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Transcutaneous Laryngeal Ultrasonography for the Assessment of Vocal Cord Mobility before and after Thyroidectomy

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Abstract

Background: Transcutaneous laryngeal ultrasonography (TLUS) has emerged as a promising non-invasive method for assessing vocal cord mobility, offering advantages over traditional laryngoscopy, particularly in scenarios where patient discomfort or risks are a concern.

Aim of Study: This study aimed to evaluate the role of transcutaneous ultrasonography in assessing vocal cord mobility before and after thyroidectomy, highlighting its utility in diagnosing vocal fold paralysis or paresis.

Patients and Methods: Vocal fold displacement from the midline was analyzed across various conditions in patients undergoing thyroidectomy. Vocal fold displacement velocity (VFDV) was measured to assess vocal fold functionality. TLUS diagnostic accuracy was evaluated for identifying vocal fold paralysis.

Results: TLUS demonstrated high sensitivity and specificity for detecting vocal fold paralysis, with significant reductions in VFDV post-thyroidectomy. The correlation between VFDV and dysphonia scores suggested potential associations between vocal fold mobility and voice quality, warranting further investigation.

Conclusion: TLUS emerges as a reliable, non-invasive alternative to laryngoscopy for evaluating vocal cord mobility in thyroidectomy patients. Its capacity for quantitative assessments and diagnostic precision enhances clinical decision-making and patient management.

Key Words: *Transcutaneous laryngeal ultrasonography – Vocal cord mobility – Thyroidectomy – Vocal fold paralysis – Vocal fold displacement velocity.*

Introduction

VOCAL fold movement, including abduction and adduction, is controlled by the recurrent laryngeal nerve. The recurrent laryngeal nerve is located in the tracheoesophageal groove from the subclavian artery in the right side and the aortic arch in the left side and then enters the larynx at the cricothyroid junction. Therefore, lesions that are near the tracheoesophageal groove and cricothyroid junction have the potential to damage the nerve, causing impaired vocal fold movement and clinical hoarseness [1].

Neoplasms of thyroid gland origin, especially thyroid cancer, and thyroid surgery are the most common causes of vocal fold paralysis, respectively [2].

Vocal cord (VC) palsy is one of the major complications after thyroidectomy **[3]**. The rate of VCP after thyroidectomy ranges from 0.5% to 20% **[4].**

In the pre-operative setting, the presence of VC palsy might indicate locally advanced malignancy with invasion into recurrent laryngeal nerve (RLN). Post-operatively, it signifies surgical complication. Diagnosis of VC palsy could lead to earlier referral for voice rehabilitation and possible intervention **[5].**

Postoperative vocal cord (VC) paresis or palsy (VCP) after thyroid or neck surgery can impair daily life. VCP causes dysphonia and hoarseness, and that affecting both VCs can cause life-threatening airway obstruction **[6].**

Flexible larynxgoscopic examination has been the gold standard for decades. However, its rou-

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Abbreviations:

AR : Arytenoid.
FC : False cord.
RLN : Laryngeal nerve.
TC : True cord.
TLUS : Transcutaneous laryngeal ultrasonography.
TLUSG : Transcutaneous laryngeal ultrasound.
VC : Vocal cord.
VCP : Vocal cord paresis or palsy.
VFDV : Vocal fold displacement velocity.

tine use had been criticized. Insertion of invasive laryngoscopy also results in unnecessary patients' discomfort **[7].**

Transcutaneous laryngeal ultrasound (TLUSG) has been proved to be a sensitive, non-invasive tool in detecting VC palsy in both pre-operative and post-operative settings. If TLUSG is applied as a screening tool, 96.1 and 85.8% of pre-operative and post-operative patients can be saved from laryngoscopic examinations **[8].**

Aim of the study:

The aim of this study was to emphasize the role of transcutaneous ultrasonography in evaluating vocal cord mobility before and after thyroidectomy.

Patients and Methods

This Case control study was conducted at Radiology Department, Faculty of Medicine, Ain Shams University Hospitals from August 2023 until February 2024.

Thirty both sex patients who were scheduled to undergo elective thyroidectomy were examined before and after thyroidectomy.

Age group: Adult age (between 18 to 80 years), from both sexes were included and those who underwent elective thyroidectomy either partial or total were included in the study. While patients younger than 18 years or had preoperative vocal cord palsy were excluded from the study.

Ethical considerations: Before being enrolled into the study, the patients consented to participate after the nature, scope and possible consequences of the clinical study had been explained in a form understandable to them.

Confidentiality was assured for all patients' data.

