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AGE VS BODY WEIGHT FOR APPROPRIATE SELECTION OF PROSEAL LMA IN INDIAN CHILDREN

Anaesthesiology

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ABSTRACT

Background and objectives: The size of the ProSeal laryngeal mask airway in children is determined by the patient's weight. However, in some instances, an alternative method may be required. This study aimed to compare sizing by the age with conventional PLMA sizing by weight in children.

Methods: 80 children with ASA physical status I-II who were scheduled for a routine genitourinary operation were included in the study. PLMA size was chosen by computer generated randomization. The results of age based method were compared with the standard weight-based method. Agreement between both techniques was evaluated with coefficient statistics.

Results: Insertion and adequate ventilation were achieved in 77 patients at the first attempt, and 3 patients required a second attempt. Agreement between the two methods of size selection of the PLMA was not statistically significant.

Conclusion: Choosing the size of the PLMA in children according to the age based method of the child is valid and practical. In particular, this is an alternative method in situations where the patient's weight is unknown, such as in emergency situations.

KEYWORDS

PLMA, Weight, Age, Size, Children

INTRODUCTION:

The ProSeal laryngeal mask airway (PLMA) has been frequently used for airway management not only in the operating room, but also in the emergency care setting [1,2].The PLMA has two lumens separating the alimentary and respiratory channels from each other, forming a more effective seal than the LMA-Classic. This supraglottic airway device has gained popularity in the paediatric population. Selection of the optimal size is important for safe and effective use of the PLMA. In children, the manufacturer recommends that the size of the PLMA should be based on weight [3]. The weight-related technique, which is the gold standard method, is not always applicable. In emergency services, the patient's weight is sometimes unknown. In addition, overweight and underweight children may be excluded from the range defined by the weight-based table [4].

Manufacturer instructions' for children are based on the anatomical structure of a Caucasian adult. The proper LMA size application in Asian is still unknown. As a consequence, there is no actual recommendation for LMA size usage in Indian children. In the following observational study, we evaluated the suitability of the previously described, age-based method of PLMA selection for children in the Indian population. The primary goal of our study was to determine whether the age-based PLMA selection method is in agreement with the weight-based formula for paediatric patients. Our secondary goal was to achieve a success rate of insertion of the PLMA of greater than 90% with the age-based technique at the first attempt.

MATERIAL & METHODS:

This study was conducted after obtaining approval from the Ethics Committee and the scientific committee of our hospital. This prospective study was performed in 80 patients aged 2months to 8 years over a period of 6 months. Children with American Society of Anaesthesiologists (ASA) physical status I-II, who were scheduled for a genitourinary operation, and in whom a PLMA was indicated for general anaesthesia, were eligible to participate in the study. Children and their parents were seen 1 day before the planned operation in the anaesthesia pre-assessment clinic.

Exclusion criteria included an expected duration of surgery more than 3 hours, patients with gastro-oesophageal reflux, a risk of aspiration, an airway infection in the last 6 weeks, or the presence of decreased pulmonary or chest wall compliance.

Patients fasted for at least 6 hours for solids and 2 h for clear fluids. The children were placed in the supine position with the head resting on a ring-shaped pillow to achieve an optimal position. Routine monitoring was performed, including an electrocardiogram, pulseoximeter, gas analyser, non-invasive arterial pressure monitor, tidal volume monitor, and airway pressure monitor. Without premedication, anaesthesia was induced with thiopental 5 mg/kg & Fentanyl 2 mcg/kg. Facemask ventilation with oxygen & Sevoflurane was performed until conditions were suitable for insertion of the laryngeal mask (loss of eyelash reflex, jaw relaxation, absence of movement). Muscle relaxants were not used in the patients.

All of the PLMAs were inserted by two experienced anaesthesiologists, according to the manufacturer's instructions with the cuff fully deflated using the digital technique. The patients were randomly and equally allocated in two groups (Weight based & Age based) by computer generated random numbers (Table-1). Following insertion of the PLMA, the devices were inflated until the cuff pressure reached 60 cm H_2O, and they were connected to the breathing circuit. Fixation was performed according to the manufacturer's instructions [5]. Ease of insertion, ease of passing suction catheter through the gastric port, OLP (which was the primary end-point), anatomical position grade, expiratory tidal volume, and peak inspiratory pressure were measured. Ease of insertion was decided by the number of attempts, successful insertion being confirmed by ventilation. If insertion was not achieved after two attempts or if mechanical ventilation failed (i.e., high peak airway pressure, high gas leakage, and an improper airway pressure trace), it was regarded as a failure. The **oropharyngeal leak pressure** was measured by auscultation and by closing the expiratory valve of the circuit when an audible noise was heard over the mouth [6]. Because of safety concerns; the maximal acceptable OLP was 30 cm H_2O.

