
Techniques and Procedures

CHOOSING THE CORRECT LARYNGEAL MASK AIRWAY SIZES AND CUFF INFLATION VOLUMES IN PEDIATRIC PATIENTS

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□ **Abstract**—The laryngeal mask airway (LMA) is now standard airway management equipment in prehospital and Emergency Department (ED) care. Most providers may not be able to match the pediatric LMA sizes to the appropriate weights of pediatric patients. The exact inflation volumes are also difficult to memorize. To overcome this problem, we propose the following equations: Weight (kg) of patient = $2^{2 \times \text{LMA}}$, where LMA is the size; cuff inflation volume (mL) = $5 \times \text{LMA}$. © 2008 Elsevier Inc.

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INTRODUCTION

The laryngeal mask airway (LMA) is commonly used not just in the operating room, but is also a standard airway device in prehospital and emergency care (1,2). We did an informal survey amongst anesthesia and emergency providers at our institution and found that most providers have some difficulties recalling the correct LMA sizes and cuff inflation volumes for children. Although some of the new disposable LMAs have the weight range and cuff inflation volume printed on the device, many, especially the non-disposable ones, do not. We came up with three simple formulas to help.

METHODS

We started by using standard LMA tables, one published in a pediatric anesthesia textbook and one in a popular emergency medicine textbook (1,2). With very minor adjustments to the recommended weight ranges and cuff inflation volumes, we produced a table with entries that followed identifiable patterns. Next, we derived mathematical equations based on those patterns.

RESULTS

The modified parameters are shown in Table 1. The entries in the weight column increase by multiples of 2. The entries in the LMA size column increase by additions of $\frac{1}{2}$. The entries in the cuff inflation volume increase by additions of $2\frac{1}{2}$. Such orderly progressions of numbers made their inter-relationships amenable to elegant mathematical representation.

The formulas describing the relationship between a child's weight ($\pm 25\%$) and the LMA size, and the formula for cuff inflation volume are:

Weight (kg) of patient = $2^{2 \times \text{LMA}}$,
where LMA is the size;

Table 1. Laryngeal Mask Airway (LMA) Sizes and Cuff Inflation Volumes for Children of Different Weight Ranges*

Weight of Child (kg)	LMA Size	Cuff Inflation Volume (mL) LMA Size \times 5
< 5	1	5
< 10	1½	7½
< 20	2	10
< 40	2½	12½

* This table may not apply to patients < 2.5 kg or > 40 kg.

and

$$\text{LMA size} = \frac{\log(\text{patientweight})}{0.6}$$

$$\text{The cuff inflation volume (mL)} = 5 \times \text{LMA.}$$

DISCUSSION

Even seasoned anesthesiologists often cannot remember the correct child's weight for a certain LMA size, or the cuff inflation volume. Emergency physicians and ambulance crew probably have even more difficulties because they do not use LMAs in children that often. As the LMA is now a standard airway device in many ambulances and EDs, knowing the right size to use is very important. Except for the new disposable LMAs, however, such information is not printed on the device.

To use the formulas derived above, start by picking the LMA that you think is suitable for a particular child, then calculate the range of weight for that LMA size by using this formula: Weight (kg) of patient = $2^{2 \times \text{LMA}}$, where LMA is the size. The range of weight for that LMA size would be the calculated number \pm 25%. For example, for a size 1½ LMA, the patient's weight should be $2^{2 \times 1.5} = 8$ kg, good for a range of 8 ± 2 , or 6–10 kg. The cuff inflation volume is about $5 \times \text{LMA}$ mL. For example, a good starting inflation volume for a size 1½ LMA is 7.5 mL.

For those who prefer to start with the weight of the patient, one can pick the correct LMA size by the formula: LMA size = $\log(\text{patientweight})/0.6$. Next, round

the answer (up or down) to the nearest half number. For example, a 13-kg child of average build should be fitted with an LMA of size $1.1/0.6 = 1.86$, or 2. The cuff inflation volume should be about 10 mL. If there is no calculator available, one should instead use the simpler weight formula, which suggests that a size 2 LMA should be suitable for children weighing $2^{2 \times 2} \pm 25\%$, or 16 ± 4 , or 12–20 kg.

To avoid doing any calculations, one can memorize Table 1. The table columns have predictable patterns. The numbers derived by our formulas or from Table 1 are only slightly different from time-tested ones printed in textbooks, and need no validation (1,2).

When a critically ill child is seen, sometimes the only information on the child is the age. Although some clinicians are excellent at guessing a child's weight, others may use the following mean weight formula (3) for children ages 2 to 9 years: Weight (kg) = age \times 2 + 9. With the estimated weight, one should be able to determine the appropriate LMA size to use.

Our formulas are mere guides. Practitioners need to tailor the exact size and cuff inflation volume to each individual child and assess the clinical result. A sign of a good LMA fit is ease of placement and effective positive pressure ventilation with good chest movements and minimal, if any, leak at low ventilatory pressures. Slight adjustment of inflation volume may be required sometimes. Our table and formulas do not necessarily extend to adult-size LMAs, which we think are much easier to memorize, or to children weighing < 2.5 kg.

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