

Use of Ultrasound in Endotracheal Intubation Andrew Fredericks, MD

The Tracheal Rapid Ultrasound Exam (T.R.U.E.) is an excellent method to confirm Endotracheal (ET) tube placement following ET intubation.

The Evidence:

An article published in 2011 in *Resuscitation* by Chou et al demonstrated that senior residents in Emergency Medicine can perform this exam with supervision following a simple introduction to its method.

What they did:

A prospective, observational study of 112 patients in an academic hospital in Taiwan. Patients received endotracheal intubation in the Emergency Department due to respiratory failure, cardiac arrest, or severe trauma. The exam was performed as described below. T.R.U.E. was confirmed with quantitative waveform capnography.

What they found:

kappa (k) value was .93, T.R.U.E. had a sensitivity, specificity, positive predictive value, and negative predictive value of 98.9% , 94.1% ,98.9%, and 94.1% respectively.

What they thought:

T.R.U.E. can be used a secondary confirmation for endotracheal tube placement.

Significance:

Ultrasound is found everywhere. In previous studies (outside of the ED), ultrasound has the exact same sensitivity and specificity as quantitative waveform capnography. Waveform capnography isn't often available in many settings. Ultrasound images are not affected by pulmonary circulation physiology which does directly affect quantitative waveform capnography. Ultrasound can detect esophageal intubation BEFORE ventilating the patient and mistakenly forcing air into the stomach.

Problems:

The study's patient population had an average BMI of 23 which is significantly less than what many EDs in the United States see. The images were performed statically in the study and not dynamically in real time. This could affect accuracy. While most of the sensitivity, specificity, npv, ppv, and accuracy were over 90% for non-cardiac arrest intubations. In cardiac arrest patients, the specificity of T.R.U.E. dropped to 75%. In addition, the technique is difficult in certain populations: neck trauma, neck tumors, history of neck operations or tracheotomy, morbidly obese patients, or patients under the age of 18.

Conclusions: This seems like a great method to monitor in real time the novice intubator and ensure the ET tube isn't in the esophagus before ventilation.

The Technique (This can be done dynamically in real-time or statically):

1. Use A Linear Probe with marker pointed towards patient's right side

2. **Place above sternal notch**
3. **The position to trachea can be determined by hyperechoic air-mucosa (AM) interface with a reverberation artifact posteriorly (you see posterior shadowing)**
4. **If, AFTER the tube has been placed, you only see a single AM interface with artifact and shadowing, you are likely in the trachea**
5. **If you see two A-M interfaces w/artifact and posterior shadowing, you are likely in the esophagus (the “goose” sign).**

Dr. Henry Mallemat has an excellent YouTube video demonstrating this technique:

https://www.youtube.com/watch?v=ma_ff3BaUyw

Sources:

- Chou, Hao-Chang, et al. "Tracheal Rapid Ultrasound Exam (T.R.U.E.) for Confirming Endotracheal Tube Placement during Emergency Intubation." Resuscitation 82.10 (2011): 1279-284. Web.
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