Prediction of Endotracheal Tube Size in Children by Predicting Subglottic Diameter Using Ultrasonographic Measurement versus Traditional Formulas

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Abstract : Background: Knowledge of the influence of the age of the child on laryngeal dimensions is essential for all practitioners who are dealing with paediatric airway. Choosing the correct endotracheal tube (ETT) size is a crucial step in pediatric patients because a large-sized tube may cause complications like post-extubation stridor and subglottic stenosis. On the other hand with a smaller tube, there will be increased gas flow resistance, aspiration risk, poor ventilation, inaccurate monitoring of end-tidal gases and reintubation may also be required with a different size of the tracheal tube. Recent advancement in ultrasonography (USG) techniques should now allow for accurate and descriptive evaluation of pediatric airway. Aims and objectives: This study was planned to determine the accuracy of Ultrasonography (USG) to assess the appropriate ETT size and compare it with physical indices based formulae. Methods: After obtaining approval from Institute's Ethical and Research committee, and parental written and informed consent, the study was conducted on 100 subjects of either sex between 12-60 months of age, undergoing various elective surgeries under general anesthesia requiring endotracheal intubation. The same experienced radiologist performed ultrasonography. The transverse diameter was measured at the level of cricoids cartilage by USG. After USG, general anesthesia was administered using standard techniques followed by the institute. An experienced anesthesiologist performed the endotracheal intubations with uncuffed endotracheal tube (Portex Tracheal Tube Smiths Medical India Pvt. Ltd.) with Murphy's eye. He was unaware of the finding of the ultrasonography. The tracheal tube was considered best fit if air leak was satisfactory at 15-20 cm H_2O of airway pressure. The obtained values were compared with the values of endotracheal tube size calculated by ultrasonography, various age, height, weight-based formulas and diameter of right and left little finger. The correlation of the size of the endotracheal tube by different modalities was done and Pearson's correlation coefficient was obtained. The comparison of the mean size of the endotracheal tube by ultrasonography and by traditional formula was done by the Friedman's test and Wilcoxon sign-rank test. Results: The predicted tube size was equal to best fit and best determined by ultrasonography (100%) followed by comparison to left little finger (98%) and right little finger (97%) and age-based formula (95%) followed by multivariate formula (83%) and body length (81%) formula. According to Pearson`s correlation, there was a moderate correlation of best fit endotracheal tube with endotracheal tube size by age-based formula (r=0.743), body length based formula (r=0.683), right little finger based formula (r=0.587), left little finger based formula (r=0.587) and multivariate formula (r=0.741). There was a strong correlation with ultrasonography (r=0.943). Ultrasonography was the most sensitive (100%) method of prediction followed by comparison to left (98%) and right (97%) little finger and age-based formula (95%), the multivariate formula had an even lesser sensitivity (83%) whereas body length based formula was least sensitive with a sensitivity of 78%. Conclusion: USG is a reliable method of estimation of subglottic diameter and for prediction of ETT size in children.

Keywords : endotracheal intubation, pediatric airway, subglottic diameter, traditional formulas, ultrasonography

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