner perceived any change in voice was recorded as abnormal.

Table 1: The standard voice questionnaire proposed to patients:[20]

1. Is your voice considered to be normal (by you and your family and friends?) before thyroid surgery? • Yes • No
2. Is your voice considered to be normal (by you and your Family and friends?) after thyroid surgery? 0n 5th postoperative day? • Yes • No
3. Is your voice considered to be normal (by you and your Family and friends) after thyroid surgery? 0n 30th postoperative day • Yes • No

Objective voice assessment:

Preoperative and postoperative voice of patients was recorded by canon voice recorder, made in Japan, keeping patient at 30 cm distance and 45 degree to mouth, to prevent overstimulation from the breath stream, in silent room[22-23]. The acoustic signal was digitized, analyzed, and stored and Multi Dimensional Voice Program (MDVP) praat voice analyzer software. The assessments of maximum phonation frequency range (MPFR, Hz) were done. Another measure of vocal capacity is the maximum phonation time (MPT), a measure of the ability to regulate ventilator and laryngeal systems for voice production independent of a frequency or intensity target[24]. MPT was obtained by having the patient sustain the vowel "a" for as long as possible on a single breath. The longest of three attempts was recorded as the maximum phonation time. Criteria for change in voice: if maximum phonation time < 10 sec. and / or Maximum Phonatory frequency range lowered >25% to baseline [15].

Vocal cord assessment: Preoperative and post operative vocal cord status was assessed by Indirect Laryngoscopy (IL) and flexible laryngoscopy (FOL). Flexible endoscope used was Olympus endoscope AR-T12E /ENF TYPE T3 of diameter 4mm with Olympus video system OTV-SC, halogen light source CLH-2,

and Sony LCD monitor, Sony color video printer, Japan. Procedures were carrying out by Consultant Otolaryngologist.

Operative technique: All cases of thyroid swellings irrespective of diagnosis after complete investigations and PAC were taken up for thyroidectomy under general anesthesia. Operations were performed by experienced surgeons. Type of thyroidectomy was selected flexibly depending upon individual patient, pre-operative evaluation and findings, extent of disease and anatomical variations.

Statistical analysis: Data was entered in the MS Excel and analyzed using the Statistical Package for Social Sciences (SPSS-17) for Windows. Demographic data were calculated in percentages and sensitivity, specificity, positive predictive value, negative predictive value were calculated for vocal cord palsy [25].

RESULTS:

Age and sex Distribution: Among 42 patients, which include the age range from 15 years to 63 years, the thyroid goiter was most common i.e. 29 (69%) patients in the age group of 20 to 50 years. 35 (83.3%) of the patients were female and 7 (16.3%) were male.

Presenting complaints: The commonest mode of presentation was swelling in the thyroid region. 38 patients presented with thyroid swellings. Two patients presented with pain and two with discomfort in the throat in addition to the thyroid swellings. One of the patients had cervical lymphadenopathy. On examination 27 (64.30%) patients had their nodules on right lobe of thyroid gland, eight (19.04%) had on the left side, seven (16.66%) had on the bilateral thyroid lobes. The majority of the patients, 24 (57.1%) patients come for the treatment in less than 12 months of presentation and 18 (42.9%) only after more than 12 months of presentation.

Type of surgery: Maximum number of patient underwent hemithyroidectomy i.e. 30 (66.7%) and subtotal thyroidectomy and total thyroidectomy 6 (14.3%) and 8 (19%) respectively. A total of 56 RLN were

taken for the study and among them 51 nerves could be identified, traced the course and surgical anatomy studied intraoperatively.

