The Use of LMA in Newborn Resuscitation

R Vadhera

Citation

R Vadhera. *The Use of LMA in Newborn Resuscitation*. The Internet Journal of Anesthesiology. 1996 Volume 1 Number 4.

Abstract

INTRODUCTION

At birth, numerous physiologic changes must occur for a fetus to successfully make the transition to a neonate. Despite the complexity of this process of adaptation to extrauterine life, of approximately 3.5 million babies born annually in the United States only 6% of newborns require advanced life support in the delivery rooms. [1] The support required increases to 80% among newborns who weigh less than 1500 grams.

The American Heart Association guidelines for neonatal resuscitation recommend that positive pressure ventilation (PPV), when indicated, be administered by bag and mask. 1 In large university hospitals this task is usually fulfilled by neonatologists, who are present 24 hours a day. An obstetric anesthesia work force survey conducted by Hawkins et al., in 1992, found that anesthesiologists performed neonatal resuscitation in 4% of vaginal deliveries and 6% of cesarean deliveries. [2] In a 1991 survey of midwestern community hospitals routine involvement of anesthesia personnel in neonatal resuscitation was noted by 31 % of respondents. [3]

RESUSCITATION OF A NEWBORN

RESUSCITATION OF A NEWBORN CAN BE DIVIDED INTO 4 MAJOR STEPS

1. Initial stabilization and evaluation:

This consists of drying, positioning the neonate under radiant warmer to minimize heat loss and suctioning of mouth and nose (racheal suctioning if meconium present). This should only take approximately 20 seconds

2. Ventilation

The second step (within 20-30 second of birth) is assessment of neonatal respiration. If the baby is apneic or has gasping respiration, begin positive pressure ventilation immediately at a rate of 40-60 breaths per minute with 100 % oxygen.

3. Chest compression

4. Administration of medications and fluids.

The majority of infants requiring any resuscitation will respond to the first two steps. In almost all depressed newborns PPV is all that is required to establish oxygenation and a heart rate of above 100 beats /minute).

VENTILATION

Airway management during neonatal resuscitation is currently achieved either with a face mask (FM) or tracheal tube (TT). To establish effective ventilation after birth, the neonate must generate an opening pressure of 20-40 cm H20. Alternatively when PPV is started peak inspiratory pressures of 30-40 cm H20. or higher (depending upon the age, maturity of the neonate and lung compliance) must be generated for initial lung expansion. [4], [5] The pressure of subsequent breaths ranges from 15-20 cm H20. in the neonates with normal lungs.

Bag and mask ventilation can occasionally be difficult and tracheal intubation may be impossible due to lack of skill or the presence of severe congenital abnormalities. Now we have to our advantage a potential third option that bridges the gap between the FM and TT.

There are lots of inherent problems associated with bag and mask ventilation, which include:

- Upper airway obstruction/inadequate ventilation
- Gastric ventilation
- Challenging procedure for those inexperienced in neonatal resuscitation 5
- Amount of expertise required

Indications for Endotracheal intubation are:

- Ineffective bag and mask ventilation.
- Route for administration of drugs.
- Need for prolonged mechanical ventilation and
- Presence of meconium stained liquor

Problems Associated with Endotracheal Intubation are

- Invasion of respiratory tract
- Risk of endobronchial and esophageal intubation
- Trauma to local tissues and respiratory tract

USE OF LMA IN NEONATES

There are many studies now published regarding the successful us of LMA in children. the experience with the LMA in infants though is very limited. [6] Initially the LMA was designed for use in adults, however, cadaveric studies in infants demonstrated that despite the anatomic difference between adult and pediatric airways, the design of the LMA would not require modification for use in infants. [7] The size 1 LMA is a smaller but identically shaped version of the adult model and is recommended for use in infants weighting 2.5 kgs to 6.5 kg. [8]

INSERTION OF LMA IN NEONATES

The size 1 LMA can be inserted in one of the two ways either in the standard fashion, with the aperture facing anteriorly, according to the manufacturer's instructions, 8 or in reverse with the aperture facing the roof of the mouth turning the LMA through 180° on reaching the posterior pharyngeal wall. Once the LMA is inserted, the cuff is inflared with 2-4 ml air.

