

Original Research Article

The utility of surgeon performed transcutaneous laryngeal ultrasound for the assessment of vocal cords in post-thyroidectomy patients

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ABSTRACT

Background: Post-thyroidectomy vocal cord palsy is a significant procedure associated complication and a notable contributor for medico-legal litigation. The standard technique for vocal cord evaluation and the most commonly used tool is direct laryngoscopy. Endocrine surgeons generally address the patients to otolaryngologist for laryngoscopy, leading to extra expense and time loss. Laryngoscopy causes patient annoyance and could potentially contribute to poor patient compliance. Ultrasonography is a non-invasive technique that is regularly used by endocrine surgeons to examine the thyroid region.

Methods: A prospective study conducted on patients who underwent thyroidectomy between September 2016 and August 2017 at endocrine surgery department in a tertiary care institute (South India), Surgeon performed ultrasound (SPU) and Video laryngoscopy (VDL) was performed before and after elective thyroidectomy.

Results: 155 patients who consented were categorized in the study, 2 of the patients included in the study had preoperative vocal cord palsy and 12 of them had unilateral postoperative vocal cord palsy detected using VDL. In general, the postoperative vocal cord palsy rate was 6.45%. Postoperative SPU was ineffective in assessing vocal cords in 16(10.32%) of patients. SPU had a sensitivity of 83.33% and negative predictive value of 97.90%, for the visualization of vocal cords in the postoperative period.

Conclusions: SPU is convenient and non-invasive technique which could provide our speciality with cheap yet powerful diagnostic tool for vocal cord assessment in post-thyroidectomy patients and can potentially decrease the requirement of difficult and cumbersome VDL.

Keywords: Surgeon performed ultrasound, Thyroidectomy, Video laryngoscopy, Vocal cord palsy

INTRODUCTION

One of the main procedure related complication of thyroidectomy is vocal cord palsy.¹⁻³ Knowledge of preoperative vocal cord palsy has medico-legal implications and should lead to extra-care in the dissection and preservation of the contralateral recurrent laryngeal nerve. Information on the patient's preoperative and postoperative vocal cord status is considered essential. The gold standard examination of vocal cords,

and the most commonly used examination tool, is direct flexible laryngoscopy.⁴

Endocrine surgeons often address patients to otolaryngologist, leading to extra expense and time loss, laryngoscopy causes patient discomfort and that could potentially lead to poor patient compliance.⁵

Ultrasonography is a non-invasive technique that is commonly used by endocrine surgeons to examine the

thyroid region, which can be easily applied on larynx to assess the vocal cords.⁶

METHODS

This study intends to assess the reliability of surgeon performed transcutaneous laryngeal ultrasound (SPU) as a substitute to video laryngoscopy (VDL) in the postoperative scrutiny of vocal cord palsy after thyroidectomy.

This is a prospective cohort study conducted in the Department of endocrine surgery, Madras Medical College, Tamilnadu, India. The study included all patients who have underwent thyroidectomy in the department of endocrine surgery from September 2016 to August 2017 (one year)

Pre and post-operative ultrasound neck and video laryngoscopy was performed on consecutive patients who underwent thyroidectomy in the study period. Ultrasound neck was performed by surgeon (SPU) in the pre and post-operative period (5-10 days after thyroidectomy). All patients who underwent ultrasound had confirmatory video laryngoscopy (VDL) with 30° scope in the same sitting performed by otolaryngologist.

Surgeon performed ultrasound (Figure 1): Single ultrasound machine (sonoray DS30 Plus) and probe (7.5 – 10 MHz linear array transducer) was used during the present study. Patients were positioned supine during the examination, with neck slightly extended.



Figure 1: Surgeon performing transcutaneous laryngeal ultrasound.

The ultrasound probe was placed transversely over the middle portion of thyroid cartilage and scanned cranio-caudally until both true and false cords were visualized. Both passive (quiet spontaneous breathing) and active (phonation with vowel “aa”) movement of the vocal cords were assessed. The grey-scale technique with the scan setting for the thyroid gland was applied to evaluate the vocal cords. The operator reported: (A) Vocal cords were visualised or not- Symmetric abductive and

adductive motion of the vocal cords was defined as normal (Figure 2). (B) Presence or absence of vocal cord palsy. Age, gender, body mass index (BMI), pre-operative diagnosis, surgery performed, SPU and VDL results and final histopathology were recorded.

