Ultrasonography Diagnostic Validity in Structural and Functional Laryngeal Disorders

Thesis
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By
Anas Mohammad Askoura
M. Sc. of Otorhinolaryngology

Supervised by

Prof. Dr. Magdy Amin Riad
Professor of Otorhinolaryngology
Faculty of Medicine - Ain Shams University

Prof. Dr. Omar Hussein Omar
Professor of Radiodiagnosis
Faculty of Medicine - Ain Shams University

Prof. Dr. Samia Ahmad Fawaz
Professor of Otorhinolaryngology
Faculty of Medicine - Ain Shams University

Dr. Tamer Ali Youssef
Assistant Professor of Otorhinolaryngology
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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INTRODUCTION

A wide variety of techniques to assess laryngeal function are available. These techniques can generally be divided into clinical and investigational categories. A practical technique optimally should be safe, non-invasive, well- tolerated, and reliable. The results should be reproducible, accurate, and recordable for future reference (**Friedman, 1997).**

Ultrasonography of the head and neck is currently a cost-effective imaging tool allowing assessment beyond the clinician's physical examination. Ultrasonography is uniquely portable when compared with other imaging modalities, making it ideal for use in the clinical setting. It provides the clinician immediate feedback, allowing the provider to make accurate assessments in a timely manner. Ultrasonography does not carry the risk of irradiation and has been the tool of choice for diagnostic and therapeutic interventions (**Holtel, 2010).**

Several scanning methods have been suggested to improve visualization of the airway structures. However, air itself remains the key barrier during scanning and visualization because it attenuates ultrasound transmission and thereby creates artifacts. A study confirmed that sonography reliably shows most of the airway structures and parameters measured **(Prasad, 2011).**

The increasing need for diagnosis and treatment of laryngeal and voice diseases requires precise data for the true and false vocal cords. Laryngeal dimensions have been measured either directly from cadavers or on radiography, computed tomography (CT), magnetic resonance imaging (MRI), or microlaryngoscopy. The results obtained from cadavers could not reflect the physiologic vocal fold length in a living person. Measurement is extremely difficult after dissection because of the elasticity of the vocal cord. With the use of radiography for measurement, the vague landmarks in the film make it difficult to measure the vocal fold length precisely. Either CT or MRI can provide accurate data for both the true and false vocal cords, but CT has potential side effects such as radiation exposure. With MRI, imaging times are relatively long, and respiratory, swallowing, and vascular artifacts can degrade image quality, particularly in patients who cannot cooperate completely. Microlaryngoscopy is a relatively invasive method and is limited by the expertise of the endoscopist **(Hu et al., 2010).**

Over- and under- diagnosis of vocal fold paralysis is quite common because of splinting of the larynx which may occur with a rigid laryngoscope; poor visualization due to supraglottic collapse; cricoarytenoid fixation and paradoxical vocal fold movements resulting from the Bernoulli effect of air flow through the glottis during respiration **(Vats et al., 2004).**

Ultrasonography is routinely used for detecting cervical lymph nodal metastases with head and neck tumours, but it is not routinely used in the staging of laryngeal carcinoma. Some investigators have yielded promising results for high-frequency ultrasonography in diagnosis of laryngeal neoplasms. One of the important advantages of ultrasound over CT and MRI is the ability to evaluate the mobility of the vocal cord **(Hu et al., 2012).**

AIM OF THE WORK

The aim of this work is to:

- Evaluate the Validity of sonography as an imaging tool in identifying normal ranges and abnormalities of Laryngeal dynamics and anatomic structures.
- Determine the optimal scanning technique in terms of transducer selection and orientation.

ANATOMY

The larynx is a complex neuromuscular structure that sits at the crossroads of the respiratory and digestive systems (**Merati and Rieder**, **2003**). It consists of a framework of cartilages and fibro elastic membranes covered by a sheet of extrinsic muscles and lined with mucous membrane; it extends from its oblique entrance formed by the aryepiglottic folds, the tip of the epiglottis, and the posterior commissure to the lower border of the cricoid cartilage and bulges posteriorly into the laryngopharynx. Then the trachea extends from the lower edge of the cricoid cartilage to the carina where it divides into the main stem bronchi. It is formed by U-shaped cartilaginous rings anteriorly and is closed posteriorly by the trachealis muscle (**Mortola and Sant'Ambrogio**, **1979).**

The larynx evolved as a protective valve mechanism at the upper end of the lower airway necessitated by an unusual crossover between the airway and alimentary canal. It functions as an open valve in respiration, a partially closed valve in phonation, and as a closed valve protecting against aspiration during swallowing (**Shaker and Hogan, 2003).**

Physiology of the voice includes not only the larynx but also other body systems as The tracheobronchial tree, lungs, and thorax, the musculoskeletal system, the supraglottic vocal tract (tongue, lips, palate, pharynx, nasal cavity and possibly the sinuses), the abdominal musculature and the psychoneurologic system . But as regard the larynx, the vocal folds form the oscillator of the vocal tract, the subglottic vocal tract acts as a power source, and the supraglottic vocal tract functions as a resonator. Complex interactions are responsible for the voice production (**Sataloff et al., 2007**).

Endoscopic anatomy

The great 19th-century voice teacher Manuel Garcia (1805–1906) was among the first to perform laryngoscope in vivo. Since the mid-1800s, the basic approach of examining the pharynx and larynx has changed little, although the technology available has improved dramatically **(Kaplan et al**., **2002).**

The earliest laryngoscope was a simple modified dental mirror, examination with a mirror and headlight remains an excellent method of obtaining some of the best views of the larynx without distortion of color or magnification. Most laryngoscopists augment the basic