Acta Clin Croat (Suppl. 1) 2023; 62:29-34
doi: 10.20471/acc.2023.62.s1.03

Original Scientific Paper

LARYNGEAL MASK AIRWAY *VERSUS* ENDOTRACHEAL INTUBATION FOR ADENOIDECTOMY IN OUTPATIENT SURGERY – SINGLE CENTER EXPERIENCE

Elora Pavla Matanović[1,2], Tea Pašalić[2], Iva Botica[3] and Renata Curić Radivojević[2]

[1]Department of Anesthesiology, Resuscitation and Intensive Care, Zabok General Hospital, Zabok, Croatia;
[2]Department of Anesthesiology, Resuscitation and Intensive Care, Zagreb University Hospital Center, Zagreb, Croatia;
[3]Department of Otorhinolaryngology and Head and Neck Surgery, Zagreb University Hospital Center, Zagreb, Croatia

SUMMARY – Adenoidectomy with or without tonsillectomy remains one of the most routinely performed surgical procedures in children. The duration of the procedure is usually less than half an hour and is done in a day surgery setting. Airway management for adenoidectomy can be especially challenging as the airway is shared between the surgeon and the anesthesiologist. The gold standard for airway management is an endotracheal tube (ETT), even though there has been an increase in the use of laryngeal mask airway (LMA) over the past decade. This retrospective study investigated patient data collected over a 4-year period (2016 to 2020). Data included 210 cases in a day surgery setting. We analyzed the choice of airway device and use of neuromuscular blockers and analgesics for pain management. The use of LMA was noted in 67.62% while endotracheal intubation was performed in 32.38% of cases. LMA resulted in fewer respiratory complications compared to ETT (p=0.006). The need for neuromuscular blockers was also lower in the LMA group (p=0.01). There was no statistically significant difference in the intraoperative dose of opioid analgesia (p=0.09). Flexible LMA is a satisfactory alternative to endotracheal intubation for outpatient pediatric adenoidectomy.

Key words: *Endotracheal tube; Laryngeal mask airway; Adenoidectomy*

Introduction

Adenoidectomy with or without tonsillectomy is one of the most routinely performed surgical procedures in children[1]. Endotracheal intubation has been the gold standard for airway management during adenoidectomy, especially in children with severe adenoidal hyperplasia[1]. Over recent years, the use of laryngeal mask airway (LMA) has been on rise and subsequently there have been extensive studies on LMA benefits. Adenoidectomy is usually performed as an outpatient procedure for which LMA is ideally suited as it decreases the usage of nondepolarizing muscle blockers, thus minimizing prolonged muscle paralysis, and lowers the incidence of postextubation complications such as laryngospasm and coughing[2,3]. There are, however, a few potential problems with LMA, such as inadequate surgical exposure and leaking or kinking, resulting in conversion to an endotracheal tube (ETT)[3,4]. Until now, only a few studies demonstrated a slight benefit of flexible LMA use over ETT[3-7]. To date, there has been no relevant study conducted in Croatia regarding

Correspondence to: *Elora Pavla Matanović, MD*, Zagreb University Hospital Center, Kišpatićeva 12, HR-10000 Zagreb, Croatia
E-mail: elora.matanovic@gmail.com

airway management for adenoidectomy in day surgery. As the largest university hospital in the country, we hoped to provide an insight on the current practices in our hospital regarding this frequently performed procedure. The aim of this retrospective study was to distinguish the potential benefit of flexible LMA over ETT and determine whether LMA use in outpatient adenoidectomy was on rise in our hospital. To better understand the advantage of LMA, we also compared anesthesia requirements, operative time, and complication rate between the two groups.

