Proceedings S.Z.P.G.M.I. Vol: 32(1): pp. 17-20, 2018. PSZMC-664-32-1-2018

Correct Estimation Endotracheal Tube (ETT) Length with New Age Based Formula (NABF) in Children Requiring General Anesthesia with Endotracheal Intubation (EI)

Syed Mehmood Ali, Abdul Bari, Mudassar Aslam
Department of Anesthesiology, Shaikh Zayed Medical Complex, Lahore

ABSTRACT

Introduction: It is necessary to predict (Endotracheal Tube) ETT length to prevent complications of oversized or undersized measurement in children. The new age based formula (NABF) is helpful in predicting length of ETT required for intubation in children. **Aims and Objectives:** To determine the frequency of correctly estimated length of ETT tube with NABF in children requiring general anesthesia with endotracheal intubation (EI). **Place and Duration of Study:** This study was conducted at the Department of Anesthesia, Shaikh Zayed Hospital for the period of 6 months. **Material and Methods:** Total 150 patients fulfilling inclusion (children of age 1-8 years, either gender undergoing elective surgery under GA, American Society of Anaesthesiology, Malampati score) were included. Children were pre-medicated with Midazolam 1 mg/kg and Ketamine 2 mg/kg intramuscular, before shifting to theatre according to the protocol of hospital. The ETT size was estimated based on the formula: NABF that is Age/(10+2). After 1 minute of the neuromuscular agent, the intubation under vision was done. The tube was secured and the respective case was labeled as corrected ETT estimation when size of tube is placed accurately in one attempt. **Results:** Mean endotracheal tube length calculated by new age based formula was 79.22±15.46 (mm) and the mean actual length was 79.47±15.52 (mm). No statistically significant association was seen between corrected endotracheal tube length calculated by new age based formula and age (p=0.486), gender (p=0.189). **Conclusion:** We conclude that new age based formula correctly estimate the length of the ETT tubein children requiring general anesthesia with an endotracheal intubation.

Key words: Endotracheal Tube (ETT), New Age Based Formula (NABF), General anesthesia, Endotracheal Intubation (EI).

INTRODUCTION

Varieties in body weight, length and tallness in youngsters in a similar age assemble have been expanded. Customary age-based equations as often as possible neglect to anticipate the right endotracheal tube (ETT) length.[1] A tracheal tube which is too long may bring about a physiologic shakiness, on the off chance that it sits at the carina while endobronchial intubation may bring about over distension of ventilated fragments of lung alongside crumple of contralateral lung, weakened gas trade and expanded danger of air spills. In a study conducted in China, correlation of the length of an uncuffed oral ETT with body length presenting the following formula:[2]

Conventional Age Base Formula = Age/(2+12)

This formula has been used clinically in general anesthesia (GA) for children.[2] The end of the tracheal tube that is placed into the trachea is called the patient end, also known as the distal end or tracheal end and it is beveled. Tracheal tubes are either cuffed or uncuffed. Uncuffed tubes are used primarily in children younger than 6 years.[3]

A variety of formulas and techniques are used to find the endotracheal tube length that minimizes injury to carina and hazard unilateral lung

ventilation as well as variable ventilation/accidental extubation in children for selecting an endotracheal tube.[4]

The NABF = Age/(2+10)

With average heights and weights lesser in our population as compared to western population, formulas based on their height and weight result in intubation with inappropriate tube length that can cause unilateral intubation and its complications.[5] One local study has found that the correct estimation of ETT length with 69% patients.[6] While another study reported that the correct estimation of ETT length with NABF was observed in 82.4% patients.[1]

The rationale of this study was to assess the number of cases in which NABF correctly estimated the length of the ETT tube in children undergoing surgery under GA (General Anaesthesia) with endotracheal intubation. This study was done to determine the frequency of correct estimation of ETT size by new age based formula *Age/(2+10)*, because Asian population height is low/short structured.

The variation has been observed in the literature in determination of correct ETT length by using same formula even in Asian population. Variations have also been increased in height and weight in children, even in the similar age groups.[6] That is why, we aimed to conduct this study to find out the exact frequency of estimation of ETT size on the basis of NABF whether it is reliable. Moreover, complications of incorrect estimation causing hazardous and deadly complications like lungs perforation, which can be avoided in future, if a low frequency of incorrect estimation is found.