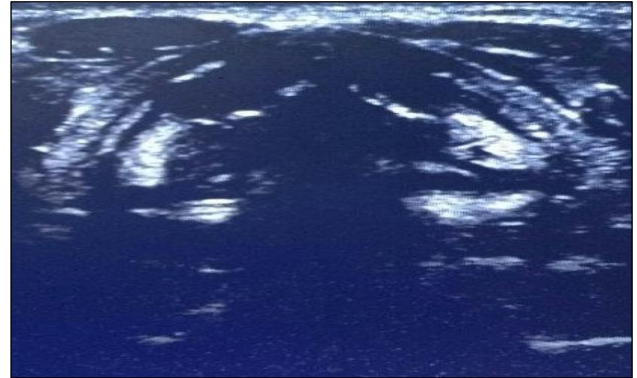


Figure 2: Visualization of vocal cords on ultrasound.

Data was analysed with IBM.SPSS statistics software 23.0 Version. Significance in the data was found using χ^2 test, receiver operator characteristic (ROC) curve analysis was used to find the Sensitivity, Specificity, PPV and NPV for comparison of SPU and VDL. Univariate and multivariate regression analysis was used to assess the risk factor for non-visualization of vocal cords. The probability value ≤ 0.05 was interpreted as significant.

RESULTS

160 patients underwent thyroidectomy during the study period, 5 of them were excluded from the study (1 died in post-operative period due to acute myocardial infarction and 4 of them were not willing for video laryngoscopy). 155 patients were included in the study. 141 (91%) were female and 14 (9%) were male. The most common surgery performed was total thyroidectomy the details are shown in Figure 3.

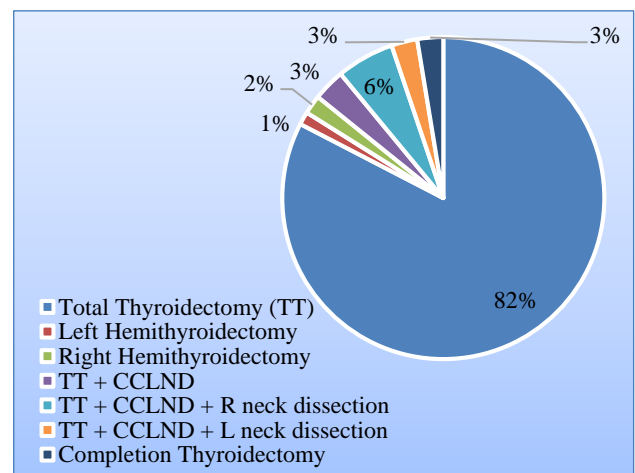


Figure 3: Pie chart showing types of surgeries performed.

Pre-operative period – 2 patients had vocal cord palsy visualized by SPU and was confirmed by VDL. 5 (3.22%) patient vocal cords were not visualized in the pre-operative period by SPU. Pre-operative SPU had a sensitivity and specificity of 100% for detection of vocal cord palsy.

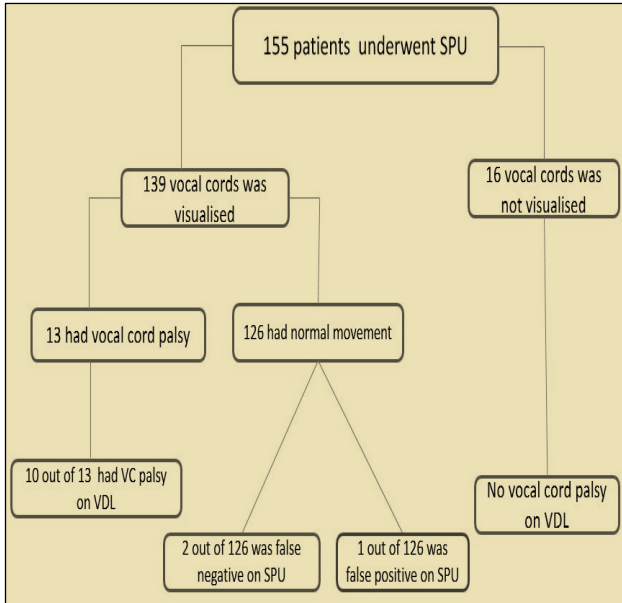


Figure 4: Study at a glance shown in flowchart.

