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THE ROLE OF LARYNGEAL MASK AIRWAY IN PEDIATRIC ANESTHESIA OF ELECTIVE GROIN SURGERY AT NEWBORNS

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ABSTRACT

Background: Laryngeal mask airway (LMA) is a substitute for intubation in general anesthesia patients, allowing air exchange through a specially designed mask. It has been commercially used since 1988 for pediatric anesthesia, difficult pediatric airway management, and diagnostic procedures. Risks of adverse events are lower in LMA. **Aim:** The current study aimed to evaluate the safety of laryngeal mask airway in newborn age group of pediatric patients and to study the rate of conversion of laryngeal mask airway to endotracheal tube. **Methodology:** This study was a cross-sectional study conducted at Ibn Al-Atheer Teaching Hospital in Mosul, Iraq, from February to October 2025. The study included 30 newborn babies aged 1 hour to 3 months who were admitted for groin surgeries. Data collection tools included non-probability sampling and non-blinding techniques. Outcomes included heart rate, blood pressure measurement, SPO2 in blood, and ECG leads. The data was analyzed using IBM-SPSS 26 with uses of one-way ANOVA. **Results:** A study of 30 pediatric surgery patients found a significant decline in heart rate and systolic blood pressure from pre-induction to post-operation. Most patients continued with pink peripheral circulation, with only two developing cyanosis. The mean duration of anesthesia and operation was 34.22±4.918 min. All patients continued safely with LMA, with one requiring ETT change. **Conclusions:** LMA is a safe pediatric anesthesia option for elective groin surgery, especially for newborns. Both LMA and ETT are considered, with LMA offering ease of insertion and less cardiovascular stimulation.

KEYWORDS: Anesthesia, groin surgery, laryngeal mask, newborns.

INTRODUCTION

Laryngeal mask airway (LMA) is a helpful alternative to intubation for maintaining airway in patients undergoing general anesthesia.[1,2] It can be positioned around the laryngeal entry under low pressure and without view of the nasopharyngeal environment, enabling positive pressure ventilation.[3] Dr. Brain created the laryngeal mask technique in 1981, and it has been in use commercially since 1988.[4] Compared to tracheal intubation, LMA has the following benefits: less airway stimulation, less invasion of the airway tissue, simpler installation, fast setup, and minimal tracheal damage during tube installation and removal.[5,6] By using a specifically made mask that fits in the hypopharynx and faces the laryngeal entrance, establishing an end-to-end seal, LMA, a unique idea in airway management, permits air exchange. The numerous uses of the LMA throughout a broad patient age range have been extensively documented in the past ten years, much of it anecdotal.[7] The laryngeal mask is a supraglottic airway device which is a minimal interference method of maintaining a patent airway. It lodge outside the lumen of the larynx, therefore, doesn't injure larynx nor trachea during the insertion of the hypopharynx (oral cavity).[8] While the endotracheal tube is an invasive method of keeping the airway patent. Its insertion inside the laryngeal lumen and needs a straight blade laryngoscope i.e (Miller kind), therefore, an injury may develop through the procedure of insertion of the tube at this age group of newborns. Any injury of this type that may develop, may lead to bleeding inside the oral cavity of those newborn babies. This invasive method which is a maximum support of keeping airways patent is not required at those simple operations of groin surgry at newborns such as hernia repair, hydrocele removal, and orchidopexy for undescended testis.[9]

The LMA has established roles in routine pediatric anesthesia, managing the challenging pediatric airway, and diagnostic procedures like I MRI (Magnetic

Resonance Imaging) and CT scans (Computerized Axial Tomography Scans), despite its application in the pediatric population having lagged behind that of adults. The application of the LMA in pediatric patients is covered in several articles.[10,11] Although it may be used with regulated, positive pressure ventilation, the LMA is often utilized with patients who are breathing on their own. The LMA has been used to premies weighing as little as one kilogram.[12,13]

Using a face mask or laryngeal mask airway instead of an endotracheal tube has been repeatedly demonstrated to reduce the incidence of adverse airway events in newborns during and after surgery, including laryngospasm, bronchospasm, and hypoxemia.[14–17] The use of a laryngeal mask airway instead of an endotracheal tube significantly reduced adverse outcomes (18% vs. 53%) in a randomized controlled trial of newborns receiving GA for various procedures.[17] Also, it has been demonstrated that laryngeal mask airways work well for babies having inguinal hernia surgery.[18]

For infants undergoing inguinal hernia surgery, the use of a face mask or laryngeal mask airway is preferred due to the lower risk of adverse events; however, factors like the possibility of reflux esophagitis or regurgitation of stomach contents, the need for high ventilation pressures, poor laryngeal mask airway fit, and the inexperience of using a laryngeal mask airway in small infants are factors that should be taken into consideration when using an endotracheal tube.[16-18]

The current study aimed to evaluate the safety of laryngeal mask airway in newborn age group of pediatric patients and to study the rate of conversion of laryngeal mask airway to endotracheal tube.