Patients and Methods

Our study included 210 subjects aged 2 to 15 who underwent adenoidectomy in a day surgery setting from February 2016 to February 2020. Patient data were retrospectively collected from intraoperative anesthesia paper charts, perioperative anesthesia forms and medical records written postoperatively onto the hospital medical software. All patients had an American Society of Anesthesiologists (ASA) score I or II. Anesthesia was provided by a total of 10 attending anesthesiologists. The main goal of the study was to deduce if LMA usage had advantages over ETT and whether it outnumbered endotracheal intubation as a primary method for airway management for outpatient adenoidectomy. No defined protocol was used on choosing ETT *versus* LMA; the choice was at discretion of the attending anesthesiologist. LMA size was chosen according to patient weight as *per* manufacturer's instructions. Study subjects were divided into two groups according to the method of airway control. We noted age, sex and weight of all study subjects. Secondary objective was to compare anesthesia requirements, procedure time and complications between the LMA and ETT groups. Collected and analyzed study parameters included premedication agents, anesthesia induction type, airway type (ETT *vs*. LMA), neuromuscular blocking agent (NMB) and intraoperative medications. We also looked at the need for postoperative analgesia in both groups. Total procedure time was defined as the number of minutes from the beginning of induction to extubation.

SPSS 26.0 (IBM SPSS Inc., Chicago, IL, U.S.) software was used on statistical data analysis. Numerical variables were expressed as mean ± standard deviation. Categorical variables were compared using the χ^2-test and expressed as numbers and percentages. The level of statistical significance was set at $p<0.05$.

Results

Patient population

From February 2016 to February 2020, 210 pediatric patients underwent adenoidectomy in a day surgery setting. LMA was used for securing the airway in 142 (67.62%) patients, while endotracheal intubation was used in 68 (32.38%) patients. LMA group had 56 (39.44%) female and 86 (60.56%) male patients. ETT group had 33 (48.53%) female and 35 (51.47%) male patients. LMA group had 121 (85.21%) ASA I status patients and 21 (14.75%) ASA II status patients. In the ETT group, 50 (73.53%) subjects were assigned ASA I status and 18 (26.47%) ASA II status.

The mean patient age was 6.04±2.93 years in the LMA group and 5.65±2.82 years in the ETT group. The mean patient weight was 24.13±11.64 kg in the LMA group and 23.45±12.46 kg in the ETT group. There was no significant difference in gender

Table 1. Patient characteristics

	LMA group n=142	ETT group n=68	p value
Male	86 (60.56%)	35 (51.47%)	0.212
Female	56 (39.44%)	33 (48.53%)	
Age (years)	6.04±2.93	5.65±2.82	0.389
Weight (kg)	24.13±11.64	23.45±12.46	0.359
ASA I	121 (85.21%)	50 (73.53%)	0.042
ASA II	21 (14.79%)	18 (26.47%)	

ASA = American Society of Anesthesiologists; LMA = laryngeal mask airway; ETT = endotracheal tube; data are expressed as mean ± standard deviation (SD)

(p=0.212), age (p=0.365) and patient weight (p=0.699) when comparing the two groups.

A significant association between ASA status and airway device type was recorded (p=0.043). These characteristics are listed in Table 1.

Anesthesia characteristics and procedure time

Prior to entering the operating room, premedication in the form of midazolam syrup was administered to 188 subjects, 60 of them in the ETT group. In the LMA group, 128 patients were premedicated. Anesthesia induction techniques were identified. Standard inhalation induction was used in younger children in whom the intravenous cannula could not be safely placed beforehand. Intravenous induction with propofol was used when intravenous access was established prior to induction. In the LMA group, intravenous induction was used in 110 (77.46%) patients, while inhalation induction was used 32 (22.54%) times. In the ETT group, intravenous induction was used 44 (64.7%) times and inhalation induction 24 (35.3%) times.

As mentioned previously, LMA was used in 142 (67.62%) and ETT in 68 (32.38%) patients. In only one case, LMA had to be substituted with ETT during the surgery due to malposition. As the first airway choice was LMA, this patient was included in the LMA group. Neuromuscular relaxant was used in 107 cases, of which it was used for endotracheal intubation in all of 68 (100%) ETT patients and 39 (27.46%) LMA group patients.