Study interventions and procedures: The medical charts of ultrasound of thirty consecutive both sex patients were analyzed. Ultrasound machine (GE LOGIQ S8) with linear probe was used at a frequency of 7-12 MH. The device was set in B-mode. Transcutaneous ultrasonography: The US examinations were performed using adapted equipment with high-resolution linear transducers.

Procedure: The patients lay supine and they were asked to expose neck and upper chest and extended neck. Transcutaneous ultrasound was performed by placing the probe on the neck area. The examined structures including the thyroid gland, vocal cords and surrounding structures were scanned in at least two perpendicular planes with respect to its anatomical orientation (longitudinal, transverse). To assess the VCs function, sonographic landmarks, false cord (FC), true cord (TC) or arytenoid (AR) were identified whenever possible. The patients were asked to perform passive (quiet spontaneous breathing) to assess the free mobile movement of the vocal folds bilaterally. The patients were asked to perform Valsalva maneuver to measure the adduction of both vocal cords from an imaginary line at the midline in addition to active deep inspiration to assess the abduction of both vocal folds. The patients were asked to perform active (phonation with a sustained vowel "aa") maneuver to measure the vocal fold displacement velocity (VFDV) by pulsed Doppler wave. Supervisors and experts interpreted the images of the examinations. All patients were examined clinically and we evaluated every patient by auditory-perceptual evaluation using the GRBAS which is a dysphonia score. After that the results were compared with laryngoscopy.

Statistical analysis: Data analysis was conducted using IBM SPSS software package version 27.0 (Armonk, NY: IBM Corp). Quantitative data were presented through minimum, maximum, mean, and standard deviation, while qualitative data were elucidated using numerical values and percentages (%). The Shapiro-Wilk test was performed to determine the date's normality. Paired sample *t*-test was conducted to determine the differences between the two paired continuous variables. A Spearman correlation test explored the relationship between the ordinal and continuous variables. Furthermore, the ROC curve analysis detected the diagnostic accuracy of the method. Statistical significance was assigned to values below 0.05, with values below 0.01 considered highly statistically significant.

Results

The mean age of the cases is 39.5. Regarding thyroidectomy, 73.3% underwent total thyroidectomy, while 26.7% had partial thyroidectomy. The most common thyroid pathology was benign TIRAD III nodules, which appeared in 30% of patients. Other pathologies included Hashimoto's with TIRAD III/IV nodules, thyroid cancer, and TIRAD IV/V nodules. Also, 16.7% had no vocal fold paralysis by ultrasound. 10% had bilateral paralysis. Left vocal fold paralysis was most common at 46.7% (Table 1).

Table (2) show the normal and paralyzed vocal fold from the midline within the study cases. For normal vocal folds, the mean distance from the midline during inspiration was 2.65mm (range 1.50-4.30mm). During Valsalva, it was 1.03mm (range 0.50-1.70mm). For paralyzed vocal folds, the mean

distance from the midline during inspiration was 0.724 mm (range 0.30-2.20mm). During Valsalva, it was 0.724mm (range 0.30-2.20mm).

Table (1): Demographic and clinical characteristics of the patients in the study.

Variables	Frequency	Percent
Thyroidectomy:		
Partial	8	26.7
Total	22	73.3
Benign TIRAD III Nod	9	30.0
Hashimoto e TIRAD III Nod	1	3.3
Hashimoto e TIRAD IV Nod	2	6.7
Pathology:		
Thyroid cancer	8	26.7
TIRAD IV Nod	7	23.3
TIRAD V Nod	3	10.0
No	5	16.7
Paralyzed vocal fold by ultrasound:		
Bilateral	3	10.0
Left	14	46.7
Right	8	26.7
Age:		
Mean ± SD	39.5±7.92	

Table (2): Vocal fold from midline measurements of the cases in the study.

	N	Minimum	Maximum	Mean	SD
Normal vocal fold from the midline					
During active inspiration (nm)	25	1.50	4.30	2.65	0.812
During valsalva (nm)	25	0.50	1.70	1.03	0.301
Paralyzed vocal fold from the midline					
During active inspiration (nm)	25	0.30	2.20	0.724	0.403
During valsalva (nm)	25	0.30	2.20	0.724	0.403

A postoperative decline in VFDV values indicates dysfunction of the VFs and possible paralysis. Table (3) shows the Vocal fold displacement velocity (VFDV) measurements before and after the surgery. Before surgery, the mean VFDV was 128.93±39.99 cm/s, with a 70-220cm/s range. However, after surgery, the mean VFDV reduced significantly to 40.43±18.67 cm/s, with a range of 0-70cm/s. This difference was found to be statistically significant in mean VFDV before and after surgery which means vocal cord paralysis, *p*-value <0.001. This finding demonstrates that thyroidectomy surgery significantly impaired vocal fold mobility, as evidenced by the reduced VFDV after surgery.