PATIENTS AND METHODS

Study design, setting and time

A hospital based cross sectional study was adopted to achieve the study objectives. The study sample was collected from the patients who were admitted to the pediatric surgical department in Ibn Al-Atheer Teaching Hospital in Mosul Governorate/ Iraq during the period from 1st February to 1st October 2025.

The inclusion criteria involved any newborn aged 1 hour to 3 months of either sex who were free from medical diseases who admitted to the Hospital for groin surgeries while patients with congenital cardiac disease such as VSD, ASD, PDA, valve disease such as stenosis or regurgitation or valve incompetence or the patients with Pulmonary complications as bacterial lung infection or bronchiolitis, moreover, Allergy to anesthetic drugs, Hepatic diseases for instance as physiological hyperbilirubinemia like Gilbert syndrome or pathological jaundice such as obstructive jaundice like biliary atresia or had renal disease as renal artery stenosis or glomerulonephritis of any types; all those patients were excluded from the study.

Data collecting tools

The data collection was performed by non-probability sampling of category convenience sampling without blinding technique. The collection of 30 newborn babies with age ranging from 1 hour to 3 months who were subjected to groin surgeries such as open herniotomy, hydrocele repair and open orchidopexy for undescended testis putting laryngeal mask airway under general anesthesia rather than endotracheal tubes or face masks, choosing LMA is according to baby weight, with lubrication of LMA with lidocaine ointment, induction of GA with sevoflurane and fentanyl, type of ventilation is spontaneous respiration, monitoring during operation is by HR, BP, SPO2, ECG waves and calculation of duration of GA and surgery. In addition seeing if any complication may develop due to insertion of LMA as an airway maintenance device for instance; bronchospasm, laryngospasm, vomiting, hemodynamic changes for example elevation of heart rate and blood pressure, any hypoxia. These complications to be seen at time of LMA insertion then intra-operatively then at recovery time.

The outcomes were heart rate, blood pressure measurement by cuff, SPO2 in blood by pulse oximetry, and ECG leads.

Statistical analysis

The data collected during the study were summarized in sheets of Microsoft Excel 2010. The statistical analysis performed by using IBM-SPSS 26. The normality of these data tested by Shapiro-Wilk analysis, and the parametric tests were decided to be chosen. Means in addition to standard deviations were calculated. The one way ANOVA for the mean differences among the multiple groups (more than 2 groups) under the study, with post hoc test to find the honestly significant difference among the significant results of one way ANOVA. P-value ≤ 0.05 considered as significant.

RESULTS

Thirty newborns who admitted for pediatric surgery had mean age of 70.16±52.468 days. The mean baby weight was 4.77±1.132 kg. Among the studied sample, the males accounted for 93.3% while the females were 6.7% as shown in figure (1).

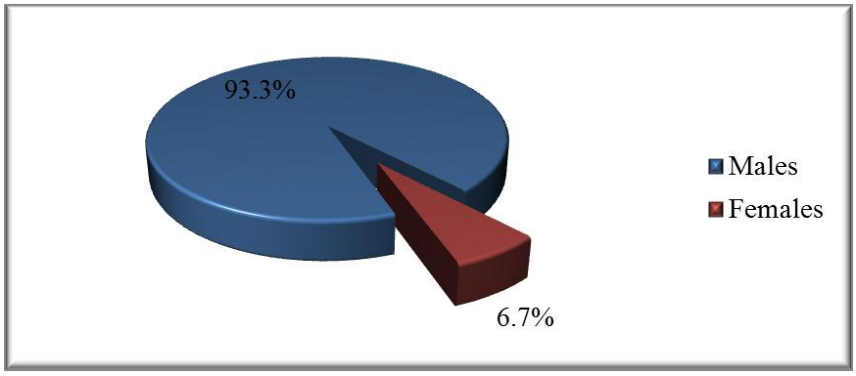

Figure 1: Distribution of the studied sample according to sex.

By comparing the heart rate in pre-induction, post induction of anesthesia and after operation, there was a statistically significant difference (p=0.000) in which there was declining in the rate from pre-induction to after operation point. Similar manner was noticed with systolic BP. Regarding the diastolic BP and SPO2, there were no significant statistical differences, as shown in table (1).

Table 1: Comparison of the outcome variables among the studied time points.