Fentanyl was administered for intraoperative analgesia. The mean dose of fentanyl was 2.82±1.32 mcg/kg in the LMA group and 2.51±1.1 mcg/kg in the ETT group. After the airway was secured, all the participants received a combination of ondansetron, a 5-HT3 blocker, and dexamethasone, a steroid, for adequate antiemetic prophylaxis and reduction of a possible airway edema. The mean dose of dexamethasone administered to the LMA group was 0.22±0.07 mg/kg and 0.24±0.95 mg/kg in the ETT group.

The mean procedure time was 21.34±9.30 min in the LMA group and 17.57±7.50 min in the ETT group. The equal variances t test failed to reveal a statistically reliable connection between premedication, opioid and dexamethasone dose regarding airway management method. However, there was a statistically significant correlation between the type of induction (p=0.05), relaxant use (p=0.01) and procedure time (p=0.004) when choosing LMA or ETT. These results are shown in Table 2.

Postoperative analgesia

Postoperative analgesia, when administered, was started in the operating room at the end of the procedure. Paracetamol alone or in combination with non-steroidal anti-inflammatory drugs (NSAIDs) and tramadol were mostly used in both groups. Drugs administered for postoperative analgesia are displayed in Table 3.

Complications

Laryngospasm after extubation was recorded in 2 patients in whom an ETT was used. Bronchospasm af-

Table 2. Comparison of LMA and ETT groups

	LMA group n=142	ETT group n=68	p value
Premedication with midazolam	128 (90.14%)	60 (88.24%)	0.673
Intravenous induction	110 (77.46%)	44 (64.7%)	0.050
Inhalation induction	32 (22.54%)	24 (35.3%)	
Fentanyl (mcg/kg)	2.82±1.32	2.51±1.10	0.090
NMB usage	39 (27.46%)	68 (100%)	0.01
Dexamethasone (mg/kg)	0.22 ±0.07	0.24±0.95	0.051
Procedure duration (min)	21.34±9.30	17.58±7.50	0.004
Complications	3 (2.11%)	6 (8.82%)	0.003

LMA = laryngeal mask airway; ETT = endotracheal tube; NMB = neuromuscular blocker; data are expressed as mean ± standard deviation (SD)

Table 3. Postoperative analgesia

Analgesic	LMA group, %	ETT group, %
Paracetamol	75.52	95.52
Paracetamol + NSAID	17.48	1.49
NSAID	4.90	0
Tramadol	0.70	0
Paracetamol + tramadol	0.70	1.49
No postoperative analgesia	0.70	1.49

LMA = laryngeal mask airway; ETT = endotracheal tube; NSAID = nonsteroidal anti-inflammatory drug

ter intubation occurred in 4 patients. This makes a total of 6 complications associated with ETT use, yielding a complication rate of 8.82% in the ETT group. Wrong LMA size was used on one occasion and had to be replaced with a smaller size LMA. Initially, LMA size 3 was used in a male patient weighing 31 kg. It was then replaced by size 2.5 LMA. In one patient, an upper left incisor was damaged during the operation in which LMA was used for securing the airway. Malposition of LMA that required an ETT conversion was noted in one patient. A total of 3 (2.11%) complications associated with LMA use were recorded. The relationship between the choice of airway device and developing complications was significant (p=0.006). The data suggest that endotracheal intubation was more likely to result in complications.

