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Introduction

Appropriate depth of endotracheal tube (ETT) placement in children is difficult, with rates of malposition as high as 74% [1]. Improper ETT depth increases risk of accidental extubation, vocal cord injury, and endobronchial intubation. Recent research described using ultrasound (US) to identify the ETT cuff in the suprasternal notch as a method to confirm appropriate ETT depth in children and adults [1,2] however there is limited data for infants and neonates.

Objective

To evaluate the accuracy and precision of suprasternal tracheal ultrasound in determining proper ETT positioning in infants and neonates.

Hypothesis

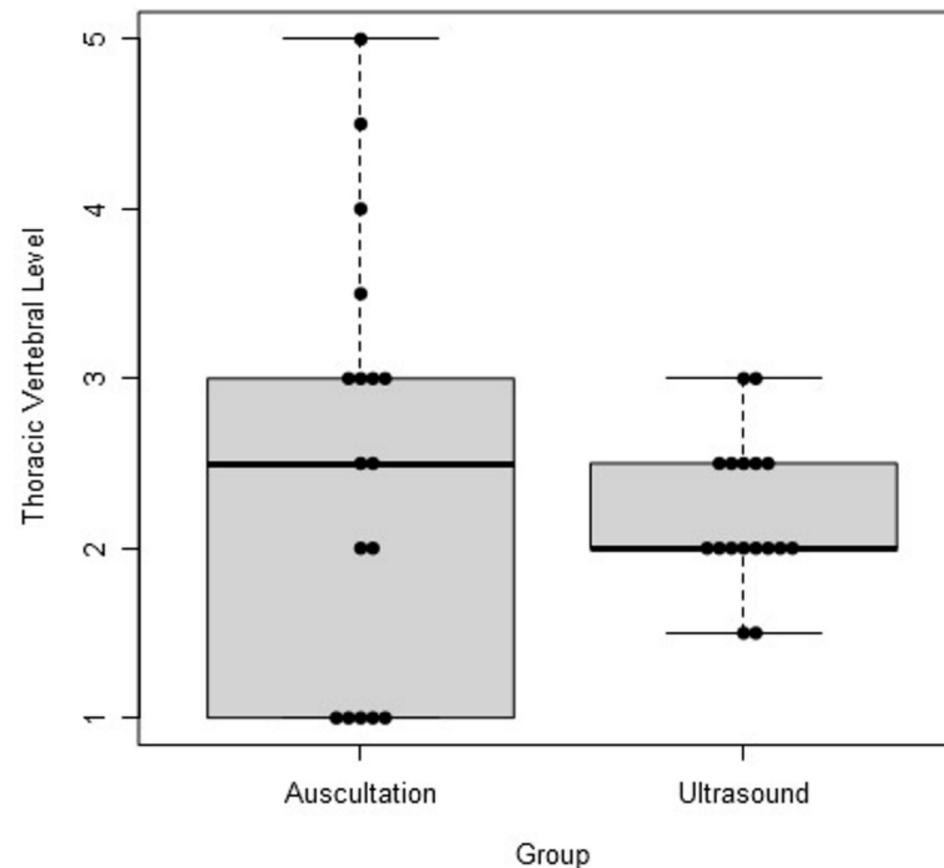
We hypothesize that using suprasternal US in infants and neonates will improve the accuracy and precision of ideal ETT tip positioning over the second thoracic vertebral body (T2).

Methods

Patients <1 year of age who had suprasternal US performed for correct depth of ETT placement were identified (US) along with an age-matched auscultation cohort (Ausc). In all patients, ETT depth confirmation was performed using chest x-ray. The robust Brown-Forsythe Levene-type test was used to determine equality of variances between the two cohorts while the Wilcoxon Rank Sum test and Fisher's Exact test were used to analyze differences in medians and proportions, respectively. All analyses were performed with R 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria). P-values <0.05 were considered statistically significant.

Figures

Figure 1. Endotracheal Tube Tip Location



Results

34 patients were included in this analysis with 17 in each cohort (US and Ausc). The median [interquartile range] age and weight in the entire sample were 4.2 [2.7, 6.0] months and 5.3 [4.2, 6.7] kg, respectively, with no differences in age, weight, and gender between the two cohorts. There was a statistically significant difference in variability of ETT placement from the ideal location (T2) between the groups (US standard deviation (sd) 0.42 levels vs Ausc sd 1.28 levels, P-value <0.001, Figure 1). A higher proportion of ETTs were placed ≥ 1 vertebral level away from T2 in the Ausc cohort (76.5% vs 11.8%, P-value <0.001, Figure 1). US improved the accuracy and precision of ETT tip placement as the US cohort had significantly lower variability in ETT placement from the T2 target when compared to the Ausc cohort (sd 0.42 vs sd 1.28). There was also a reduction in significant misplacement of the ETT tip from the T2 target, with only 11.8% of the US cohort misplaced ≥ 1 vertebral level compared to 76.5% in the Ausc group. These results support the hypothesis that suprasternal US of the ETT cuff in infants and neonates improves the accuracy and precision of tip positioning.

Conclusion

Suprasternal US of the ETT cuff may improve both the accuracy and precision of ETT positioning at T2 in infants and neonates.

References

1. Uya et al. (2020). Point-of-Care Ultrasound in Sternal Notch Confirms Depth of Endotracheal Tube in Children. *Pediatric Critical Care Medicine*, 21(7).
2. Ramsingh et al. (2016). Auscultation versus Point-of-care Ultrasound to Determine Endotracheal versus Bronchial Intubation. *Anesthesiology*, 124(5), 1012-1020.