Table (3): Vocal fold displacement velocity (VFDV) measurements within the cases in the study.

VFDV	N	Minimum	Maximum	Mean	SD	*p*-value
Before surgery (cm/s)	30	70	220	128.93	39.99	<0.001**
After surgery (cm/s)	30	0	70	40.43	18.67	

The *p*-value is calculated by a paired sample *t*-test.
** Significant at <0.01.

Table (4) shows the GRBAS grades after the surgery. No patients (0%) had a normal grade 1 score. However, the majority (63.3%) had mild-to-moderate dysfunction (grade 2), while over a third (36.7%) had severe impairment (grade 3).

Table (4): GRBAS (dysphonia score) of the cases in the study.

Grades	1	2	3
Frequency	0	19	11
Percent	0%	63.3%	36.7%

Table (5) displays the Correlation between dysphonia score and Vocal fold displacement velocity (VFDV) before and after the surgery. There was no significant correlation found between presurgical VFDV and dysphonia score (r=0.056, p=0.769). The correlation between postsurgical VFDV and dysphonia score approached statistical significance (R=–0.309, p=0.096). The negative correlation coefficient indicates that higher VFDV (better mobility) tended to be associated with lower (better) dysphonia scores. However, the *p*-value suggests that this relationship was not statistically significant in this small sample.

Table (5): Correlation between dysphonia score and Vocal fold displacement velocity (VFDV).

VFDV	*r*	*p*-value
Before surgery (cm/s)	0.056	0.769
After surgery (cm/s)	–0.309	0.096

r is the correlation coefficient.
The *p*-value is calculated by the Spearman correlation test.

Table (6) shows the diagnostic accuracy metrics for detecting left and right vocal fold paralysis by Transcutaneous laryngeal ultrasonography compared to the reference standard of Laryngoscopy. For left vocal fold paralysis, sensitivity was 85%, indicating good detection of true positives, while

specificity was 100%, reflecting no false positives. Positive predictive value (PPV) was 100%, and negative predictive value (NPV) was 76.9%. The area under the ROC curve (AUC) was 0.912. Similarly, for right vocal fold paralysis, Sensitivity was 76.9%, specificity was 100%, PPV was 100%, NPV was 87.0%, and AUC was 0.850.

The high AUC values and statistically significant *p*-values <0.01 for both sides indicate strong overall diagnostic accuracy of ultrasonography. Therefore, transcutaneous laryngeal ultrasonography demonstrates good sensitivity and excellent specificity for diagnosing vocal fold paralysis compared to the reference standard.

Table (6): Diagnostic accuracy of Transcutaneous laryngeal ultrasonography.

	Sensitivity	Specificity	PPV	NPV	AUC	*p*-value
Left	0.850	1.00	1.00	0.769	0.912	<0.001**
Right	0.769	1.00	1.00	0.870	0.850	0.002**

PPV is a Positive predictive value. The *p*-value is calculated by ROC curve analysis.
NPV is a negative predictive value. ** Significant at <0.01.
AUC is the area under the curve.