MATERIAL AND METHODS

This study was conducted at the Department of Anesthesia, Shaikh Zayed Hospital for the period of 6 months. 150 patients fulfilling the inclusion criteria were included after an approval from Ethical Committee of the hospital. The inclusion criteria included the children of age 1-8 years, either gender undergoing elective surgery under GA, American Society of Anesthesiology (ASA) I-II. And Mallampati score I-II.

All the children who were lean with BMI<18kg/m^2 or obese children with BMI>30kg/m^2, with neck deformity or tonsils (on clinical evaluation) and premature children (<37 weeks gestation on antenatal record) were excluded from the study.

Informed consent was obtained from parents. Demographic profile (name, age, sex, height and weights) was obtained from files. The child was pre-medicated with Midazolam 1 mg/kg and Ketamine 2 mg/kg intramuscular (IM) before shifting to theatre according to the protocol of the hospital. ETT size was estimated based on the formula: *Age/(2+12)*.

After the application of standard monitors, induction was done using Sevoflurane 8% or Propofol 1% 2 mg/kg IV depending upon patient's age, cooperation and prior presence of I/V line. I/V line was established, then if not present before and succinylcholine 1.5 mg/kg was given. After 1 minute of the neuromuscular agent, the researcher himself performed intubation and under vision, bilateral chest auscultation, fiberoptic laryngoscopy and length. Tube was secured. Case was labeled as corrected ETT estimation, if size of tube was placed accurately in one attempt. All this information was recorded on proforma. In case, where tube length by NABF was not correct, a different size was tried until intubation was done.

STATISTICAL ANALYSIS

The data were analyzed using SPSS v20.0. Numerical data like age, height, weight, was presented as mean and standard deviation. Gender and correctly estimated tube length with NABF be expressed as frequency and percentage. Data was stratified for age (1-3, 4-6, 6-8), gender (male/female), height, weight, ASA grade and mallampati grade. Post-stratification, chi-square test was applied for comparing the groups. P-value ≤0.05 was taken as significant.

RESULTS

Actual length was 79.47±15.52 mm respectively Mean age of patients was 4.55±2.29 years. The mean height of patients was 99.35±18.49 cm. However, the mean weight of patients was 17.79±4.48 kg. The 84(56%) male and 66(44%) female patients were enrolled in the study. There were 74(49.33%) patients whose ASA (American Society of Anesthesiologists) status was I and 76(50.67%) patients ASA status was II. There were 127(84.67%) patient in which endotracheal tube

length was correct by using new age based formula. (Table-1) Mean endotracheal tube length calculated by new age based formula was 79.22±15.46 and the mean. No statistical significance was noted of different effect modifiers (Age, Gender, ASA, Height, Weight) as mentioned in the Table-2.

		Frequency (%)
Gender	Male	66(44%)
	Female	84(56%)
ASA status	I	76(50.67%)
	II	74(49.33%)
Correct estimated prediction by NABF	Yes	127(84.67%)
	No	23(15.33%)

Table-1: Demographic information of the study population

	Group	**Corrected estimated prediction by NABF**		***p*-value**
		Yes	**No**	
Age (years)	1-3	46(36.2%)	8(34.8%)	0.486
	4-6	51(40.2%)	7(30.4%)	
	7-8	30(23.6%)	8(34.8%)	
Gender	Male	74(58.3%)	10(43.5%)	0.189
	Female	53(41.7%)	13(56.5%)	
ASA status	I	66(52%)	8(34.8%)	0.120
	II	61(48%)	15(65.2%)	
Height	70-90	46(36.2%)	8(34.8%)	0.319
	91-110	44(34.6%)	5(21.7%)	
	111-130	37(29.1%)	10(43.5%)	
Weight	5-15	45(35.4%)	7(30.4%)	0.654
	16-25	79(62.2%)	16(69.6%)	
	>25	3(2.4%)	0(0%)	

Table-2: Impact of effect modifiers on the corrected estimated prediction by NABF (Chi-Square test)

DISCUSSION

Varieties in body weight and stature in kids in a similar age bunch exist on the planet. Customary age-based formulae regularly neglect to anticipate the right ETT.[1,2]

In this study mean endotracheal tube length calculated by new age based formula was 79.22±15.46 and the mean actual length was 79.47±15.52 respectively. There were 127 (84.67%) patient in which endotracheal tube length was correct by using new age based formula. No statistically significant association was seen between correct endotracheal tube length calculated by new age based formula and age (p-value=0.486), gender (p-value=0.189), ASA status (p-value= 0.129), Height (p-value=0.319) and weight (p-value=0.654) of patients respectively.