Voice changes on subjective assessment at 5th POD:

Among 42 patient 15 (35.71%) had change in voice on subjective voice assessment in which only 7 patient had vocal cord palsy on flexible fibreoptic laryngoscopy. In group of patient who were asymptomatic (no change in voice) having vocal cord palsy in 3 patient on flexible fibreoptic laryngoscopy. (Table-3)

Table -3: subjective voice changes vs. vocal cord status on FOL

Subjective voice change on 5th postoperative day	Vocal cord status on FOL		Total
	PALSY	MOBILE	
YES	7	8	15
NO	3	24	27
Total	10	32	42

Voice Changes on objective assessment at 5th POD: Among 42 patient 14 (33.33%) had change in voice on objective voice assessment in which only 8 patient had vocal cord palsy on flexible fibreoptic laryngoscopy. Out of 28 patients who were asymptomatic (no change in voice), vocal cord palsy was seen in 2 patients on flexible fibreoptic laryngoscopy. (Table-4)

Table -4: Objective voice changes vs vocal cord status on FOL

Objective voice change on 5th postoperative day	Vocal cord status on FOL		Total
	PALSY	MOBILE	
YES	8	6	14
NO	2	26	28
Total	10	32	42

Voice changes on subjective assessment at 30th POD: Among 42 patient 9 (21.42%) had change in voice on subjective voice assessment at 30th postoperative day in which only 7 patient had vocal cord palsy on flexible fibreoptic laryngoscopy. It means that 5 patients' voice improved and 3 patients' vocal cord palsy recovered from 5th postoperative day. In group of patient who were asymptomatic (no change in voice), 2 patients still had vocal cord palsy on flexible fibreoptic laryngoscopy as compared to 3 patients on 5th postoperative day. (Table-5)

Table -5: subjective voice changes vs. vocal cord status on FOL

Subjective voice change on 30th postoperative day	Vocal cord status on FOL		Total
	PALSY	MOBILE	
YES	5	4	9
NO	2	31	33
Total	7	35	42

This study showed that the subjective voice assessment test had sensitivity – 71.42%, specificity – 88.57%, accuracy rate – 83.33%, positive predictive value – 55%, negative predictive value - 93.93% to detect vocal cord palsy after thyroidectomy at 30th postoperative day.

Voice Changes on objective assessment at 30th POD: Among 42 patient 11 (26.19%) had change in voice on objective voice assessment at 30th postoperative day in which only 7 patient had vocal cord palsy on flexible fibreoptic laryngoscopy. Its mean that 6 patient improved in voices and 3 patient's vocal cord palsy recovered from 5th postoperative day. In group of patient who were asymptomatic (no change in voice) vocal cord palsy was present in 1 patient on flexible fibreoptic laryngoscopy as compared to 2 patients on 5th postoperative day. (Table-6)

Table -6: Objective voice changes vs. vocal cord status on FOL

Objective voice change on 30th postoperative day	Vocal cord status on FOL		Total
	PALSY	MOBILE	
YES	6	5	11
NO	1	30	31
Total	7	35	42

This study showed that the objective voice assessment test had sensitivity – 85.71%, specificity – 85.71%, accuracy rate – 85.71%, positive predictive value – 54.54%, negative predictive value – 96.77% to detect vocal cord palsy after thyroidectomy at 30th postoperative day.

DISCUSSION

In this study the ages of the patients ranged from 15 years to 63 years with a mean age of 39.40 years. The thyroid goiter was most common in the age group of 25 to 50 years. Among 42 patients, 24 (57.14%) patients were from this group. There were 10 (23.82%) patients from the age group of >50 years, followed by the age group of the <25 years, which accounted for the (19.04%) patients.

Norman A. Matheson et al has mentioned that the thyroid nodules are said to be more common in female, the ratio being four times more in female [26]. But in our series the thyroid goiter were five times more common in female. Out of these 42 patients, 35(83.33%) were female and 7(16.67%) were male. Although this study was performed in tertiary referral center of eastern region of Nepal, people of different part of Nepal have been operated. Further study is needed to confirm this higher frequency of thyroid goiter in female in our context.