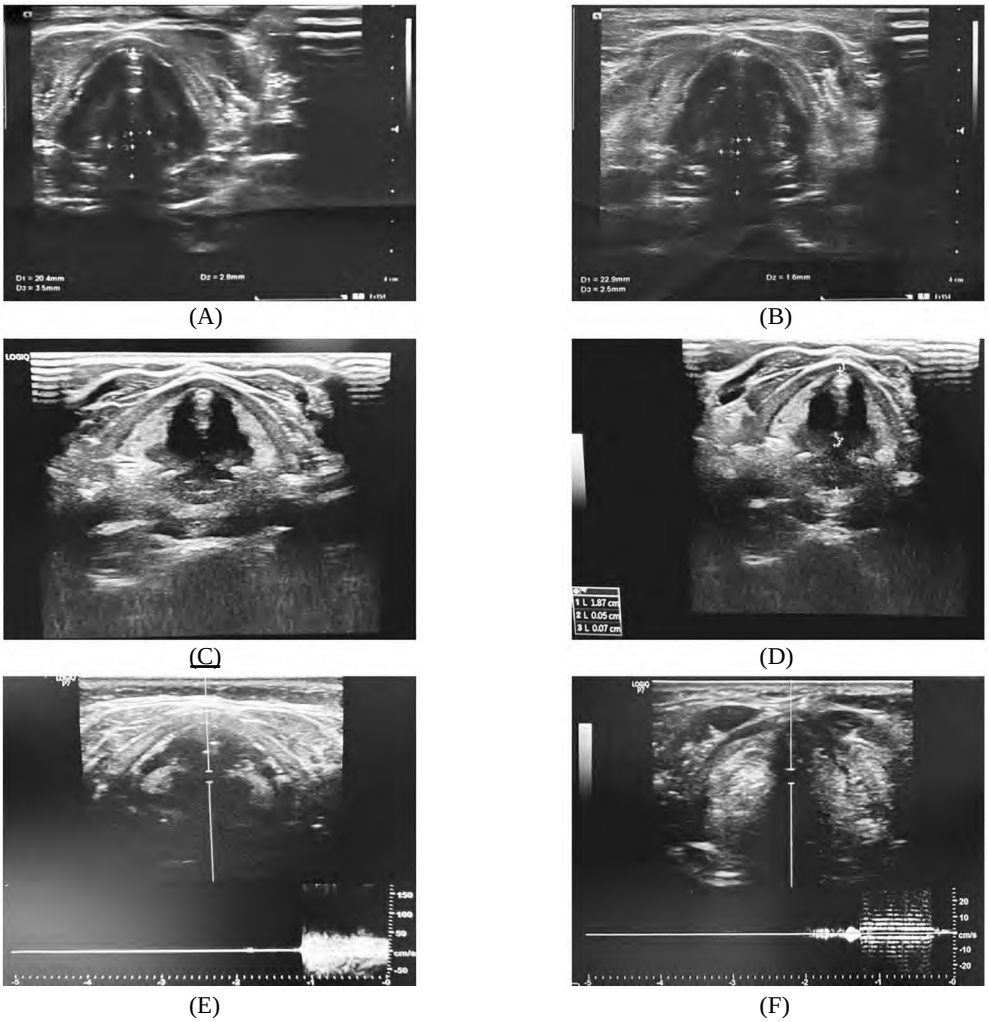

Fig. (1): A 38 years old female patient, presented with Hashimoto thyroiditis with large thyroid nodule (TIRAD 3), partial thyroidectomy was done and she experienced hoarseness of voice 2 weeks later. Laryngeal ultrasonography was done and positive result was reported of immobile bilateral VFs with distance 0.5 mm from midline at both valsalva and active inspiration. Laryngoscopy was done and the result was confirming bilateral VFs paralysis. Immediate tracheostomy was done and she referred to ENT clinic for treatment and good observation. VFDV before thyroidectomy was 49 cm/s and it was 7 cm/s after thyroidectomy. The normal VFs movement in a female has Hashimoto thyroiditis with large thyroid nodules (TIRAD 3) before thyroidectomy during valsalva maneuver and active inspiration, (A) Showing abduction of both VFs normally during active inspiration, the right VF abduction by 3.5 mm from midline and the left VF by 2.9 mm. (B) Showing adduction of both VFs normally during valsalva maneuver, the right VF adduction by 1.6 mm from midline and the left VF by 2 mm. The VFs movement in a bilateral VFs paralysis female after thyroidectomy during valsalva maneuver and active inspiration, VFDV before and after thyroidectomy, (C and D) Showing fixed bilateral VFs with 0.5 mm distance from midline during both valsalva maneuver and active inspiration. (E) Showing VFDV before thyroidectomy measuring 49 cm/s. (F) Showing VFDV after thyroidectomy measuring 7 cm/s. Laryngoscopy confirmed bilateral vocal cords paralysis.