Anatomical position was assessed by **fibreoptic bronchoscopy** and graded: 1 = vocal cords (visual obstruction of epiglottis to larynx < 50%); 2 = arytenoids or posterior part of the laryngeal inlet; 3 = epiglottis (visual obstruction of epiglottis to larynx > 50%); and 4 = no glottal view, or view of epiglottis [7]. **Peak inspiratory pressure** was measured during volume controlled mechanical ventilation at a tidal volume of 8 ml/kg. Measurements were made by a blinded assistant unaware of the study's aims and process of insertion.

Table 1-Weight and Age reference guide [8,9]

LMA SIZE	WEIGHT (Kg)	AGE (MONTH)
1	<5	0-5
1.5	5-10	5-12
2	11-20	13-60
2.5	21-30	61-120

LMA = laryngeal mask airway

RESULTS:

There were total of 80 patients aged 0 to 96 months, with all of them in healthy condition. The patient's demographic and clinical data including age, body weight, height, surgery length were presented in Table 3. PLMA was mainly used in genitourinary procedures. Size 2 LMA was the most frequently used size. Table 2 shows different sizes of PLMA used in our study.

The number of attempts, insertion time, OLP, the fibreoptic scores for each size of LMA and the peak inspiratory pressure given in Table 3. Insertion and adequate ventilation were achieved in 77 patients at the first attempt, and 3 patients required a second attempt .There were no failed attempts at insertion with any size.

There were no differences in ease of insertion, anatomical positioning grade, Oropharyngeal leak pressure and peak inspiratory pressure between the two groups. Blood was identified on the PLMA after removal in one patient in the postoperative period. However, other complications, such as loss of airway, stridor, and laryngospasm, were not detected.

Clinical characteristics of patients were analyzed using descriptive statistics. Pearson's correlation and Spearman's rank correlation were used to identify correlations between LMA size and age and weight. Comparison of correlation between LMA size and body weight and age was performed using Z-test. A p-value <0.05 was considered to be statistically significant.

Table 2: Number of PLMA inserted in both groups

PLMA SIZE	AGE	WEIGHT
1	2	1
1.5	15	16
2	18	20
2.5	5	3
TOTAL	40	40

Table 3: Demographic data and Anaesthetic parameters

	PLMA(age)	PLMA(weight)
Age (Years)	4.7±2.5	4.5±2.7
Weight (kg)	17.3±9.8	18.1±9.6
Height (cm)	106.2±22.4	104.8±23.1
ASA (I/II)	38/2	37/3
Insertion time of PLMA (s)	15±1.5	15±1.2
Duration of Anaesthesia (min)	50.5±12.5	53.5±14.5
Success rate placement		
At the first attempt	38	39
At the second attempt	2	1
Oropharyngeal leak pressure	28.6 ±1.4	28.8 ±1.2
Peak inspiratory pressure	13.8±1.8	13.6±1.9
Fibreoptic Score		
4	0	0
3	2	2
2	5	6
1	33	32
Complication		
Blood tinged equipment	0	1

DISCUSSION:

The age-based PLMA selection method showed a good correlation with the body weight-based selection method in paediatric patients. Age-based selection resulted in a success rate of insertion of the PLMA greater than 90% at the first attempt.

Usually, size of LMA is recommended by the manufacturer according to weight, a formula evaluated in previous studies in adults, but several other factors are of interest. **Asai et al** [10] found that larger sizes were more likely to provide an airtight seal. **Voyagis et al**. [11] found that sex-related selection provides better ventilating conditions than weight-related methods. **Berry et al** [12] showed that height should be considered in selecting size.

In previous studies, using weight alone was not sufficient to determine the size of LMA or tracheal tube. **Loke et al**. [13] states that using a size 2.5 LMA ('up-sizing') provided a better fit than size 2 in children weighing 10–20 kg. **Gallart et al** [14] used the combined widths of the patient's index, middle and ring fingers to size the LMA. **Eck et al** [15] found that tracheal tube size was best predicted using age, height and weight in children.

Because children are growing, there may be overlap between ages in the same weight group, or vice versa. Because development of the oropharyngeal cavity is related with age, pure weight-based methods may not be the most suitable. **Kim et al** [16] hypothesised that age could be a more useful guide to LMA size, especially in over- or underweight children. We compared conventional size of PLMA by actual weight with that by an ideal weight inferred from growth data. Ease of insertion, anatomical positioning, peak inspiratory pressure and OLP were not statistically significant between PLMA (weight) and PLMA (age).

However, greater OLP was obtained in few children in both groups. OLP indicates the degree of airway protection, the feasibility for positive ventilation, and the likelihood for successful placement of a PLMA. To prevent gas leakage and aspiration of pharyngeal secretion, OLP may need to exceed the pressure of fluid at the posterior pharyngeal wall, which is approximately up to 10 cm H_2O. Similar to our findings, **Goldmann et al.** [17] found that OLP with the PLMA was 28.60 ± 1.36 cm H_2O.

CONCLUSION:

We conclude that the proposed age-based method for determining the appropriate size of the PLMA is useful compared with the manufacturer's weight-based formula. In this case, the age-based size determination method can be applied in clinical practice as an alternative method to the weight-based formula in Indian children. In rare cases where body weight is not known, age can also be used as an acceptable alternative.

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