

An Observational Study to Assess Vocal Cord Mobility by Laryngeal Ultrasonography and Direct Laryngoscopy in Total Thyroidectomy Patients

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ABSTRACT

BACKGROUND

Thyroid surgery is a common surgical procedure. Complications such as bleeding, hypoparathyroidism and Recurrent Laryngeal Nerve Injury (RLNI) represent nearly half of all the complications of thyroid surgery. Thyroidectomy patients are routinely evaluated preoperatively for vocal cord mobility with indirect laryngoscopy. In the immediate postoperative period after extubation, they are again examined by direct laryngoscopy to assess vocal cord mobility. Transcutaneous ultrasound (USG) is an easy, noninvasive alternative to the above methods. The development of gray-scale, real-time, high-resolution, B-mode USG helps in visualization of the normal anatomy of the larynx, and the movements of the true and false cords. It can be an alternative to the more invasive direct examination of the vocal cords using direct laryngoscopy or videorhinolaryngoscopy (VRL). There are numerous studies involving laryngeal ultrasound and direct laryngoscopy for assessment of vocal cord movement for thyroidectomy patients, but comparative studies of these two methods for assessment of vocal cord mobility after thyroidectomy are limited in number.

METHODS

After obtaining institutional ethical committee clearance, a prospective observational study among 60 participants was done. General anaesthesia was given, and the patients were positioned for thyroidectomy surgery. After the surgery, direct laryngoscopy was done to assess the vocal cord mobility. Heart rate, blood pressure, and duration of the direct laryngoscopy were recorded. After this, under strict aseptic precautions, the neck was scanned with a high frequency linear probe (frequency: 8-12 Hz) and the vocal cord mobility was recorded. Surgical dressing was kept after the procedure.

RESULTS

Analysis of the monitored data shows that the findings of direct laryngoscopy and ultrasonography of the neck were consistently similar. In some difficult airway cases, laryngoscopy proved to be difficult, but USG could still monitor the cord movement. Patients had sympathetic stimulation as evidenced by rise in blood pressure, heart rate during direct laryngoscopy. During ultrasonographic examination of neck, no such sympathetic stimulation was observed. The images seen through USG were easily interpreted and the study shows that direct laryngoscopy can be replaced by ultrasonography.

CONCLUSIONS

Use of ultrasonography for vocal cord movement examination in post thyroidectomy patients, yields consistent results comparable to those of direct laryngoscopy and the former has the potential to replace the latter.

KEYWORDS

Direct Laryngoscopy, Ultrasonography, Vocal Cord Movement, Post Thyroidectomy

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BACKGROUND

Thyroid surgery is a common surgical procedure in India. Complications such as bleeding, hypoparathyroidism and Recurrent Laryngeal Nerve Injury (RLNI) represent nearly half of all the complications of thyroid surgery.¹ Thyroidectomy patients are routinely evaluated preoperatively for vocal cord mobility with indirect laryngoscopy.² In the immediate postoperative period after extubation they are again examined by direct laryngoscopy to assess vocal cord mobility.³ Transcutaneous ultrasound (USG) is an easy, non-invasive alternative to the above methods.⁴ The development of grey-scale, real-time, high-resolution, B-mode USG helps in visualization of the normal anatomy of the larynx, and the movements of the true and false cords.⁵ It can offer to be an alternative to the more invasive direct visualisation of the vocal cords using DL/videorhinolaryngoscope (VRL).

Rationale of the Study

The research was for assessment of vocal cord mobility by USG and direct laryngoscopy in immediate postoperative period. There are numerous studies involving laryngeal ultrasound and direct laryngoscopy for assessment of vocal cord movement for thyroidectomy patients, but comparative studies of these two methods for assessment of vocal cord mobility after thyroidectomy is limited in number.

Objectives

- 1) To find the usefulness of transcutaneous ultrasonography in assessing vocal cords of thyroidectomy patients in the immediate postoperative period after routine direct laryngoscopic assessment.
- 2) To find any adverse effects while doing both the procedures such as hemodynamic changes as evidenced by blood pressure and pulse rate changes.

Hypothesis

Laryngeal ultrasonography can give consistent findings compared to direct laryngoscopy for assessing vocal cord mobility in immediate postoperative period of total thyroidectomy patients.

Inclusion Criteria

Age group 18-65 yrs. Patients presenting for thyroidectomy surgery American Society of Anesthesiology (ASA) class I & II.

Exclusion Criteria

Pre-existing neurological disease affecting vocal cord functions.