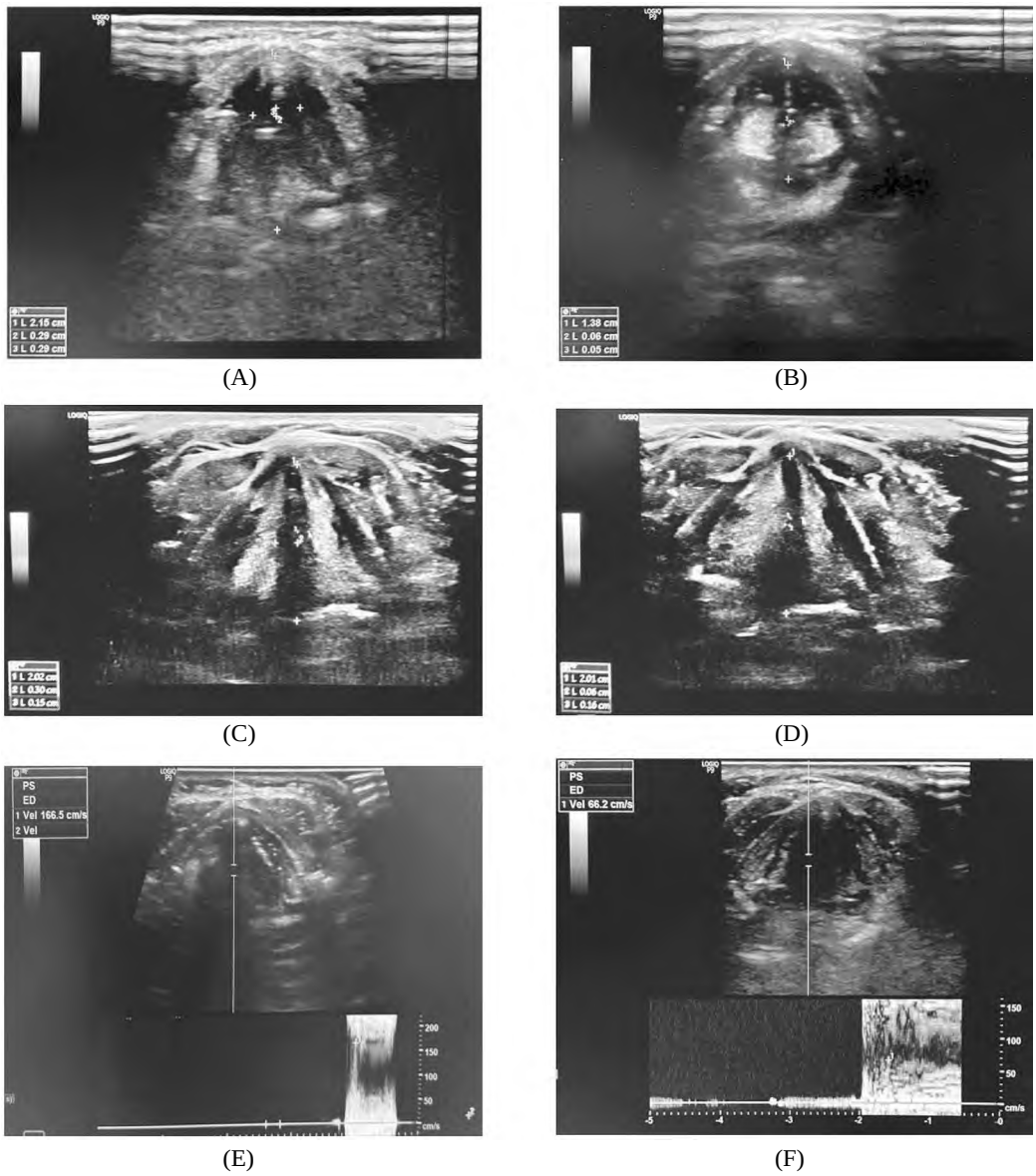

Fig. (2): A 21 years old male patient, presented with thyroid cancer, total thyroidectomy was done and he experienced hoarseness of voice 10 days later. Laryngeal ultrasonography was done and positive result was reported of immobile left VF. Distance of left VF from midline at both valsalva and active inspiration was 1.5 mm. While the right VF was mobile with distance 0.6 mm from midline at vasalva, it was 3 mm during active inspiration. VFDV before thyroidectomy was 166 cm/s and it was 66 cm/s after thyroidectomy. The normal VFs movement in a male has thyroid cancer before thyroidectomy during valsalva maneuver and active inspiration, (A) Showing abduction of both VFs normally during active inspiration, the right VF abduction by 2.9 mm from midline and the left VF by 2.9 mm. (B) Showing adduction of both VFs normally during valsalva maneuver, the right VF adduction by 0.6 mm from midline and the left VF by 0.5 mm. The VFs movement in a left VF paralysis male after thyroidectomy during valsalva maneuver and active inspiration, VFDV before and after thyroidectomy, (C) Showing fixed left VF with 1.5 mm from midline and abduction of right VF during active inspiration by 3 mm. (D) Showing fixed left VF with 1.5 mm distance from midline and adduction of right VF during valsalva maneuver by 0.6 mm. (E) Showing VFDV before thyroidectomy measuring 166 cm/s. (F) Showing VFDV after thyroidectomy measuring 66 cm/s. Laryngoscopy confirmed left vocal cord paralysis.

Discussion

The present study aimed to detect the role of transcutaneous ultrasonography in evaluating vocal cord mobility before and after thyroidectomy.