Post-operative period – 12 patients had vocal cord palsy diagnosed using VDL (2+10 new). By SPU 13 patients were found to have vocal cord palsy. 16 (10.3%) patient vocal cords were not visualized in the post-operative period by SPU, none of them had vocal cord palsy on confirmatory VDL. Overall palsy rate was 6.45%. The summary of the findings is shown in Figure 4.

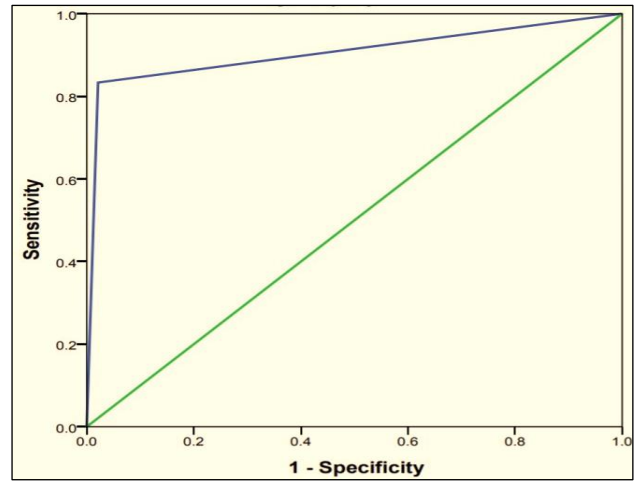


Figure 5: Receiver operator characteristic curve analysis.

2x2 cross tabulation was done (Table 1) and sensitivity, specificity, positive predictive value (PPV) and negative predictive (NPV) values were 83.33%, 97.90%, 77.92% and 98.59% respectively. The diagnostic accuracy of SPU was 90.62%.

Table 1: 2 × 2 cross tabulation.

2x2 cross tabulation		Post-operative VDL		Total
		Palsy	Mobile/ Non-visualization	
Post-operative SPU	Palsy	10	3	13
	Mobile/Non-visualization	2	140	142
Total		12	143	155

Table 2: Analysis of risk factors for non-visualization of vocal cords.

Factors	Assessable n=139 (89.7%)	Non-visualization n=16 (10.3%)	Univariate (p value)	Multivariate (p value)
Mean age	39.42	57.88	0.000	0.000
Male gender (%)	7.9	18.8	0.245	0.245
Mean BMI	23.85	27.70	0.001	0.001

Table 3: Comparison of previous studies with present study.

Study	Sample size	Year	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Sidhu S et al ⁹	100	2001	62	97	73	95
Dedecjus M et al ¹⁰	50	2010	100	95.7	60	100
Wong KP et al ¹¹	204	2013	93.3	97.8	77.8	99.4
Borel F et al ⁸	103	2016	33	95	42	89
Present study	155	2017	83.33	97.90	76.92	98.59

Receiver operator characteristic (ROC) (Figure 5) curve analysis was done and area under the curve was 0.906, p value: 0.0005(<0.001), 95% CI (0.781-1.00).

Risk factors for non-visualization of vocal cords on SPU (Table 2) were assessed. Increasing age and Body mass index (BMI) were risk factors for non-visualization of vocal cords on SPU.

DISCUSSION

Video-laryngoscopy is not a routine practice for many surgeons owing to its unpleasant experience (gag reflex and neck and jaw rigidity), time consuming, demand extra costs for the patients and may require topical anaesthesia and sterilization of scope. Nonetheless, the opinion for routine pre-operative and post-operative evaluation of the vocal cords remains controversial.⁷ Ultrasound is facile, acceptable, economical, radiation free, gentle and non-invasive procedure and all patients with thyroid illness undergo ultrasound neck as a part of clinical work-up and vocal cord mobility can be examined in the same sitting.

