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Review Article

TLUS (Transcutaneus Laryngeal Ultrasonography) as a safe option to evaluate vocal cords in COVID-19 Pandemic era: A Literature Review

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Abstract

RLN palsy as a thyroid and parathyroid surgeries complication is usually diagnosed using a direct flexible laryngoscopy (DLF). During this pandemic, doing the DFL has become a major risk to the patient and to the doctor performing the examination as the procedure will allow the virus to aerosolize. Meanwhile, transcutaneous laryngeal ultrasonography (TLUS) has been the go-to procedure to diagnose the vocal cords. A literature searching was performed in the PubMed database in April 2021. 17 full text articles were assessed to review the TLUS modality usage to screen the vocal cords abnormalities in pandemic era. TLUS has a high sensitivity rate in screening abnormalities of the vocal cords. TLUS is considered as a safer option to DFL, thus it is much better fit to use while in pandemic state. When an abnormality is found, it should be confirmed using a DFL.

Keywords: Thyroid surgery; Vocal cord paralysis;

Ultrasonography; COVID-19

1. Background

USG has been a staple for surgeons to assess vocal cords prior to thyroid and parathyroid surgeries. It is also often referred as the stethoscope equivalent for the neck. Thyroid and parathyroid surgeries are the two most common invasive procedures in the endocrine medicine. There are two major complications for these operations, such as recurrent laryngeal nerve (RLN) palsy and surgical hypoparathyroidism [1]. The RLN palsy has the incidence rate of 9.8% for temporary palsy and 2.3% for permanent palsy [2]. These numbers were diagnosed using a direct flexible laryngoscopy (DLF). These palsy will cause the patient to experience hoarseness, choking, and aspiration due to unilateral palsy [3]. Meanwhile, patients who have anatomical abnormality were referred to ENT Surgeon. On march 11th 2020, WHO declared the Covid-19 virus as a global pandemic. Based on current data, it has a higher mortality rate compared to influenza [4,5]. During this pandemic, doing the DFL has become a major risk to the patient and to the doctor performing the examination as the procedure will allow the virus to aerosolize. Thus, this creates a demand to diagnose these abnormalities while maintaining the necessary health protocol that will create a safe environment for the examiner and examinee [6]. Hence, the transcutaneous laryngeal ultrasonography (TLUS) has been the go-to procedure to diagnose the vocal cords. Despite DFL is still the gold standard for diagnosing vocal cords, the TLUS is a non-invasive procedure, easy to learn, not constricted to be done by an ENT Surgeon, cheaper, and safer procedure to perform. According to the studies, DFL has a 99% visualization rate when evaluating vocal cords. This visualization rate is much higher when compared to TLUS. However, DFL is invasive, has a long term uncomfortable side effect for the examinee, needs local anesthesia, and has a chance to create an allergic reaction [5]. Considering all of those points, it is logical to prefer the safer non-invasive procedure. Nevertheless, TLUS is an operator dependent and skill dependent examination to do. This raises further discussion on considering this modality usage which will be elaborated in this review [7].

2. Review Results

A literature searching was performed in the PubMed database in April 2021. All English-language publications since 1996 to 2021 were obtained. We used search terms of ‘‘Transcutaneus Laryngeal Ultrasonography to Evaluate Vocal Cords in COVID-19 Pandemic Era’’. These were mainly based on the official thesaurus (MeSH). The initial searching results were screened through its title and abstracts. Thereafter, the potential original articles mainly focusing on TLUS were all identified. 17 full text articles were downloaded and reviewed to evaluate the TLUS usage on vocal cords abnormalities evaluations.

2.1 TLUS (Transcutaneus Laryngeal Ultrasonography)

TLUS is done using a USG 5-10-MHz (aperture 40 mm) linear transducer. The patient undergoing the procedure will be positioned in a supine position while having their neck hyperextended (Figure 1). For overweight and/or short-necked patient, a pillow under the neck will help further extend the neck. These USG examinations are performed to evaluate the neck vascularization, the two thyroid lobule, vocal cords, and thyroid’s isthmus [8].

The transducer is placed transversally on top of the

thyroid cartilage while evaluating the vocal cords. Transducer should be moved craniocaudal until the two vocal cords are seen. If there are any difficulties in finding the vocal cords, the transducer should be placed on the lateral side of the acoustic window, which is the thyroid cartilage. If found correctly, true and false vocal cords will be seen alongside the artenoid cartilage (Figure 2). The true vocal cords will be hypoechoic and positioned right below the thyroid cartilage while false vocal cords will be more hyperechoic and positioned more caudally when compared to the true vocal cords. Another difference is that when saying the letter "I" true vocal cords will move symmetrically maintaining the abduction adduction [9-13].

