Perioperative ultrasonographic evaluation of the vocal cord: An underutilized tool

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Abstract

Application of Ultrasonography (US) for larynx, in particular vocal cord evaluation is relatively new. The US offers a number of advantages, being non-invasive, reproducible, no radiation risk, portable, bedside and allow real time dynamic assessment without causing any significant patient discomfort. We described briefly some of the potential uses and techniques of US of vocal cord as an anaesthesiologist in the perioperative period.

Keywords: Perioperative, ultrasonography, vocal cord, neck surgery

Bedside evaluation of vocal cord is performed most commonly by direct and indirect laryngoscopy or flexible bronchoscopy, but this may not be readily applicable in all patients, especially children, uncooperative and intubated patients or patients with over-active gag reflex, or any other pathology interfering introduction of laryngoscopy, fiberscope [1, 2]. Ultrasound (US) has been widely used to evaluate head and neck pathology for years, however, application of US for larynx, particularly vocal cord evaluation is relatively new [3, 4, 5]. Conventional US allows visualization of upper airway and larynx, with special techniques functional evaluation of vocal cord can also be done as a non-invasive dynamic test. TeUS offers a number of advantages, being non-invasive, reproducible, fast, portable, and real-time dynamic assessment without causing any significant patient discomfort [4, 6, 7]. Ultrasound has been used over more than two decades for diagnosis of various laryngeal disorders [8, 9] including the assessment of vocal cord mobility [3, 10, 11]. Recently, few studies have demonstrated its usefulness in perioperative assessment of vocal cord movement in patients with goiter undergoing thyroid resection [5, 10, 12]. Due to its superficial location, a linear transducer should be able to provide identification of laryngeal parts with precision. Vocal fold is easily seen through thyroid cartilage in children and young adults. However, as we grow older which gives rise to acoustic shadow on US image, especially in elderly and male making the visualization of vocal cord difficult [13, 14]. Vocal cords can be visualized using three level of view, glotic or thyroid, infra glotic or infra thyroid, and supraglottic or suprathyroid view [15]. In infra thyroid view, the transducer is placed on the cricothyroid membrane with US beam angulated approximately 30° cranially to visualize the vocal cords. In suprathyroid view, the US probe is placed under the chin and by tilting the probe upward, the US beam points caudally, the posterior half of the vocal folds are visualized along with the arytenoid and can easily appreciate the vocal folds movements [13, 16]. On US scanning, vocal cords are seen as triangular, hypoechoic structures with their apex lying behind the angle of the thyroid lamina and their bases inserted on the hyperechoic arytenoid vocal process. Te true vocal folds are seen as hypoechoic images surrounded by mobile linear hyperechoic images of the vocal ligament; the false cords are hyperechoic due to their fatty content and mucous gland [9, 17] (Fig. 1).

Although larynx has air conduits within its lumen which can act as a barrier to US, the strap muscles and paraglotticissue s transmit US well to both vocal fold and arytenoid area, the sharp angle of thyroid cartilage can be overcome by liberal application of...
conductiv gel, the thyroid gland, even if enlarged, provides a good medium for US wave [10, 14].

Hu et al. conducted a study involving 229 healthy volunteers of either sex, aged 2–81 years, high frequency US scanning was done to identify the sono graphic values of human true and false vocal cords. Both true and false vocal cords visualization was 100% in all female and male under 18 years, however, the visualization in male gradually dropped up to 40% after 60 years [18]. Recently, Woo et al. conducted a study comparing low (3–9 MHz) versus high frequency (5–12 MHz) US scanning to evaluate the vocal cords mobility in 301 consecutive patients undergoing thyroid and other neck surgery, US finding was validated with direct laryngoscopy; they demonstrated significantly higher visualization rate with low frequency (97.7% vs. 88.4%) with high sensitivity (97.6% vs. 92.9%) and specificity (96.5% vs. 86.5%) in comparison to high frequency US [19].

New functional imaging of vocal cord using Nakagami imaging technique which is based on statistics of backscattered signals; it is used for tissue characterization [20, 21]. This imaging technique has potential use to assess the relative concentration of collagen and elastic fibers, which are the key factors influencing the biomechanical properties of the vocal folds. Tere is growing interesting the use of laryngeal US for both anatomical abnormality and functional assessment of larynx. Anatomical assessment such as identifying masses, lesions, and nodules at the vocal folds, B-mode scanning, combined with Doppler imaging makes it possible to also evaluate the vocal cord functionality in real time. Te future indications may extend to evaluate subglotic stenosis, post-extubation stridor, obstructive sleep apnea, epiglottitis, laryngeal papillomatosis, etc.

References


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