METHODS

After obtaining institutional ethical committee clearance, the study was conducted as a prospective observational one

conducted in the general surgery operation theatres of Govt. TD Medical College, Vandanam, Alappuzha.

Sample Size

As it was a pilot study, we recruited 60 consecutive thyroidectomy patients undergoing both direct laryngoscopy and laryngeal ultrasonography. After getting approval from the institutional ethical committee, participants were recruited for this study. Patients were educated about the study using patient information sheet. Informed written consent was taken from all patients in their mother tongue. The patients were given Tab. Ranitidine 150 mg and Tab. Metoclopramide 10 mg PO on the night before surgery and at 6 am on the morning of surgery. Patients were kept nil per oral for 8 hours prior to surgery. Upon arrival in the operating room ECG, noninvasive blood pressure monitor, and pulse oximeter were connected and basal heart rate and BP were recorded. Intravenous access with 18 G cannula in forearm was obtained and intravenous fluid 0.9% NS was started. All patients will be premedicated with IV Midazolam 1 mg, IV glycopyrrolate 0.2 mg and IV fentanyl 100 mcg. The patient was preoxygenated by using Bains breathing circuit and mask for 3 minutes. The patient was induced with IV propofol 2.5 mg/kg. IV Vecuronium 0.1 mg/Kg was given after checking mask ventilation. The patient was given IV lignocaine 1.5 mg/kg 1 minute before direct laryngoscopy. Direct laryngoscopy and endotracheal intubation with cuffed tube of size 6.5 mm ID for female and 7.5 mm ID for male was done, and anaesthesia was maintained with 33% oxygen 66% nitrous oxide, and isoflurane 0.6%. Patient was positioned in thyroidectomy position. Muscle relaxation was maintained with intermittent dose of IV vecuronium 1 mg every 20 minutes. After the surgery was finished the patient was made supine and all anaesthetic agents were stopped, and the patient was reversed with IV neostigmine 0.05 mg/Kg and IV glycopyrrolate 0.01 mg/Kg. After adequate tidal volume is achieved direct laryngoscopy was done. The endotracheal tube was deflated and removed, and the vocal cords mobility was observed. The heart rate, blood pressure, and duration of the direct laryngoscopy were recorded.

After the direct laryngoscopic assessment the patient was given 100% oxygen by mask with Bains circuit till the patient was awake and airway reflexes returned. The neck was cleaned with betadine and under strict aseptic precautions neck was scanned with a high frequency linear probe (frequency: 8-12 Hz). Sterile camera cover was used to maintain asepsis during scanning. The various structures were identified such as carotid artery, jugular vein, tracheal ring, thyroid cartilage, arytenoids, and vocal folds. Thereafter the probe was kept transversely over the thyroid cartilage to view the vocal folds movements. False vocal cords appear as hyperechoic structures whereas true cords are hypoechoic. Normal vocal cord movement is defined as symmetrically abduction and adduction motion of the true vocal cords during quiet respiration. During the procedure the heart rate, blood pressure and oxygen saturation were recorded every minute. The duration of the procedure, and any discomfort was noted. The surgical dressing was kept

after the procedure. All statistical analyses were carried out using the software Statistical Package for the Social Sciences (SPSS) Statistics version 19.0.0 with the help of a professional statistician. Data was expressed in its frequency and percentage as well as mean and standard deviation.

Statistical Analysis

Data collected will be entered a Microsoft excel data sheet and will be analysed using SPSS 22 version software. Categorical data will be represented in the form of frequencies and proportions. Chi-square will be the test of significance. Continuous data will be represented as mean standard deviation. Independent t test will be the test of significance to identify the mean difference between the two groups. P value <0.05 will be considered statistically significant. All statistical and analyses were carried out using the software Statistical Package for the Social Sciences (SPSS) Statistics version 19.0.0 with the help of a professional statistician. Data was expressed in its frequency and percentage as well as mean and standard deviation.

RESULTS

Mobility			
Method	Bilaterally Mobile	Unilateral / Bilateral Palsy	P
Direct laryngoscopy	52	2	0.061
Transcutaneous USG	56	4	0.072

Table 1. Mobility of the Cord

The difference in finding of both methods were not significant (p value >.05)

Examination Finding			
Method	Easy Visualization	Difficult Visualization	p
Direct laryngoscopy	56	4	0.421
Transcutaneous USG	58	2	0.369

Table 2. Visualization of the Vocal Cord

The difficulty of visualization was similar in both methods (p value >0.05).

Consistency			
Method	Similar Results	Different Results	p
Direct laryngoscopy	56	4	0.810
Transcutaneous USG	56	4	0.810

Table 3. Comparison of Examination Results

The examinations are reliably consistent (p value >0.05).

