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Transcutaneous Laryngeal Ultrasound (TLUS): A Promising Method for Assessing the Vocal Cords

Jesse D. Pasternak

Department of Surgery, University Health Network, University of Toronto. Toronto, Ontario Canada

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SUMMARY

Background

An integral part of the thyroid surgeon's workflow prior to thyroidectomy is assessing the vocal cords. The recurrent laryngeal nerve (RLN), the main motor innervation to these cords, traverses the central neck posterior to the thyroid gland and between the parathyroid glands. It can be very small and extremely sensitive to manipulation during dissection. An injury to this nerve can disrupt innervation to the vocal cord, severely affecting its mobility. If a unilateral neuropraxia occurs, hoarseness and trouble breathing during exertion can ensue; if the neuropraxia is bilateral, airway obstruction may require tracheostomy.

Many guidelines for thyroid surgery have recommended the consideration of preoperative evaluation of the vocal cords, which helps ascertain the perioperative risks to voice and airway management. Classic options have been described to assess the vocal cords, including using mirrors and videoscopes. Ultrasound evaluation has been described by many thyroid surgeons around the world, with excellent sensitivity and specificity. This study describes the effectiveness of surgeon-performed ultrasound evaluation of the vocal cords (1).

Methods

This was a prospective observational study performed in multiple Italian academic centers and included 792 assessed vocal cords in 396 patients. A transcutaneous laryngeal ultrasound (TLUS) was performed by placing the ultrasound probe inferior to the thyroid cartilage looking superiorly. If the view was not adequate to diagnose either normal or abnormal function, additional techniques were performed, including a lateral window view. A second clinician, who was unaware of the first clinician's findings, performed flexible laryngoscopy, which is considered the gold standard of vocal cord assessment in many international jurisdictions.

The primary end point was correlation of TLUS and flexible laryngoscopy. Specific patient characteristics were reviewed including sex, age, BMI, and type of thyroid disease.

Results

Of the 396 patients reviewed, 134 were men (44%) and 227 (57%) were overweight. Comparing TLUS to the gold standard of flexible laryngoscopy, the sensitivity of TLUS was 97% and the specificity was 96% in accurately detecting vocal cord movement. The negative predictive value of TLUS was 99.7%.

THYROID SURGERY Transcutaneous Laryngeal Ultrasound (TLUS): A Promising Method for Assessing the Vocal Cords

Jesse D. Pasternak

Visualization of the vocal cords by TLUS was difficult in 14 of the 396 patients, all of whom were male. These patients required the lateral acoustic window for cord visualization, however this technique provided an accurate diagnosis. TLUS rarely overdiagnosed RLN palsy, as 47 patients has suspected vocal cord paralysis (11.8%) using ultrasound, whereas the flexible laryngoscope showed only 30 patients with cord immobility (7.6%). Only one patient was seen to have no abnormality on TLUS

but had abnormal function of one cord on flexible laryngoscopy (0.3% false-negative rate).

Conclusions

Concordance between TLUS and flexible laryngoscopy was 95.7%, with only one false-negative result among 792 assessed vocal cords. The results demonstrate that TLUS appears to be highly sensitive in screening for vocal cord abnormalities, with no increased aerosolization risks to the proceduralist.

COMMENTARY

This study shows that assessment of the vocal cords by ultrasound is a reliable and effective tool in the perioperative period (1). Many studies have outlined the utility of TLUS for use by thyroidologists showing the technique to be a useful component of the clinician-performed ultrasound (2-4). For many physicians who see patients with thyroid conditions on a regular basis, ultrasound has become an integral part of the physical exam, representing the “stethoscope of the neck.” Moving the probe a few inches superiorly toward the larynx allows the sonographer to complete the perioperative assessment of the neck with ease and patient comfort. As compared to the flexible laryngoscope, TLUS requires no special cleaning, can be reused between patients easily, and does not generate aerosolized particles.

The strength of this study is that the cohort includes a high proportion of groups previously described to have difficult exams, namely male and overweight patients. Further, the study was performed in multiple centers by clinicians who were not formal specialists in radiologic examination of the neck. This supports potential good generalizability of the study into broad practice settings with a clinical thyroid focus. A downside of the study design was that the results relied on the clinician performing

Figure 1. Example of a TLUS. This TLUS is of a 40-year-old woman from my practice, viewing superiorly from below the thyroid cartilage. The static image captures only main components, including the anatomic false and true vocal cords. However, as the patient speaks, dynamic assessment would show that normal true vocal cords move medially towards the midline in patients without nerve palsies.

THYROID SURGERY Transcutaneous Laryngeal Ultrasound (TLUS): A Promising Method for Assessing the Vocal Cords

Jesse D. Pasternak

the ultrasound having subspecialized knowledge of alternative viewing windows and techniques for difficult cases. I uniformly perform this procedure in my clinical practice (Figure 1), and as a surgeon, the acquisition of TLUS skills is not onerous and very reliable.

As the current gold standard for assessing vocal cords, flexible laryngoscopy has many drawbacks. First, it is expensive, both to initially buy a videoscope as well to maintain its function. Specialized cleaning and processing must be performed between each use. Second, and more importantly, its use has been labeled an “aerosol generating procedure (AGP)” (3). It is often suggested that clinicians performing this procedure wear full personal protective equipment, including N95 masks in isolated rooms with stringent post-procedure cleaning protocols. Further, a breach in protocol would potentially expose all those in the room where this procedure is performed to an aerosolized pathogen. A worrisome contemporary example is a patient with asymptomatic COVID-19 undergoing vocal cord assessment before thyroid surgery. If this patient were instead to undergo TLUS

instead, the patient could continue to wear a face mask throughout the procedure.

The sensitivity of TLUS has been shown by multiple studies to be high (around 96%), and false-negative results are rare (4). The clinician may also use TLUS to screen for vocal cord abnormalities and move to flexible laryngoscopy if there are concerns with the exam. This scenario was also shown to be rare (3.5%), and in these cases, advanced lateral viewing windows allowed subsequent cord visualisation by TLUS (5,6).

Although this technique has been gaining traction over the past decade, as with many medical advancements, established workflow systems are slow to change. As there are increased risks associated with flexible laryngoscopy during the current COVID-19 pandemic, perhaps there will be a greater impetus to incorporate TLUS in the perioperative assessment of vocal cords among patients with thyroid conditions being considered for surgery. Should this happen, training and support for thyroidologists wishing to adopt this technique must be available from early adopters.

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THYROID SURGERY Transcutaneous Laryngeal Ultrasound (TLUS): A Promising Method for Assessing the Vocal Cords

Jesse D. Pasternak

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