VDL causes patient discomfort, more expensive than SPU and limited by an uncooperative patient. In the present study, 4 patients did not undergo VDL for such reasons, 3 patients refused VDL due to fear of discomfort, and 1 had a vasovagal episode during the examination. No patient refused to undergo SPU and there were no complaints during the procedure.

By using SPU: sensitivity, specificity, PPV and NPV were 83.33%, 97.90%, 76.92% & 98.59% respectively. With these results we infer SPU can't substitute VDL as a diagnostic tool for assessment of vocal cords, but if we use SPU as a screening tool to select patients who should undergo VDL, the total number of post-operative VDL could be reduced by 83.3%. ROC analysis area under the curve was 0.906, p value – 0.0005(<0.001), 95% CI (0.781-1.00), this indicate SPU is a good tool for identification of vocal cord palsy in post- thyroidectomy patients.

Review of literature says there are similar studies conducted in the past (Table 3), all the previous studies have specificity of more than 95%, and the present study we have got sensitivity of 97.90%, whereas the sensitivity of SPU in previous studies have wide variation, Borel F et.al in their study got an inadequate sensitivity of only 33% and concluded that ultrasonographic vocal cord palsy should be confirmed by laryngoscopy.⁸ Sidhu S et al in their initial experience got a sensitivity of 62% which was also considered inadequate.⁹

Whereas, Dedecjus M et al and Wong KP et al in their respective study got sensitivity and specificity of more than 90%.¹⁰⁻¹¹ Cheng SP et al conducted large two phase prospective study in the year 2012 and concluded that Surgeon-performed laryngeal ultrasound is relatively

authentic method for evaluating vocal cord movement in the preoperative setting.¹² In the present study we got a sensitivity of 83.33% and we strongly believe this is insufficient to substitute video-laryngoscopy for detection of vocal cord palsy in post- thyroidectomy patients.

In this study increasing age and BMI was identified as risk factors for non-visualization of vocal cords by SPU in both univariate and multivariate regression analysis, because gradual ossification of thyroid cartilage occurs in the aged population and act as an obstacle for propagation of ultrasound waves, and faulty image on sonogram. In the age of minimally invasive techniques and cost stipulation, the significance of this tool is tremendous because lesser patients would require video-laryngoscopy before and after thyroidectomy.

In spite of our data, there were certain shortcomings in the study. The low incidence of preoperative and postoperative vocal cord palsy, study would be judged underpowered and the sample size may be small.

Contrary to VDL, SPU does not produce satisfactory images to diagnose accompanying laryngeal conditions and other subtle information of the vocal cords, other conditions which would alter voice quality might be missed. Also, in this study, we did not perform other quantitative measurements such as arytenoid angle and tissue displacement velocity with the Doppler mode which could be supplementary to our outcome.¹³⁻¹⁷ Vocal symptoms can bias the assessment of SPU, which is operator-dependent.

Fukuhara T et al did similar study by novel lateral approach along with conventional approach for assessment of vocal cords using ultrasound and concluded that lateral approach improve visualization rate.¹⁸

The reliability of this method remains unpredictable if surgeons with different ultrasound experience performs the procedure. Moreover, this procedure has a conspicuous disadvantage that it is inveigled by the calcification or angle of the thyroid cartilage. Furthermore, low rate of visualization of vocal cords is due to the poor ultrasonic permeability of air, with synchronous movement of the thyroid cartilage, and it is challenging to stabilize the transducer and accomplish accurate results.

CONCLUSION

SPU is a reliable procedure for selecting patients who should undergo secondary VDL and the use of invasive laryngoscopy could be limited to patients who have abnormal mobility of vocal cords on SPU, when vocal cords are not visualized on SPU, or who present with significant voice change. Both the diagnoses of vocal cord palsy and non-visualization of vocal cords on SPU should be indications for secondary VDL.

Surgeons own comprehensive knowledge of head and neck anatomy and an added acquaintance of ultrasound of this region especially the larynx can benefit the specialty with economical and powerful diagnostic tool. Moreover, vocal cord mobility assessment can be integrated into regular thyroid ultrasound examination.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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