Airway and Thoracic Ultrasound

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KEYWORDS

• Airway ultrasound • Thoracic ultrasound • Resucitation • Emergency department • Critical care ultrasound

KEY POINTS

- Ultrasound continues to grow in use for rapid diagnosis and assessment within the emergency department.
- Ultrasound aids the physician in early diagnosis for resuscitation of the critical patient.
- With new emerging research, airway ultrasound shows promise as not only diagnostic but also therapeutic adjunct to a patient's care.
- Thoracic ultrasound allows for evaluation of insults to the breathing component of resuscitation and also can diagnostically direct therapy earlier than previously available in critical care areas.

Videos of the sonographic airway extending from the oropharynx through thoracic cavity to the level of the diaphragm accompany this article at http://www.ultrasound.theclinics.com/

INTRODUCTION

A patent airway and respiration are central to the resuscitation of any critical patient within the emergency department and frequently when a critical patient presents, there is little medical information available to supplement care. Often these patients are unable to provide history to their illness or cooperate with a physical examination. Ultrasound has shown to be useful in immediate resuscitation of critical patients with such applications as the focused assessment with sonography in trauma or multiple other protocols developed for assessment of shock. Prior studies typically addressed circulation in the critical patient. However, recently ultrasound is showing promise as a rapid diagnostic bedside adjunct for evaluation of the airway and breathing (thoracic) in these critical patients.

AIRWAY ULTRASOUND ANATOMY

As emergency ultrasound continues to develop, one area of interest is as a novel tool for airway assessment. In the last several years, there have been many techniques developed for airway assessment from intraoral to external cutaneous examinations.[1–3] Each examination offers a different vantage point for evaluation of the structures of the airway but all with limitations because of orientation of osseous and cartilaginous structures and air interference within the airway itself.

SUBLINGUAL (INTRAORAL) SCANNING WINDOW

Tsui and colleagues[2,3] in a letter to the editor in the *Canadian Journal of Anesthesia* proposed an

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alternative route to external scanning by placing a curved high-frequency probe in the sublingual fossa. There is limited research to its use at this point but in the position the oropharynx can be evaluated by avoiding the gagging reflex of the soft palate. Further definition of sonographic anatomy and research is needed before this becomes a common scanning window when evaluating the airway.

EXTERNAL ULTRASOUND WINDOW

The hyoid bone separates the neck anatomy into two separate sonographic windows when performing external ultrasound. This landmark splits the airway into suprahyoid and infrahyoid scanning windows.[1,4] With the ultrasound transducer in a transverse orientation to the patient's body the hyoid bone can be identified in its long axis as a hyperechoic inverted U-shape with posterior acoustic shadowing (Video 1). In the sagittal or parasagittal orientation the hyoid bone can be visualized in cross-section as a superficial hyperechoic curved structure with posterior acoustic shadowing (Video 2).

Suprahyoid

Using either a linear high-frequency or curved low-frequency probe the floor of the mouth, tongue, and salivary glands can be visualized in transverse, sagittal, and parasagittal views (Video 3).[1,5]

Infrahyoid

Sonography of the infrahyoid region is ideal with use of a linear high-frequency probe because of the superficial structures of the neck. In this position the epiglottis can be partially visualized, as can the thyroid membrane, vocal cords, cricoid, trachea, and esophagus (**Figs. 1** and **2**, Videos 4–7).

CLINICAL USE

There has been little research performed in the emergency department for the clinical use of airway ultrasound. The more promising studies so far have been assessment of airway for difficult intubation,[6] evaluating the differentiation of trachea intubation versus esophageal intubation,[7–12] identification of anatomy for surgical airway,[1,5,13,14] and evaluation of the epiglottis.[15,16] Yet much of the clinical use in the emergency department is ill defined at this time. There is promise with further research.

Assessment of the Airway for Difficult Intubation

Difficult laryngoscopy occurs frequently in elective and emergent intubations. Evaluation of the airway is most commonly done using Mallampati test, which initially identified difficulty intubation with a high amount of accuracy. However, subsequent studies have showed mixed results of the Mallampati test to predict a difficulty airway in individuals undergoing elective intubation.[17] This can prove

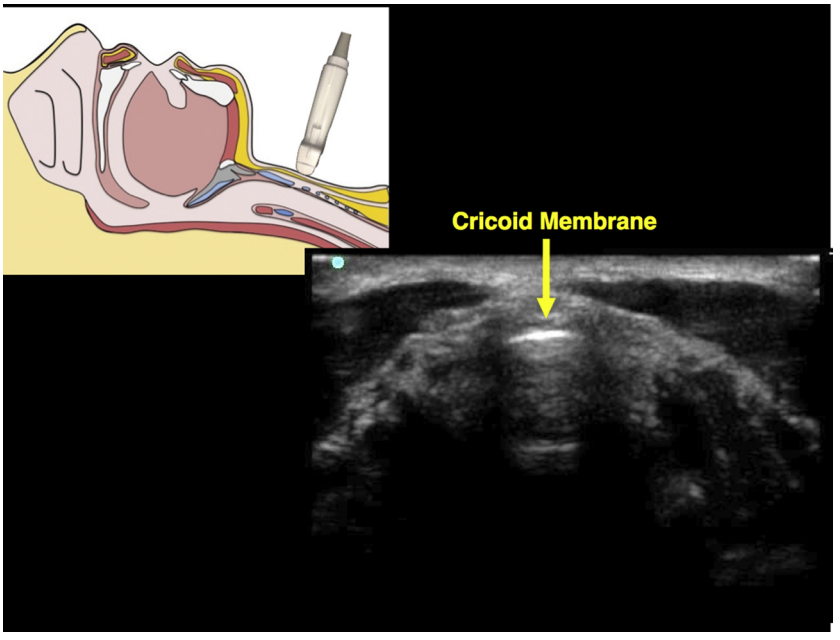

Fig. 1. Cricoid membrane transverse neck.