According to the results of a local study by Riffat Saeed from Pakistan showed 45 (69%) patients were inserted with a correct estimated prediction by using the New Age Base Formula in Children Requiring General Anaesthesia with ETT.[6]

In this study endotracheal tube length was correct among 127 (84.67%) patient by using new age based formula which is higher than that of reported by Saeed et al, (2013). This difference may be due to the variation in sample size or other methodological considerations adopted in the local study. Ming-Hung Shih et al, (2008) in his study reported that the LBF predicted a ETT length in 82.4% subjects. There were 17.6% re-intubations.[1]

However, Ming-Hung Shih et al, (2008) results regarding correct endotracheal tube length was almost similar with the results of this study with very minor difference, i.e., Ming-Hung Shih: 82.4% & This study: 84.67%. However, the sample size in the study of Ming-Hung Shih was quite much higher than that of this study.

Koichi et al. (2001) found that the Age Base Equation was appropriate to Japanese youngsters. Nonetheless, it was prescribed that three lengths ought to be accessible before endotracheal intubation.[7] In a distributed literature on a weight-based formula for tracheal tube measure in youngsters, it was discovered that the WBF was factually second rate compared to the ABF.[8]

The decision of an effectively assessed ETT is one of the primary components diminishing the danger of postoperative confusion, while regard for different tenets of the right utilization of ETT (suitable size, low pressure– high volume sleeve and checking of the Sleeve) stay imperative. Just the utilization of these guidelines will permit a more extensive client of the right length ETT in pediatric anesthesia, to profit by their various focal points, e.g. decrease of the quantity of reintubations, better control of air release, enhanced ventilator checking and conceivable lessening of the contamination of agent rooms. Since the human body manufacture and structure are diverse crosswise over populaces, the anticipated length of the 'best fit' ETT ascertained for offspring of different nations does

not stay steady, notwithstanding when utilizing a similar equation.

CONCLUSION

The results of this study showed that the new age based formula can correctly estimate the length of ETT tubein children requiring general anesthesia with endotracheal intubation.

REFERENCES

1. Shih M-H, Chung C-Y, Su B-C, Hung C-T, Wong S-Y, Wong T. Accuracy of a new body length-based formula for predicting tracheal tube size in Chinese children. Chang Gung Med J. 2008;31(3):276-9.
2. Bhardwaj N. Pediatric cuffed endotracheal tubes. Journal of Anaesthesiology Clinical Pharmacology. 2013; 29(1):13.
3. Jerry A SE. Tracheal tubes and associated equipment understanding anesthesia equipment Philadelphia: Lippincott Williams & Wilkins; 2008. p. 561-632.
4. Cordeiro AMG, Fernandes JC, Troster EJ. Possible risk factors associated with moderate or severe airway injuries in children who underwent endotracheal intubation. Pediatric Critical Care Medicine. 2004; 5(4):364-8.
5. Neema PK, Jayant A, Sethuraman M, Rathod RC. Mainstream time-capnography: an aid to select an appropriate uncuffed endotracheal tube in small children. Journal of clinical monitoring and computing. 2008; 22(6):445-7.
6. Saeed R SN, Qamar I, Bari A, Ahmad MN. Frequency of Correctly Estimated Size of ETT with New Age Base Formula in Children Requiring General Anaesthesia with ETT. Pak J Med Health Sci. 2013; 7(4):1086-9.
7. Takita K, Morimoto Y, Okamura A, Kemmotsu O. Do age-based formulae predict the appropriate endotracheal tube sizes in Japanese children? Journal of anesthesia 2001;15(3):145-8.
8. Eipe N, Barrowman N, Writer H, Doherty D. A weight-based formula for tracheal tube size in children. Pediatric Anesthesia 2009;19(4):343-8.

The Authors:

Dr. Syed Mehmood Ali,
Assistant Professor
Department of Anesthesia
Shaikh Zayed Hospital, Lahore

Dr. Abdul Bari
Department of Anesthesia
Shaikh Zayed Hospital, Lahore

Dr. Mudassar Aslam
Associate Professor
Department of Anesthesia
Jinnah Hospital, Lahore

Corresponding Author:

Dr. Syed Mehmood Ali
Assistant Professor
Department of Anesthesia
Shaikh Zayed Hospital, Lahore
Email:smass100@hotmail.com