

## Editorial

# Verification of Endotracheal Intubation by Ultrasound in Emergency Situation

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## Keywords

Ultrasound; Endotracheal intubation; Esophageal intubation

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Early confirmation of endotracheal intubation is crucial to avoid any disastrous consequences. Although quantitative waveform capnography for confirmation of tracheal tube placement has been considered gold standard, it has some serious limitations. Firstly, its accuracy may be compromised in patients with massive pulmonary embolism and patients suffering from cardiac arrest (especially where cardiopulmonary resuscitation has not yet started or the patient is in cardiac arrest state for a prolong period), as detection of carbon dioxide by capnography depends on adequate pulmonary blood flow. Secondly, a patient has to be ventilated for at least four-five times to know exactly where the ET tube is positioned. Ventilating the stomach of a patient with misplaced ET tube can cause gastric distension, vomiting and aspiration [1].

Therefore, due to various shortcomings of the techniques currently used to verify ET tube placement, a reliable and safer technique that can be used in real time without ventilating the lungs is warranted.

Various studies have shown that ultrasound is a novel tool to confirm proper placement of the ET tube [1-3]. Ultrasound to verify ET tube can be performed by placing the probe over the trachea, thorax or at the level of diaphragm. The advantage of transtracheal US (TTUS) over the other methods is that it does not need ventilation of lungs for verification of ET tube position. In TTUS, a linear or curvilinear probe is positioned on cricothyroid membrane or just above the supra sternal notch. Probe placement is either transverse or horizontal. A transverse view just above the supra sternal notch provides a better view to visualize both trachea and esophagus together. But a sagittal view is limited to long axis view of either the trachea or one of the para tracheal spaces [1]. Moreover, the esophagus travels away from the trachea as it moves inferiorly from the level of the cricoid cartilage towards the suprasternal notch [1]. The typical ultrasound image of endotracheal intubation (one air-mucosa artifact) is due to the sound impedance shift at the interface

between the water filled mucosa and air. Two air-mucosa indicates esophageal intubation. These characteristic patterns are easy to detect. The tube itself is not identified [4].

Transthoracic or diaphragmatic US can diagnose inadvertent endobronchial placement of the ET tube.

Number of original research publications evaluated the accuracy of US for detection of endotracheal intubation and reported a sensitivity of 94 to 100% and a specificity of 86 to 100% [1,2,5,6]. Our recent meta-analysis of eleven studies and 969 intubations reported that pooled sensitivity and specificity with 95% confidence interval were 0.98 (0.97 to 0.99) and 0.98 (0.95 to 0.99) respectively. In emergency scenarios, transtracheal ultrasonography showed an aggregate specificity and specificity of 0.98 (0.97 to 0.99) and 0.94 (0.86 to 0.98), corresponding 95% confidence interval [7].

US have some definite advantages over existing method of verification. US can detect ET tube position simultaneously with intubation or just after it, which is faster than any other method [1]. Unlike capnography, US does not depends on adequate pulmonary blood flow; thus its accuracy is not compromised in patients with massive pulmonary embolism and patients suffering from cardiac arrest. Transthoracic US can also promptly diagnose endobronchial intubation. It can also be used to verify proper placement of double lumen tube.

The technique of transtracheal US to verify ET tube placement has its own limitations. Ultrasound device is not an instantly useable device due to the requirement to start up, warm up and adjustment of depth and gain. Thus, it is more complex and time consuming than simply applying the probe onto the patient's skin particularly in emergency scenarios. Surgical emphysema, difficult neck anatomy, calcification may obscure US image [4]. Another drawback is the need of a second person to do US examination, which is not always feasible in emergency condition. Unlike capnography, accuracy of US examination is operator dependent. So, training and experience of the operator may influence the sensitivity and specificity of US examination.

Although US verification of ET tube is relatively a new technique, it has shown high degree of accuracy to confirm tracheal placement of ET tube, in reasonably less time and without ventilation. This method should be used along with capnography, as a preliminary test before the final confirmation by capnography. Both transtracheal US and capnography cannot differentiate between tracheal and bronchial intubation. Therefore, transthoracic or diaphragmatic US should also be done to avoid endobronchial placement of the ET tube.

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