	Before induction	After induction	After operation	p-value*
	Mean±SD	Mean±SD	Mean±SD	
Heart rate	149.70±12.468 A	137.20±16.543 B	119.50±13.203 C	**0.000**
SBP	137.16±11.132 A	124.96±17.335 AB	115.50±15.415 B	**0.000**
DBP	62.16±16.727	56.76±12.640	59.73±18.687	0.438
SPO2	98.76±1.006	98.85±0.690	99.63±0.965	0.563
*One-Way ANOVA test; Tucky Post-hoc test, different letters means significant while same letters mean no significant				

The distribution of the studied sample according to peripheral circulation was demonstrated in figure (2) which elicited that most of the patients continued with pink peripheral circulation while only two patients develop cyanosis represented 6.7%.

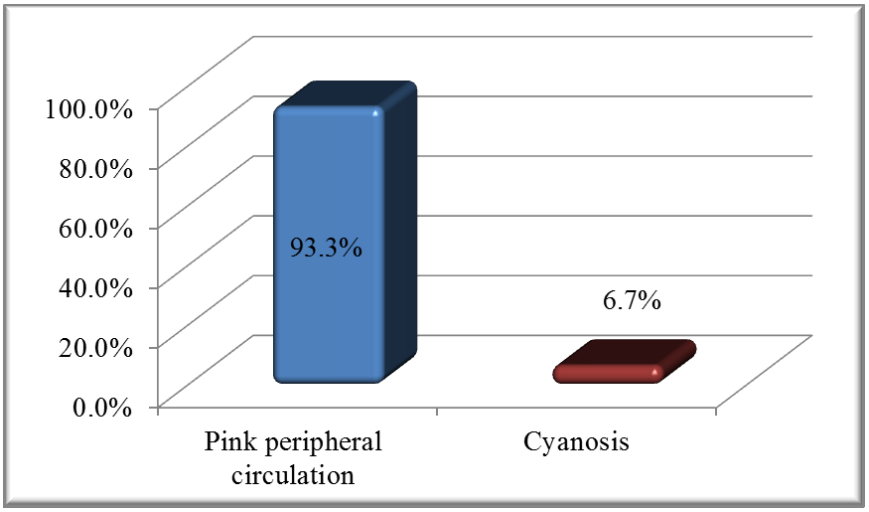

Figure (2): Distribution of the studied sample according to peripheral circulation.

Table 2: Demonstrated the Mean Duration of Anesthesia and Operation Which 34.22±4.918 Min and 18.33±5.894 Min Respectively.

	Mean	Std. Deviation
Duration of anesthesia (min)	34.22	4.918
Duration of operation (min)	18.33	5.894

Among the studied sample, all patients continued safely with LMA, with only one patient develop complication that necessated the change to ETT as shown in figure (3).

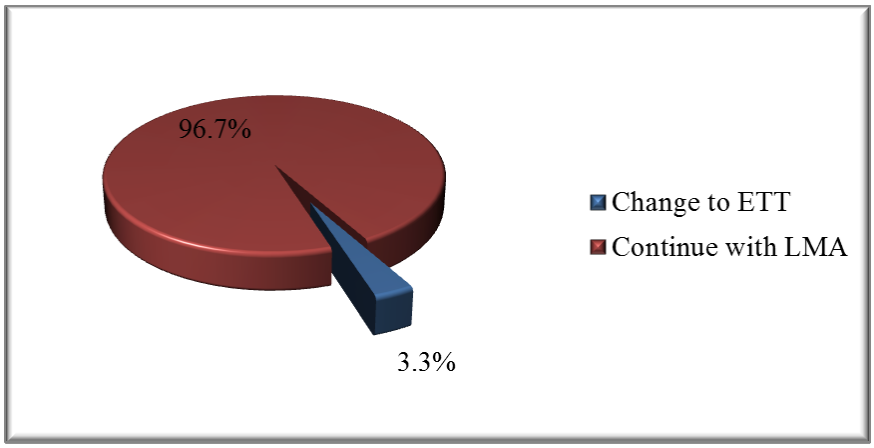

Figure 3: Frequency of changing to ETT.

DISCUSSION

The laryngeal mask airway (LMA) has resulted in less limited mucociliary clearance, better hemodynamic and respiratory stability, and a decreased requirement for anesthetics.[19]

In the current study, giving the correct and full doses of general anesthetic agents to the newborns up to 3 months of age can lead to good insertion of LMA without developing side effects of light anesthesia such as cyanosis or coughing during insertion of LM; for instance fentanyl 1 mcg/kg then repeat it when needed before or during the insertion as a narcotic analgesia; deep sevoflurane concentration that allows good insertion of LMA at newborn babies. The ketamine HCL was avoided in this research because it leads to increments of heart rate and elevation of blood pressure although it has an analgesic action. Among the studied sample, the mean age of newborn babies was 70.16±52.468 days, they underwent different types of groin surgeries with no intra-operative or post-operative complications. Infants undergoing minor surgery under the age of 12 months and receiving LMA had a lower incidence of perioperative respiratory adverse events than those using endotracheal tubes (ETT), according to a large randomized control trial by Drake-Brockman et al.,[17] There is mounting proof that placing an LMA in a baby is feasible. In several small randomized controlled trials, including those involving newborns with gestational ages ≥34 weeks, Qureshi et al.,[12] Zhu et al.,[20] and Trevisanuto et al.,[21] reported that LMA was more effective than the face mask in providing ventilation and preventing further endotracheal intubation in neonatal resuscitation. The use of LMAs in anesthesia for preterm newborns < 52 weeks post-menstrual age may also be taken into account for the potential decreased incidence of postoperative extended mechanical ventilator reliance, according to the Su et al.,[22] research.

