[NM-204] The Use of Ultrasound-Guided Tracheal Intubation in Pediatrics

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Introduction
Ultrasound-guided tracheal intubation (UGTI) is a novel approach to tracheal intubation (1). Proposed benefits include immediate confirmation of correct tube placement, a decreased risk of dental trauma, and rapid intubation in an airway soiled by blood, secretions, or vomit. While the role of UGTI in airway management has yet to be definitively established, we believe UGTI may be useful in patients with limited mouth opening/neck mobility, copious secretions, and prior difficult laryngoscopy. We present a descriptive review of our institutional experience with this technique.

Methods
Data from each UGTI performed at the Children's Hospital of Philadelphia since December 2012 was recorded in a quality assurance airway registry. We queried this registry for the following: subject age/gender, airway examination, ultrasound view, number of attempts/providers, success/failure, time to success, graded difficulty, muscle relaxant administered, and complications. We included all patients with attempted UGTI in our analysis regardless of age, airway status, and the nature of surgery.

Results
To date, UGTI was attempted on 11 patients, with details of each case shown in Table 1.
All intubation attempts were performed under general anesthesia [inhalation=10, propofol=1], with neuromuscular blockade administered in 91%. Success rate was 82% for the entire cohort [1st attempt 64%, 2nd attempt 9%, 3rd attempt 18%, 4th attempt 9%], and 100% for those < 10 years old [1st attempt 86%, 3rd attempt 14%]. Seven of eleven cases were timed (from initial attempt to presence of end-tidal CO_2), with a median intubation time of 56 seconds [range 45-300s]. An excellent ultrasound view was achieved in 64% and an adequate view in 36%. The most frequent technical difficulty was that the "bend of the stylet needed to be adjusted" in 27% of cases, followed by "poor localization of the tube" in 18%.

Discussion
There are not enough cases to draw definitive conclusions; however we anticipate reporting more cases at the time of our presentation. The first attempt success rate does not compare favorably with standard laryngoscopy in the entire cohort; however, this is skewed by older patients requiring multiple attempts. Our failures occurred in patients over 18, suggesting that this technique may not be ideal for older patients. In children under 10, there was 100% success within three attempts. As experience increases, we anticipate an improvement in success, speed, and number of attempts. Based on this initial report we may pursue a controlled evaluation of the technique in the future to better characterize the technique. UGTI may ultimately be useful in patients with difficult direct laryngoscopy, however the role of this new technique is yet to be defined.

1. Fiadjoe JE, et al. Ultrasound-guided Tracheal Intubation, A Novel Intubation Technique. Anesthesiology 177, 6, 2012: 1389-1391

Age/ Sex	Known/ Suspected Difficult Airway	Pre-op Airway Exam	NMB	U/S View	# Attempts	# Providers	Success	Time (sec)	Graded Difficulty (VAS)	Complication
19y M	N	normal	Y	Adequate	2	2	N	NR	82	none
17y F	N	normal	Y	Excellent	1	2	Y	56	25	none
18y F	N	normal	Y	Adequate	4	2	Y	NR	39	none
5y F	N	normal	N	Excellent	1	1	Y	45	8	none
5y M	Y	Micro- gnathia	Y	Excellent	3	1	Y	300	65	none
3y M	N	normal	Y	Excellent	1	1	Y	165	15	none
23y M	N	normal	Y	Adequate	3	2	N	NR	69	none
7y F	N	normal	Y	Adequate	1	2	Y	NR	3	none
4y F	N	normal	Y	Excellent	1	2	Y	66	1	none
5y F	N	normal	Y	Excellent	1	2	Y	50	3	none
6y F	N	normal	Y	Excellent	1	1	Y	46	29	none

Table 1. Descriptive Results of UGTI attempts. Known/Suspected Difficult Airway based on risks including limited mouth opening, limited neck mobility, micrognathia, large tongue, midface hypoplasia, hemifacial microsomia; Neuromuscular blocker used in all cases was vecuronium; Ultrasound (U/S) View defined as Poor (glottis is not visible), Adequate (glottis visible), or Excellent (glottis visible, cords easily identified); # Providers defined as single (performing intubation and ultrasound) vs two provider (one intubator, one ultrasonographer); Time defined as seconds from insertion of ETT until CO2 detection. NR = Not Recorded; Graded difficulty assessed by intubator on 0-100 scale with 0 being very easy and 100 being very difficult; Complications included blood in airway, airway injury, hoarseness, sore throat, or other.