This study examined the vocal fold displacement from the midline across various conditions. This analysis is pivotal in understanding the impact of thyroidectomy on vocal cord mobility, an essential aspect for predicting postoperative vocal function **[9]**. The normal vocal fold measurements from the midline during active inspiration ranged from 1.50nm to 4.30nm, with a mean value of 2.65±0.812. During the Valsalva, normal vocal fold measurements from the midline showed a narrower range, from 0.50nm to 1.70nm, with a mean of 1.03±0.301. The reduced range and lower mean value compared to active inspiration reflect the

nature of the Valsalva maneuver, which involves forced expiration against a closed airway, hence less movement of the vocal folds from the midline is expected. This condition mimics certain phonatory and respiratory stresses that could highlight subtle abnormalities in vocal fold mobility not evident during normal breathing [10,11].

For paralyzed vocal folds, the measurements from the midline during both active inspiration and the Valsalva were identical, ranging from 0.30 nm to 2.20nm with a mean of 0.724nm and an SD of 0.403. The uniformity of these results across both conditions indicates impaired vocal fold mobility, where the expected physiological variation between active inspiration and the Valsalva maneuver is absent. This finding is crucial, as it demonstrates the utility of transcutaneous laryngeal ultrasonography in detecting vocal fold paralysis, characterized by reduced and less variable displacement.

The consistency of measurements for paralyzed vocal folds suggested that vocal fold immobility can be quantitatively assessed through this non-invasive imaging technique, providing valuable pre- and post-operative information. This finding underscores the importance of assessing vocal fold mobility in a standardized manner, contributing to the refinement of clinical protocols for managing patients undergoing thyroidectomy.

In addition, the current study found statistically significant differences in the Vocal fold displacement velocity (VFDV) measurement before and after the surgery. The significant reduction in mean VFDV from 128.93±39.99cm/s before surgery to 40.43±18.67cm/s post-surgery underscores the profound effect of thyroid surgery on vocal cord function which means impairment in vocal fold mobility. The measurement of Vocal Fold Displacement Velocity (VFDV) plays a critical role in evaluating vocal fold mobility and function, especially in the context of thyroidectomy [12]. VFDV is the most objective parameter measured by Doppler, and it is proportional to the velocity of the wave, causing the vibration of the vocal folds [13].

Specifically, Wolff et al. [14] discussed the significance of VFDV as the most objective parameter in Transcutaneous Laryngeal Ultrasonography (TLUS), highlighting its proportional relationship to the wave velocity causing vocal fold vibrations. This parameter becomes crucial in diagnosing vocal fold paralysis or paresis, where a reduction in VFDV can indicate impaired mobility.

Our findings were consistent with a previous study by Dubey et al. [15], which utilized transcutaneous laryngeal ultrasonography to measure VFDV before and after thyroidectomy. The authors found that the median Pre-operative VFDV (240cm/sec) was significantly higher than the median Post-operative VFDV (180cm/sec). The authors concluded that TCLUS can consistently evaluate individuals with disabled VFs using FL that is specifically set aside for the purpose of confirming or addressing cases that are uncertain.

In addition, Dedecjus et al. [13] found that VFDV was under 30cm/s in two participants, who were then diagnosed with VF paralysis through laryngoscopy. Conversely, a reduction of 50% in VFDV was observed in eight others compared to their pre-surgical velocities (ranging between 65 and 140cm/s); half of these individuals were identified with VF impairments by an ENT doctor. In all cases, VFDV reverted to normal three months post-thyroidectomy, indicating the temporary nature of these conditions.

Therefore, VFDV stands as a crucial metric for assessing VF functionality. It is a straightforward, objective measure where significant deviations can accurately indicate VF paralysis. Although definitive normal VFDV values have yet to be established, with ranges noted from 60 to 300cm/s in previous studies, values below 60cm/s are indicative of VF dysfunction. The potential for assessing arytenoid symmetry horizontally in TLUS remains an area for future exploration [16].

On the other hand, the current study revealed an interesting, albeit not statistically significant, relationship between the speed of vocal fold displacement (VFDV) and the severity of dysphonia, both before and after surgical intervention. Before surgery, the correlation between VFDV and the dysphonia score was negligible, with a correlation coefficient (r) of 0.056 and a p-value of 0.769, indicating no significant relationship. However, Post-surgery, the result suggested a potential inverse relationship between post-surgical VFDV and dysphonia scores, as evidenced by a negative correlation coefficient (r=–0.309). This implies that patients with higher VFDV, indicative of better vocal fold mobility, tended to have lower (improved) dysphonia scores. Nonetheless, this relationship was not significant, p-value=0.096.