Discussion

The goal of this study was to give a clear overview of current practices in airway management for ambulatory adenoidectomy in our institution. To the best of our knowledge, this is the first study of this kind in Croatia. The standard practice of endotracheal intubation for adenoidectomy has slowly been replaced with the use of flexible LMA[5]. We have shown that LMA is now used as an airway method of choice in two-thirds of outpatient adenoidectomies in our institution. Patient demographic factors such as gender, age and weight did not seem to correlate with either airway device. ASA status was linked to the choice between LMA and ETT, with more ASA I patients receiving LMA than ETT. This is not consistent with the research performed by Peng *et al.*[6], who disputed such correlation. Interestingly, we found intravenous induction to be more used in both groups. One of the main advantages of LMA, in day surgery, is reduction of NMB, which lowers the possibility of prolonged muscle paralysis. Such claims were proven by our study in which only 27.46% of patients in the LMA group received NMB compared to 100% with ETT (p=0.01). However, we found no statistical difference in opioid dose between the two groups. Oddly, the mean intraoperative dosage of fentanyl was greater in the LMA group. This is not consistent with the research done by Joshi *et al.*, which showed a lower mean dosage of fentanyl needed for securing the airway with LMA, although they did note, as we did, that the difference was of little clinical consequence[8]. Adequate postoperative analgesia in both groups was mostly achieved with paracetamol and NSAIDs.

Lower airway complications are to be expected with LMA, as it decreases airway irritation and minimizes laryngeal trauma[9]. Sierpina *et al.* noted an increase in spontaneous ventilation with LMA which may contribute to smoother emergence from anesthesia resulting in less postoperative cough, bronchospasm and stridor[7,9]. We affirmed this claim as complications regarding the airway were prevalent in the ETT group, in which 4 bronchospasms and 2 laryngospasms were recorded. Our data suggested that complications were more likely to happen with tracheal intubation (p=0.006). The biggest surprise in our study was the significantly longer procedure time in the LMA group, i.e., 21.34 minutes compared to 17.58 minutes in the ETT group (p=0.004). The literature suggests a shorter procedure time with LMA use[3,10]. Lalwani *et al.* argued that insertion of LMA takes less time, while extubation of a patient with ETT requires full awakeness prolonging the procedure time[10]. Our unusual finding could be due to impaired surgical access. Ranier *et al.* report no statistically significant differences in the operative

time between the two groups, although it is important to note that their study included andenotonsillectomies[11]. More research is needed to conclude why our result was such. Concerns over surgical access to the operating field and possible aspiration are still strong, even though Peng *et al*. dismissed such claims in their paper[4,6,9,11]. Their surgical visual field was not affected, and satisfactory protection of the airway was achieved. However, they did highlight the possibility of LMA kinking and subsequent obstruction of air flow, calling for better understanding of LMA obstruction etiology and prevention strategies[6]. We recorded only one patient in whom LMA had to be replaced with ETT due to malposition. Our conversion rate was rather negligible, i.e., 0.7%. The culprit for this problem could be found in Davis mouth gag, which is routinely used during this procedure for mouth opening and ETT or LMA holding. Similarly, Boroda *et al*. in their study noted conversion in only 2 out of 139 cases. The lower conversion rate, they argued, was in part the result of difference in LMA placement expertise between surgical centers[4].

The results of our study demonstrate a rising trend in the use of flexible LMA for pediatric outpatient adenoidectomy in our hospital. We confirmed the safety of LMA for airway control and showed that it was more advisable for airway management when compared to ETT in outpatient setting, as it lowers or completely omits the use of NMB while having a lower complication rate. More research is needed to better understand why the procedure time was longer when LMA was used.