Both the techniques provide similar success rates in achieving a clinically good airway. 6 Insertion is successful in more than 90% of neonates on the first attempt after minimal expertise, a finding consistent with the finding in adults. [9]

USE OF LMA IN NEONATAL RESUSCITATION

Now we have to our advantage the LMA, a potential third option, that bridges the gap between the FM and TT.

Denny et al. first reported using the LMA to resuscitate a term newborn for emergency tracheotomy when ventilation of the lungs by bag and mask was inadequate and tracheal intubation proved impossible. Other case reports have shown the successful use of the LMA in resuscitation of newborns with congenital airway abnormality under the inadequate ventilation and difficult intubation scenario. [11,12]

Paterson et al. and Brimacombe published their data using size 1 LMA in neonatal resuscitation, in 21 and 40 neonates respectively. Both authors achieved a very high success rate in achieving a good clinical airway and positive pressure ventilation. 9,[13]

Time required for LMA insertion : Paterson et al. showed an average time of insertion to be 8.6 seconds. In all the published data most of the insertions were successful in less than 20 seconds.

EFFICACY OF RESUSCITATION

In both the studies 95-100 % of the neonates were successfully resuscitated. The pink up time and improvement of heart rate was approximately 30 seconds. In most of the cases effective resuscitation of the neonates took 1-2 minutes.

The LMA in all cases provided a clinically patent airway for PPV, CPAP and spontaneous breathing. 9 The mean time for PPV and CPAP was 80 seconds and 55 seconds respectively, till the spontaneous ventilation returned and LMA was removed. Only one failure to ventilate situation was observed by Brimacombe. 13

Advantages of LMA over bag and mask ventilation [14]

- Clearer airway
- Reduction of observed upper airway obstruction
- Improved ventilation and oxygenation
- Reduction of gastric insufflation?

Paterson et al. did not observe any evidence of gastric distension during resuscitation procedure

- Reduced incidence of tracheal intubation and
- Amount of expertise required

Advantages of LMA over TT

- No need for laryngoscopy
- Less trauma to local tissues and respiratory tract.
- No risk of endobronchial or esophageal intubation

and

- Amount of expertise required.

Tests on neonatal intubation training models have shown that midwives and junior doctors can obtain a clear airway more rapidly with LMA than TT and with fewer failures. [15] There has been a word of caution added by Mawer and Williams about the use of LMA in unfamiliar hands who are not competent in endotracheal intubation and resuscitation .11,[16]

Limitations with the use of LMA

1. Airway is not secured and protected from regurgitated gastric contents
2. Gastric ventilation, distension and increased risk of aspiration. Paterson et al. failed to observe any gastric distension in their series. 9
3. Malpositioning of the LMA appears to be more common is pediatric patients. The epiglottis is relatively narrow, short and angled away from the axis of trachea.. Impinging of the epiglottis on the grille of LMA (28%) is a relatively common phenomenon in infants and neonates. 6
4. High incidence of delayed airway obstruction was observed by Misushima et al. in 12 of 47 cases. 6 In 50% of these cases, patient movement and consequent dislodgement of the LMA was cited as the reason airway obstruction developed. Paterson et al. suggested that brief periods of resuscitation required and continuous manual fixation of the LMA help avoiding the airway obstruction. 9
5. The soft cuff provides only a low pressure seal against the larynx thereby limiting the facility for controlled ventilation. When the cuff is inflated a gas tight seal (as great as 20 cm H20 pressure) exists between the larynx and the LMA. Goudsouzian et al. found an audible leak with a size 1 LMA at a mean pressure of 17 cm H20 (range 8-28 cm H20) during controlled ventilation of the lungs. 17 This could be a cause for concern as opening pressures as high as 20-40 cm H20 must be generated initially to accomplish lung expansion. Paterson et al. clearly showed that though the audible leak occurred at 22 cm H20 pressure, they could still obtain a peak circuit pressure of 37 cm H20 and effectively ventilate the neonates. 9 This may be because the investigators held the LMA in place manually and applied continuous forward pressure on the LMA. They also suggested that because the opening pressure required is higher in a premature newborn or one with lung disease, both the pressure generated before audible leak occurs at LMA and the peak inspiratory pressure may not be adequate to ventilate these neonates with decreased lung compliance. Though on the other hand Brimacombe et al. have used the LMA for neonatal resuscitation in neonates as small as one kg. 13
6. Neonates with meconium aspiration, to allow suctioning of the lower airway.
7. Administration of the resuscitation drugs.