The mean body weight of the newborn in the current study was below 5 kg. This was similar to Miao-Pei et al.,[23] and Wanous et al.[24]

In the current study, there were significant decline of pulse rate between the pre-induction point and post-induction of anesthesia but within the normal range. Wanous et al.[24] reported that there were only slightly changes in heart rate during LMA placement for surfactant administration. Regarding the oxygen saturation, the current study found no significant difference at different points of time, similarly, a study conducted by Weisberg et al.,[25] that evaluate the LMA and ETT, found no clinically significant difference in oxygenation between study groups at all three time points. While Wanous et al.[24] reported slightly changes in oxygen saturation. The haemodynamic response to LMA insertion was reported by Jamil et al.,[26] which much less as no laryngoscopy is needed which causes minimal changes in pulse rate and blood pressure upon insertion. The stress response consequent to its insertion is minimal as compared to tracheal intubation. In contrary, Shah et al,.[27] and Obsa et al,.[28] showed that there were increasing in the level of HR and SBP following insertion of LMA.

The mean duration of anesthesia and operation in the current study were 34.22±4.918 min and 18.33±5.894 min respectively with were corresponding to those reported by Su et al.,[22] in which the median surgical time (LMA 20 min) and the median anesthesia time (LMA 35 min) were both significantly longer in the ETT group. Nevešćanin et al.[29] found that the duration of anesthesia had a median time of 25 minutes and duration of surgery was minutes 10.

Among the current sample, only one patient had shifted from LMA to ETT, the ventilation was spontaneous through the surgical operation, then at 10:15 am, the SPO2 reduced suddenly then apnea and cyanosis were developed. The immediate management was done with

endotracheal intubation size 3.5 mm ID; non-cuffed kind tube. The larynx was of difficult intubation grade IV=4 i.e. cormark test with assisted ventilation with hand and reservoir bag, all this was at recovery period. At the end, the SPO2 return and became 97% with ETT. Switching from a Laryngeal Mask Airway (LMA) to an Endotracheal Tube (ETT) during surgery, also known as an LMA exchange, is a common practice in certain surgical scenarios, particularly those requiring long-term mechanical ventilation. This technique allows for a safer and more controlled airway, especially in difficult airway situations. The exchange involves replacing the LMA with an ETT while maintaining the patient's airway and ventilation.[30]

The current study showed no post-operative complication concerning the insertion of LMA. Recently studies have been reporting the safety of LM use in both adults and children.[31,32] A study by Chen et al. asserts that no muscle relaxant is necessary in general anesthesia when using LM airway.[33] Using a laryngeal mask airway instead of an endotracheal tube significantly decreased adverse outcomes (18% vs. 53%) in a randomized controlled trial of neonates receiving GA for various procedures.[17] Furthermore, it has been demonstrated that laryngeal mask airways work well for newborns having inguinal hernia surgery.[18]

At some difficult medical situations such as what happened with one newborn at this research who has a congenital laryngomalacia with bilateral undescended testis that needed orchidopexy, we used LM instead of ETT at this operation of bilateral orchidopexy with a successful outcomes of breathing during and after operation. We used corticosteroids to aid in the spontaneous breathing of this laryngomalacia newborn such as dexamethasone and hydrocortisone intraoperatively. We avoided the use of ETT that is an invasive method of maintaining patent airways to avoid stimulation of larynx and trachea during this prolonged surgical operation and we succeeded with LM.

CONCLUSION

In conclusion, LMA can be a viable and safe option for pediatric anesthesia in elective groin surgery, particularly for newborns. In elective groin surgery for newborns under general anesthesia, both LMA and ETT are considered, with LMA offering advantages like ease of insertion and less stimulation of the cardiovascular system. However, ETT remains a preferred choice in some complex situations or for infants with specific conditions like severe RDS or oxygen dependence. Very important point that sometimes during the use of LMA, the stomach may fill with oxygen especially when we need assisted ventilation by hand and reservoir bag because LMA is a supraglottic device and not the same as ETT that lodges inside larynx and trachea. This stomach with full of oxygen can impair ventilation, therefore, only insertion of a nasogastric tube or an oro-gastric tube can deflate the stomach from oxygen and respiration return to normal level spontaneously without insertion of endotracheal tube at all.

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