The chief presenting complaint was swelling in the thyroid region, which was present in thirty eight (90.47%) patients. Two patients presented with pain and two with discomfort in the throat in addition to the thyroid swellings. Norman A. Matheson et al has also mentioned that the commonest presenting complaint is thyroid swelling [26]. Most common 27 (64.30%) patients had their nodules on right lobe of thyroid gland, 8 (19.04%) had on the left side, seven (16.66%) had on the bilateral thyroid lobes. In many literatures swelling is more common in right lobe, to find out the cause further study will be needed.

In the present study 56 RLNs were taken for the study, of which 51 RLNs were identified, traced the course and surgical anatomy studied intraoperatively. Among the studied nerves, 20 (44.7%) of the nerves were of the left side and 31 (55.3%) of the nerves were from the right side. Despite systematic intra-operative search RLN was identified in 91% of the cases in our study. A slightly lower rate of identification of RLN on routine exposure of the nerve was achieved by Giovanni Sturniolo et al [28] - 82.3%, however Hisham AN and Lukman MR [29] the RLN was clearly identified in 97.8% dissections.

In our series of study incidence of vocal cord palsy were 23.8% of patients on 5th postoperative day in which three patients recovered and came to 16.66% of patient which is similar to the study done by Filho JG et al [29] where recurrent laryngeal nerve injury varied from 1.8% to 13.3%.

This study showed that the subjective voice assessment test had sensitivity- 70%, specificity – 75%, accuracy rate – 73.80%, positive predictive value – 46.67%, negative predictive value 88.89% to detect vocal cord palsy after thyroidectomy at 5th postoperative day and sensitivity- 80%, specificity – 81.3%, accuracy rate – 80.95%, positive predictive value – 57.14%, negative predictive value - 92.85% to detect vocal cord palsy after thyroidectomy at 30th postoperative day. Objective voice assessment test had sensitivity- 80%, specificity – 81.3%, accuracy rate – 80.95%, positive predictive value – 57.14%, negative predictive value - 92.85% to detect vocal cord palsy after thyroidectomy at 5th postoperative day and sensitivity- 85.71%, specificity – 85.71%, accuracy rate – 85.71%, positive predictive value – 54.54%, negative predictive value - 96.77% to detect vocal cord palsy after thyroidectomy at 30th postoperative day.

Similar studies done by Hanna, B.C. et al [31] to determine if a simple assessment of vocal cord function performed in a routine clinical setting can predict vocal cord paralysis on laryngoscopy in patients following thyroid or parathyroid surgery. Eighty-six patients participated in the study. Eleven had a change in their voice postoperatively and one patient had difficulty coughing. Six of these patients had a vocal cord paralysis. A further five apparently asymptomatic patients had a vocal cord paralysis. The positive predictive value of voice assessment for vocal cord paralysis was 55%.

Stojadinovic A, et al, [15] examine the utility of patient-reported and clinician-determined voice assessment in identifying post thyroidectomy voice dysfunction. He found eight (16%) had early transient and one (2%) had permanent postoperative voice dysfunction. VCHx(voice casel history) symptoms had negative (NPV) and positive (PPV) predictive values of 96%--100% and 39%--53%, respectively for voice dysfunction.

This study has confounding effects in voice recording results because the voice alteration (false positive results) could be due to simple irritation of the vocal cords following intubation, psychogenic dysphonia, laryngeal edema, extra laryngeal strap muscles damage or temporary malfunction of these muscles, laryngotracheal fixation or superior laryngeal nerve palsy which is often not detected by routine

laryngoscopy. False negative results are presumably due to incomplete paralysis of the vocal cord or compensatory movement from the opposite cord. In present study we cannot differentiate between temporary and permanent vocal cord palsy because the follow up period were only upto 1 month. The vocal cord palsy is called permanent if the palsy persists even after six months of operation or recurrent nerve injury.

CONCLUSION

Simple Voice assessment does not correctly predict the vocal cord palsy in patients who developed vocal cord palsy after thyroid surgery. Use of voice changes to screen for vocal cord paralysis after thyroid must be used with care.

When applied to a routine clinical setting the results of voice assessment is not satisfactory.

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