Figure 1: Patient's position, placement of the gel pad and ultrasound tranducer on the neck [13]

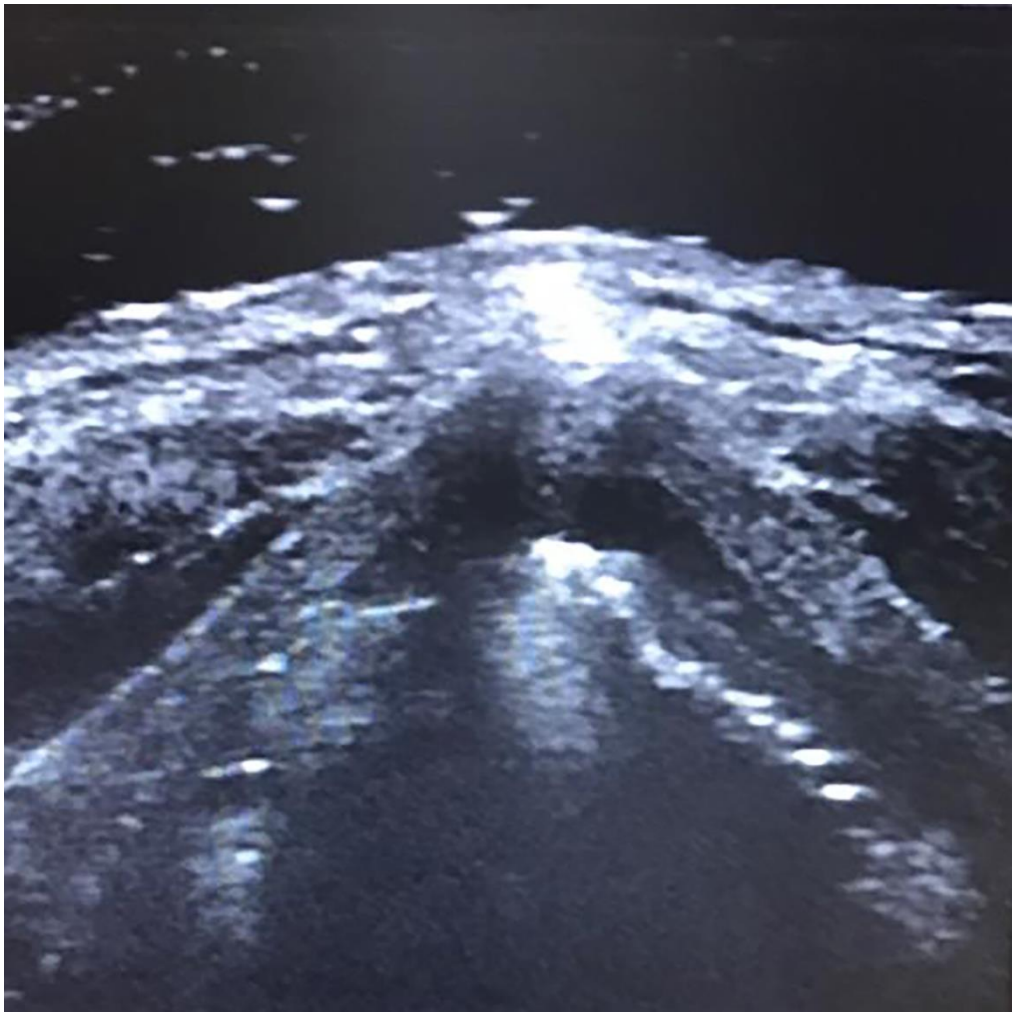

Figure 2: A superior view from below the thyroid cartilage. The image captures only main components, including the anatomic false and true vocal cords. However, as the patient speaks, dynamic assessment would show that normal true vocal cords move medially towards the midline in patients without nerve palsies [12].

2.2 DFL (Direct Flexible laryngoscopy)

DFL is performed while the patient maintains a semi recumbent position. Before the procedure, the patient is instructed to close the mouth and to breathe through their nose. Patient are given the topical anesthesia and decongestive medicine before the examination. The laryngoscope being used has 3.6mm diameter, inserted through the nose, to the nasal lining, until the lower side of the nasal septum. While the laryngoscope is being inserted, the patient is instructed to breathe through the nose. When the scope reaches the soft palate, the vocal cords will be seen (Figure 3). The patients is then asked to say the letter "I" allowing the examiner to evaluate the vocal cords [9].