Time	Mean (bpm)	SD	N	p
Preoperative	71.3	9.6	60	0.724
Pre procedure	66.3	8.3	60	0.024
Direct laryngoscopy	88	6.8	60	0.001
Transcutaneous USG	68.2	7.9	60	0.452

Table 4. Heart Rate Changes During Examination

The heart rate changes were significant from preoperative and preprocedural heart rate during direct laryngoscopy (p value <0.05) whereas the change was insignificant during USG examination (p value>0.05).

Time	Mean Arterial Pressure	SD	N	p Value
Preoperative	88.9	9.6	60	0.724
Pre procedure	72.3	8.3	60	0.024
Direct laryngoscopy	98.6	6.8	60	0.874
Transcutaneous USG	75.5	7.9	60	0.029

Table 5. Distribution of Blood Pressure in the Group (Blood Pressure Changes During Examination)

The mean arterial pressure changes were significant from preoperative and preprocedural blood pressure during direct laryngoscopy (p value <0.05) whereas the change was insignificant during USG examination (p value>0.05)

DISCUSSION

The detection of recurrent laryngeal nerve palsy is important not only for safe management of patient but also for dealing with medicolegal issues that may arise post operatively. Amarjeet Kumar et al did an observational study on assessment of functionality of vocal cords (VCs) using ultrasound before and after thyroid surgery and compared it with videorhinolaryngoscopy (VRL) and concluded that USG might prove to be a non-invasive alternative to VRL to visualise the VCs in perioperative period⁶ Emad Kandil et al conducted research on assessment of Vocal fold function Using Transcutaneous Laryngeal Ultrasonography (TLUSG) and flexible fiberoptic laryngoscopy and found that TLSUG can be used as an alternative to the flexible fiberoptic laryngoscopy.⁷

Shah MK et al compared transcutaneous laryngeal ultrasound with video laryngoscope for assessing the vocal cord mobility in patients undergoing thyroid surgery and concluded that in patients undergoing thyroidectomy, transcutaneous laryngeal ultrasonography can serve as a non-invasive, bedside screening tool for assessing vocal cord palsy postoperatively. Inita R Matta et al conducted study to find the usefulness of laryngeal ultrasound in diagnosing vocal cord palsy and found that laryngeal ultrasound is a cheap, easy, non-invasive method to diagnose vocal cord palsy.⁸ Shih ping Cheng et al conducted a research on preoperative ultrasonographic assessment of vocal cord movement during parathyroid and thyroid surgery and found that surgeon performed US appears to be a relatively accurate method for assessing vocal cord movement in the preoperative setting.⁹

With unilateral recurrent laryngeal nerve injury, patients can develop hoarseness and stridor whereas bilateral recurrent laryngeal nerve injury leads to stridor, dyspnoea and often life-threatening laryngeal obstruction.^{10,11} The incidence of injuries to the recurrent laryngeal nerve has been reported between 1% to 2% from different thyroid surgery centres when performed by experienced neck surgeons. This incidence is higher when thyroidectomy is performed by a less experienced surgeon¹²⁻¹⁴ or when thyroidectomy is done for a malignant disease, during re-explorations nerves may cause debilitating outcomes. When the nerve is identified and dissected, the reported RLN injury rate during thyroidectomy is 0-2.1%. This is reportedly higher in the re-operative setting (2-12%) or if the nerve is

not clearly identified, and in Graves' disease.¹⁵⁻¹⁹ Mechanisms of injury to the nerve include complete or partial transection, traction, or handling of the nerve, contusion, crush, burn, clamping, misplaced ligature, and compromised blood supply. Deliberate identification of the RLN minimizes the risk of injury.²⁰

Intraoperative nerve monitoring (IONM) helps to identify the nerve during surgical dissection but it should be used judiciously, as overstimulation of the ed (4-6.6%)²¹

CONCLUSIONS

Both direct laryngoscopy and ultrasonography appear to yield consistent results during examination of vocal cords in post thyroidectomy cases in the immediate post-operative period. In a few cases where direct laryngoscopy was not able to visualize the cords, transcutaneous ultrasonography proved to be helpful. Analysis of the monitored data shows that both methods are adequate to examine the vocal cords in the post-operative period, but the sympathetic surge during the procedure as evidenced by heart rate changes and blood pressure changes were significantly higher during direct laryngoscopy examination. More studies involving USG are required to examine the feasibility of replacing direct laryngoscopy with ultrasonography.

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