References

1. Jaffe R, Schmiesing C, Golianu B. Anesthesiologist's Manual of Surgical Procedures. 6th edn. Philadelphia: Wolters Kluwer, 2020; p. 228/232, 1345/1349.
2. Meretoja OA. Neuromuscular block and current treatment strategies for its reversal in children. Paediatr Anaesth. 2010;20(7):591-604. doi: 10.1111/j.1460-9592.2010.03335.x
3. Ozmete O, Sener M, Caliskan E, Kipri M, Aribogan A. The use of flexible laryngeal mask airway for adenoidectomies: an experience of 814 paediatric patients. Pak J Med Sci. 2017;33(4). doi: 10.12669/pjms.334.12432
4. Boroda N, Malesinska M, Kars M, Smith L. The use of laryngeal mask airway for adenoidectomy. Int J Pediatr Otorhinolaryngol. 2018;107:42-4. doi: 10.1016/j.ijporl.2018.01.034
5. Gravningsbraten R, Nicklasson B, Raeder J. Safety of laryngeal mask airway and short-stay practice in office-based adenotonsillectomy. Acta Anaesthesiol Scand. 2008;53(2):218-22. doi: 10.1111/j.1399-6576.2008.01806.x
6. Peng A, Dodson K, Thacker L, Kierce J, Shapiro J, Baldassari C. Use of laryngeal mask airway in pediatric adenotonsillectomy. Arch Otolaryngol Head Neck Surg. 2011;137(1):42. doi: 10.1001/archoto.2010.230
7. Sierpina D, Chaudhary H, Walner D, Villines D, Schneider K, Lowenthal M, Aronov Y. Laryngeal mask airway *versus* endotracheal tube in pediatric adenotonsillectomy. Laryngoscope. 2012;122(2):429-35. doi: 10.1002/lary.22458
8. Joshi G, Inagaki Y, White P, Taylor-Kennedy L, Wat L, Gevirtz C, *et al*. Use of the laryngeal mask airway as an alternative to the tracheal tube during ambulatory anesthesia. Anesth Analg. 1997;85(3):573-7. doi: 10.1097/00000539-199709000-00016
9. Yu S, Beirne O. Laryngeal mask airways have a lower risk of airway complications compared with endotracheal intubation: a systematic review. J Oral Maxillofac Surg. 2010;68(10):2359-76. doi: 10.1016/j.joms.2010.04.017
10. Lalwani K, Richins S, Aliason I, Milczuk H, Fu R. The laryngeal mask airway for paediatric adenotonsillectomy: predictors of failure and complications. Int J Pediatr Otorhinolaryngol. 2013;77(1):25-8. doi: 10.1016/j.ijporl.2012.09.021
11. Ranieri D, Neubauer A, Ranieri D, Junior P. The use of disposable laryngeal mask airway for adenotonsillectomies. Braz J Anesthesiol. 2012;62(6):788-98. doi: 10.1016/s0034-7094(12)70179-4

Sažetak

LARINGEALNA MASKA PREMA ENDOTRAHEALNOJ INTUBACIJI ZA ADENOIDEKTOMIJU U JEDNODNEVNOJ KIRURGIJI – ISKUSTVO JEDNOG CENTRA

E. P. Matanović, T. Pašalić, I. Botica i *R. Curić Radivojević*

Adenoidektomija, s tonzilektomijom ili bez nje, jedna je od najčešćih kirurških zahvata u djece. Trajanje zahvata obično je kraće od pola sata i izvodi se u uvjetima dnevne kirurgije. Upravljanje dišnim putovima kod adenoidektomije može biti osobito izazovno, jer se dišni put dijeli između kirurga i anesteziologa. Zlatni standard za upravljanje dišnim putovima je endotrahealni tubus, iako se u posljednjem desetljeću češće rabe laringealne maske (LMA). Provedena je retrospektivna studija na 210 bolesnika operiranih tijekom 4-godišnjeg razdoblja (2016. do 2020.) u dnevnoj kirurgiji. Analizirali smo izbor sredstva za osiguranje dišnog puta, primjenu neuromuskularnih blokatora i analgetika za ublažavanje boli. Primjena LMA zabilježena je u 67,62%, dok je endotrahealna intubacija učinjena u 32,38% slučajeva. Nakon LMA zabilježeno je manje respiracijskih komplikacija u usporedbi s ETT (p=0,006). Potreba za neuromuskularnim blokatorima također je bila manja u skupini LMA (p=0,01). Nije pronađena statistički značajna razlika u intraoperativnoj dozi opioidne analgezije (p=0,09). Fleksibilna LMA je zadovoljavajuća alternativa endotrahealnoj intubaciji za ambulantnu pedijatrijsku adenoidektomiju.

Ključne riječi: *Endotrahealni tubus; Laringealna maska; Adenoidektomija*