The correlation between dysphonia score and Vocal fold displacement velocity (VFDV) in thyroidectomy has been investigated in several studies, with varying conclusions. Some studies have found a correlation, suggesting that changes in VFDV may be associated with post-thyroidectomy vocal alterations. For instance, Rai et al. [17] analyzed vocal fold behavior in young normophonic adults under-

going thyroidectomy. They observed a correlation between dysphonia scores and VFDV, indicating that post-surgery alterations in vocal fold dynamics could influence voice quality. Similarly, Ramalho et al. *[18]* also reported a correlation, highlighting the impact of thyroidectomy on vocal fold movement and velocity, with implications for vocal recovery and therapy.

On the contrary, the relationship between dysphonia score and VFDV requires further exploration. Some studies have noted the need for additional research to fully understand this correlation. Dubey et al. *[15]* mentioned that the correlation is unresolved and necessitates further investigation, indicating the complexity of quantifying the impact of thyroidectomy on voice outcomes.

Regarding the diagnostic accuracy of TLUS in assessing vocal cord mobility before and after thyroidectomy, the present study found that TLUS exhibited a high sensitivity of 85% for identifying left vocal fold paralysis, successfully detecting a large majority of true positive cases. Its specificity reached 100%, indicating an impeccable ability to identify all true negative cases without any false positives correctly. The area under the receiver operating characteristic (ROC) curve (AUC) was 0.912, highlighting excellent diagnostic accuracy. For right vocal fold paralysis, the sensitivity was slightly lower at 76.9%, yet still indicative of a robust capacity to identify true positives. The specificity and PPV remained at 100%, affirming the method's precision in confirming true negatives and diagnosed cases.

The high AUC values for both left and right vocal fold paralysis, coupled with statistically significant p-values <0.01, validated the superior diagnostic accuracy of TLUS. These findings advocate for the utility of TLUS as a reliable, non-invasive diagnostic tool with excellent sensitivity and specificity for detecting vocal fold paralysis, offering a significant clinical advantage over traditional methods.

The diagnostic accuracy of Transcutaneous Laryngeal Ultrasonography (TLUS) in assessing vocal cord mobility before and after thyroidectomy has been reported in various studies. For example, Wolff et al. *[16]*, in their study on the application of Translaryngeal Ultrasound (TLUS) in patients with neck surgery, found the accuracy of TLUS compared to laryngoscopy to be 98.3%, with a sensitivity of 98.1% and specificity of 100%, aligning with our results.

This indicates a high diagnostic accuracy of TLUS for assessing vocal fold function in patients after thyroid, parathyroid, and neck lymph node surgery. Kumar et al. *[12]* also found that the visualization rate of the vocal cords with ultrasound was 96.9%, whereas with video rhinolaryngoscope (VRL) was 100%.

The sensitivity and specificity of ultrasound to detect paralysis were 100% and 93.44%, respectively, suggesting high diagnostic accuracy of TLUS in assessing vocal cord mobility perioperatively.

In addition, Wolf et al. *[16]* reviewed publications on the role of TLUS in vocal fold evaluation and reported that visibility of vocal folds in TLUS ranged from 72.8 to 100%. They concluded that TLUS can usually adequately assess whether the function of the vocal folds is intact or if paresis/paralysis has occurred, indicating it can be a convenient alternative to laryngoscopy.

Sadacharan et al. *[19]* also reported the diagnostic accuracy of TLUS in visualizing vocal cords in the post-operative period. TLUC has a sensitivity of 83.33% and a negative predictive value of 97.90%. This is significant, as it indicates TLUS's reliability in detecting potential vocal cord impairments after surgery.

Further, Tosun et al. *[20]*, found that the sensitivity, specificity, positive predictive value (PPV), and negative predictive values (NPVs) were 75%, 98.66%, 85.71%, and 97.36% (74/76), respectively. The diagnostic accuracy of TLUS was 97.96%, underlining its reliability for post-thyroidectomy vocal cord evaluation. This is complemented by findings from Wong et al. *[21]* who reported a sensitivity of 88.9% in detecting vocal cord paralysis (VCP) with TLUS, underscoring its feasibility as a non-invasive tool for high-risk patients.

Furthermore, Ting-Chun Kuo et al. *[22]* highlighted the exceptional diagnostic accuracy of TLUS, with a 100% accuracy rate in their study, compared to a sensitivity of 70.21% and specificity of 100% for laryngeal twitch palpation (LTP). This high level of accuracy suggests TLUS's potential to improve pre-operative and post-operative assessment of vocal cord mobility significantly, minimizing the need for more invasive procedures like laryngoscopy.