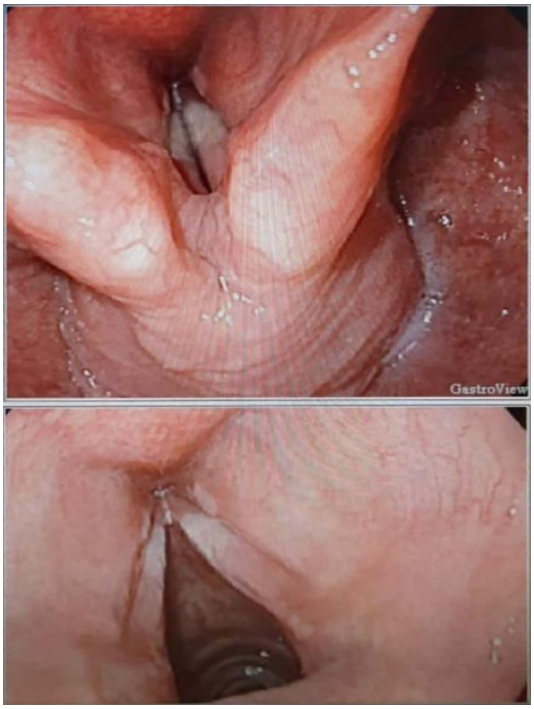

Figure 3: Normomobile vocal cords to Direct Flexible laryngoscopy (DFL) - in adduction and abduction

3. Discussion

Evaluating vocal cords has been an integral and standard practice while doing a thyroid surgery. A guideline published by American Academy of Otolaryngology and Head and Neck Surgery suggests that all patient undergoing such surgery has to be evaluated on their vocal cords before and after the surgery using the DFL [4]. As previously stated, DFL is an invasive procedure that causes long term uncomfortable side effect and cannot be done by the surgeon alone. On the other hand, TLUS offers a cheaper, easier, and safer alternative to examined vocal cords before and after the surgery [8].

A study by Borel et al. stated that TLUS has a low sensitivity thus need a DFL to confirm the findings. In this study, TLUS only diagnosed 3 RLN palsies while DFL diagnosed 9 of all subjects. Borel et al. found that male gender and old age are two significant risk factors of having difficulties to diagnose RLN Palsy [14-17].

Building on this, a few of institutions suggest a new device that increases visualization, especially on men. Newest article suggests using a gel pad to increase the surface area between the neck and USG transducer. The article was published by Woo et al. that stated that the gel pad usage on 482 patients increases the visualization of TLUS from 93.4% to 99.0%, boosting the sensitivity of 98.0% to 98.0%, and the specificity of 99.7% to 99.8%. The gel pad usage is found significantly improving visualization of the vocal cords. Therefore, using a gel pad is a simple and easy way to increase the visualization [10].

Gambardella et al. reported a study involving 396 patients to compare the TLUS and DFL. TLUS showed

a sensitivity of 97% and specificity 96% in detecting the vocal cords movement. They reported that only 14 out of 396 patients with difficulty of finding the vocal cords. In such cases, they used the lateral acoustic window to visualize the vocal cords. This study also showed that TLUS rarely over-diagnosed a patient on having a RLN palsy. 30 patients confirmed having RLN palsy using the DFL out of 47 patient suspected having RLN palsy using TLUS. Moreover, only 1 patient out of 396 patient ended up becoming a false negative [9].

While DFL is the gold standard, it still has many downsides. The examination is more expensive when compared to TLUS. DFL is considered an aerosol generating procedure thus requiring the staff and the patient to use a high level of PPE while performing the examinations [11,12]. This increases further the budget used. On the other hand, TLUS is a much cheaper and safer option. While TLUS is good on examining vocal cords before and after the thyroid surgery, TLUS findings highly depends on the operator skill while performing the examinations. As such, further course might be needed to further hone the surgeon skill to perform the TLUS.

4. Conclusion

Current studies proved TLUS boasts a high sensitivity rate while screening abnormalities of the vocal cords. TLUS is considered as a safer option to DFL, thus it is much better fit to use while in pandemic state. TLUS should be used before and after the thyroid surgery. When an abnormality is found, it should be validated using a DFL.

Clinical Significance

DFL is an aerosol generating procedure even though as a gold standard for evaluating vocal cords paralysis as a complication of thyroid surgery. Hence, TLUS is a safer option to use before and after thyroid surgeries in pandemic era.

Acknowledgment

Not applicable.

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