

Comparing nasal tragal length and gestational age-based charts to estimate the optimal endotracheal tube depth in neonates of less than 32 weeks- A cross sectional study

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Abstract

Endotracheal intubation is one of the common procedures in delivery rooms and neonatal intensive care units. Most of the preterm neonates require intubation either in labour room for resuscitation or in NICU for surfactant therapy or mechanical ventilation. Proper positioning of endotracheal tube is essential in mechanically ventilated neonates for optimal ventilation. Neonates with malpositioned endotracheal tube are at increased risk of endobronchial intubations, accidental extubation, pneumothorax, lung collapse, hypoxemia, unequal surfactant administration. The optimal position for endotracheal tube tip is in the middle part of trachea. This position is radiologically identified by the position between upper border of the T1 vertebrae and lower border of the T2 vertebrae. Among 68 samples in our

study, 65.6% of the endotracheal tube were correctly placed. In the NTL group among 34 subjects 79.4% were correctly placed, 2.9% were placed above T1 and 17.6% were placed below T2. In the GA group among 34 subjects, 44.1% were correctly placed, 52.9% were placed above T1 and 2.9% were placed below T2. 52.9% cases in GA group and 20.5% cases in NTL group required reposition after chest x-ray. Our study showed that the NTL formula had mid tracheal concordance of 79.4% as compared to 44.1% when NRP-GA tables were used in neonates of less than 32 weeks. Hence considering the ease of measurement and better mid tracheal concordance in neonates of less than 32 weeks we recommend the use of NTL formula to estimate the insertion depth of endotracheal tube in this gestation group.

Keywords: Nasal tragus length, Endotracheal tube, Gestational age

Introduction

Endotracheal intubation is one of the common procedures done in delivery room and neonatal intensive care units. Proper positioning of endotracheal tube is essential in mechanically ventilated neonates for optimal ventilation. Endo tracheal intubation is challenging in preterm neonates due to narrow and short airways. Malposition Endotracheal tube results in endo bronchial intubations, pneumothorax, hypoxemia, lung collapse, accidental extubation, unequal surfactant administration¹. Endotracheal tube placed too deep results in selective bronchial intubation which is reported in 7% of cases and placed too high results in accidental extubation and esophageal intubation which is reported in 21.4% cases².

malposition Endotracheal tube tip is the common unpredicted radiologic finding seen in around 40-60% of intubated neonates³. Middle part of trachea the optimal position for endotracheal tube tip⁴. This position is radiologically identified by position between upper border of T1 vertebrae and lower border of T2 vertebrae⁵.

Accurate determination of ETT position clinically challenging as optimal placement may be affected by point of measurement references, neck position and respiratory phase. Rapidly rising heart rate, audible and equal breath sounds in both axilla with positive pressure ventilation, symmetrical chest movements, absent air entry over stomach are the clinical methods of confirming endotracheal tube position within trachea⁶. Currently a number of methods are available to calculate the optimum endotracheal tube depth using external body parameters such as gestational age⁶, birth weight⁷, foot length⁸, head circumference and nasal tragal

length⁶, sternal length⁹. Weight is easily available and commonly used but estimating optimal ETT depth using it may be inaccurate in edematous and growth retarded neonates. NTL is easy to obtain but few studies have suggested NTL formula overestimates ETT depth in very low birth weight babies.

Methodology

Source of data

Neonates admitted to NICU of Vani Vilas Hospital, Bangalore Medical College and Research Institute, Bangalore

Method of collection of data

After obtaining approval and clearance from the institutional ethical committee, those who fulfilled the inclusion criteria were enrolled into the study after obtaining informed consent. Neonates with indication for intubation were intubated and the tube is adjusted to estimated length obtained from NTL formula or gestation charts and air entry on both sides of the chest was checked by auscultation. Chest x-ray taken in anteroposterior view within 2 hours of intubation with baby's head in neutral position. Optimal tube depth is the ETT tip position between upper border of T1 vertebrae and lower border of T2 vertebrae.

- Design of study: Cross sectional study
- Study period: February 2022 to August 2022
- Place of study: Department of Paediatrics, Vani Vilas Hospital, BMCRI, Bangalore.

Statistical analysis

The collected data was analysed using SPSS software version 20. In the study there were 2 groups with 34 samples in each group. Continuous variables were expressed in terms of mean, standard deviation, standard error. Categorical variables are expressed in terms of frequency and percentage. Chi Square test was used to

compare the categorical variables between the two groups.

Results

In our study mean gestational age of subjects were 30.2 +/-0.8 in NTL group and 30.9+/-0.8 in gestational age group. Mean birth weight of neonates were 1.28+/-0.8 kg in gestational age group and 1.34+/-0.8 kg in NTL group. Mean age at intubation was 1.43+/-0.82 days in gestational age group and 1.55+/-0.82 days in NTL group. Mean duration of ventilation was 4.01+/-0.161 in gestational age group and 4.11+/-0.161 in NTL group. There was no significant difference between the groups with respect to duration of ventilation.

Table 1:

	GA group	NTL group	P-value
Between T1 and T2	15 (44.1%)	27 (79.4%)	< 0.0001*
Above T1	18 (52.9%)	1 (2.9%)	
Below T2	1 (2.9%)	6 (17.6%)	
Repositioning after X-ray	18 (52.9%)	7 (20.5%)	

Mean estimated endotracheal tube depth was 6.8+0.68 cm in gestational age group and 7.4+/-0.68 in NTL group. Mean estimated endotracheal tube depth was higher in NTL group as compared to Gestational age group.

Among 68 samples in our study, 65.6% of the endo tracheal tube were correctly placed. In the NTL group among 34 subjects 79.4% were correctly placed, 2.9% were placed above T1 and 17.6% were placed below T2. In the GA group among 34 subjects, 44.1% were correctly placed, 52.9% were placed above T1 and 2.9% were placed below T2. 52.9% cases in GA group and

20.5% cases in NTL group required reposition after chest x-ray. There was statistically significant difference between NTL and Gestational age-based chart group with respect to optimal tube depth with P-value of <0.0001.

Discussion

In our study mid tracheal concordance was 44.1% in gestational age group as compared to 15% in a study conducted by Peng C et al¹⁰, 61% in a study conducted by Kemply et al¹¹ and 39% in an Irish study conducted by Flinn et al¹². Our study showed that GA based charts of NRP underestimated optimal insertion depth of endotracheal tube which was consistent with study conducted by Peng C et al.

In our study NTL formula had mid tracheal concordance of 79.4% as compared to 95% accuracy in a study conducted by Shukla et al¹³, 57% in a study conducted by Peng C et al. This difference in mid tracheal concordance in different ethnicities may be due to difference in facial morphology. In NTL group in our study, of the 20% neonates requiring repositioning 17% had endo tracheal tube placed below T2 which was consistent with a study conducted by Ugyur et al¹⁴. As there are no known studies comparing NTL and gestational age-based charts to estimate the optimal tube depth in neo nates of less than 32 weeks, findings in our study were compared with studies which enrolled neo nates of all gestational age. However our study concluded that NTL formula has better mid tracheal concordance than Gestational age based charts of NRP in neonates of 28-32 weeks of gestation.

Conclusion

Our study showed that the NTL formula had mid tracheal concordance of 79.4% as compared to 44.1% when NRP-GA tables were used in neonates of less than

32 weeks. Hence considering the ease of measurement and better mid tracheal concordance in neonates of less than 32 weeks we recommend the use of NTL formula to estimate the insertion depth of endotracheal tube in this gestation group.

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