These findings indicated that the diagnostic accuracy of TLUS in assessing vocal cord mobility before and after thyroidectomy is substantiated by its high sensitivity, specificity, and negative predictive value. Its non-invasive nature and high diagnostic reliability position TLUS as a valuable tool in the pre-operative and post-operative evaluation of thyroidectomy patients, potentially enhancing clinical outcomes and patient care.

TLUS facilitated the precise measurement of vocal fold displacement from the midline during breathing, revealing significant variances between normal functioning vocal folds and those affected by paralysis. This highlights its critical role in the quantitative detection of mobility impairments.

Furthermore, measuring vocal fold displacement velocity (VFDV) via TLUS demonstrates a notable decline following thyroidectomy, underscoring its significance as an objective metric for assessing vocal fold functionality.

Although the correlation between VFDV and the severity of dysphonia necessitates further examination, preliminary data hint at underlying associations that merit deeper exploration. Moreover, TLUS has proven to possess exceptional diagnostic accuracy in identifying vocal fold paralysis, characterized by high sensitivity, specificity, and negative predictive value compared to the established gold standard of laryngoscopy.

Collectively, these findings affirmed that TLUS stands as a dependable, non-invasive, and economically viable alternative to laryngoscopy for the assessment of vocal cord mobility in the context of thyroidectomy procedures.

Its capacity to provide quantitative assessments and diagnostic precision significantly enhances clinical decision-making and patient management. Future research endeavors should aim to define standard normal values and further elucidate the correlations highlighted, thereby expanding upon the encouraging results presented herein.

Conclusion:

This study elucidated the growing recognition of transcutaneous laryngeal ultrasonography (TLUS) as a valuable, non-invasive technique for evaluating vocal cord mobility pre- and post-thyroidectomy. TLUS facilitated the precise measurement of vocal fold displacement from the midline during breathing, revealing significant variances between normal functioning vocal folds and those affected by paralysis. This highlights its critical role in the quantitative detection of mobility impairments.

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Conflicts of interest:

We have no conflicts of interest to disclose.

Author's Contribution:

- H K A selected the patients and reviewed their images and did the interventional procedure, collected, tabulated, and analyzed the data.
- M A A, N M H, supervised management of the cases, interpreted the patient data and wrote the manuscript.
- All authors read and approved the final manuscript.

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تصوير الحنجرة بالموجات فوق الصوتية عبر الجمد لتقييم حركة الأحبال الصوتية قبل وبعد استئصال الغدة الدرقية

الخلفية: برز التصوير بالموجات فوق الصوتية للحنجرة عبر الجلد كطريقة واعدة غير جراحية لتقييم حركة الأحبال الصوتية، مما يوفر مزايا مقارنة بتنظير الحنجرة التقليدى، لا سيما فى السيناريوهات التى يكون فيها انزعاج المريض أو مخاطره مصدراً للقلق.

الهدف من العمل: هدفت هذه الدراسة إلى تقييم دور التصوير بالموجات فوق الصوتية عبر الجلد فى تقييم حركة الأحبال الصوتية قبل وبعد استئصال الغدة الدرقية، مع تسليط الضوء على فائدتها فى تشخيص شلل الطية الصوتية أو الشلل الجزئى.

المرضى والطرق: تم تحميل إزاحة الطية الصوتية من خط الوسط عبر حالات مختلفة لدى المرضى الذين يخضعون لاستئصال الغدة الدرقية. تم قياس سرعة إزاحة الطية الصوتية لتقييم وظيفة الطية الصوتية. تم تقييم دقة التشخيص بالموجات فوق الصوتية للحنجرة عبر الجلد لتحديد شلل الطية الصوتية.

النتائج: أظهر التصوير بالموجات فوق الصوتية للحنجرة عبر الجلد حساسية ونوعية عالية للكشف عن شلل الطية الصوتية، مع انخفاض كبير فى سرعة إزاحة الطية الصوتية بعد استئصال الغدة الدرقية. تشير العلاقة بين سرعة إزاحة الطيات الصوتية ودرجات خلل النطق إلى وجود ارتباطات محتملة بين حركة الطيات الصوتية وجودة الصوت، مما يستدعى المزيد من الاستقصاء.

الخلاصة: يظهر التصوير بالموجات فوق الصوتية للحنجرة عبر الجلد كبديل موثوق وغير جراحى لتنظير الحنجرة لتقييم حركة الأحبال الصوتية لدى مرضى استئصال الغدة الدرقية. وتعزز قدرته على إجراء التقييمات الكمية والدقة التشخيصية اتخاذ القرارات السريرية وادارة المرضى.