CONCLUSION

A common consensus among most of the authors is that LMA is a potential valuable adjunct for the management of neonatal airway. They also agree that further large multicentre studies are required to evaluate the precise role of LMA in neonatal resuscitation and to decide what level of initial and continued training is needed.

Finally it has been suggested that their use for the time being should be restricted to the staff who are familiar with and competent in their insertion and all doctors involved in airway management during resuscitation should become familiar with the LMA.

Guideline VII of the American society of Anesthesiology Guideline for Regional Anesthesia in Obstetrics states:" The primary responsibility of the anesthesiologist is to provide care to the mother. If the anesthesiologist is also requested to provide brief assistance in the care of the newborn, the benefit to the child must be compared to the risk to the mother."

References

1. Emergency Cardiac Care Committee and Subcommittees, American Heart Association Guidelines for Cardio Pulmonary resuscitation and emergency cardiac Care: VII. Neonatal resuscitation. JAMA 268; 2276-2281, 1992.
2. Hawkins JL, Gibbs CP, Orleans M, Schmid K; Obstetric anesthesia work force survey -1992 versus 1981. Anesthesiology 81; A 1128, 1994.
3. Heyman HJ, Joseph MJ, Salem MR, Heyman K : Anesthesia personnel, neonatal resuscitation and the courts. Anesthesiology 75: A 1074, 1991.
4. Leuthner SR, Jansen RD, Hageman JR : Cardiopulmonary

resuscitation of the newborn. Pediatric Clinic N. Am 41: 893-907, 1994.
5. Bloom RS: Delivery room resuscitation of the newborn, Neonatal Perinatal Medicine . Edited by Fanaroff AA, Martin RJ, St Louis, Mosby - Year Book., 1992, pp 301-324.
6. Mizushima A, Wardall GJ, Simpson DC : The laryngeal mask airway in infants. Anaesthesia 47: 849-851, 1992.
7. Brain AIJ: The Development of the laryngeal mask; A brief history of invetion, early clinical studies and experimental work from which the laryngeal mask evolved. Eur J Anesthesiology (suppl): 5-17, 1997.
8. Brain, AIJ: The Intavent Laryngeal Mask Instruction Manual, 2nd edition. Henley on Themes, Intavent Internation SA, 1992.
9. Paterson SJ, Byrne PJ, Molesky MG, Seal RF, Finucane BT: Neonatal resuscitation using the Laryngeal Mask airway. Anesthesiology 80; 1248-1253, 1994.
10. Denny NM, Desilva KD, Webber PA : Laryngeal Mask airway for emergency Tracheostomy in a neonate (letter). anesthesia 45:895, 1990.
11. Mawer RJ: Equipment for pediatric resuscitation (letter), Anaesthesia 50 (1): 87- 88, 1995.
12. Baraka A: Larynx mask airway for resuscitation of a newborn with Pierre - Robin syndrome (letter). Anesthesiology 83(3):645-6, 1995.
13. Brimacombe J, Gandini D: Resuscitation of neonates with the laryngeal mask airway - a caution (letter). Pediatric 95 (3): 453-4, 1995.
14. Brimacombe J. : The laryngeal mask airway for neonatal resuscitation (letter). Pediatrics. 93(5): 874, 1994.
15. Lavies NG: Use of the laryngeal mask airway in neonatal resuscitation (letter). Anaesthesia 48: 352,1993.
16. Williams RK: Resuscitation of neonates with laryngeal mask airway - a caution (letter). Pediatrics 95(3): 453-4, 1995.
17. Goudsouzian NG, Denman N, Cleveland R, Shorten G: Radiologic localization of the laryngeal mask airway in children. Anesthesiology 77: 1085-1089, 1992.

Author Information

Rakesh B. Vadhera, MD., FRCA
Obstetric Anesthesia, Department of Anesthesiology , Baylor College of Medicine