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Efficacy of laryngeal airway mask compared with endotracheal tube in reducing coughing following general anesthesia in adults

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ABSTRACT

Introduction: Coughing is an airway complication that could affect the outcome of surgery following general anesthesia in adults. In this systematic review, we aimed to study the efficacy of applying laryngeal airway mask (LMA) compared with endotracheal tube (ETT) in reducing the postoperative cough in adults under general anesthesia.
Method: PubMed was searched for the relevant articles. Inclusion criteria were all the randomized controlled clinical trials, which used LMA and ETT in adults under general anesthesia. Only English language articles were included in this study with no time limitation.
Result: Overall, 15 articles were retrieved, which were relevant with the purpose of this study. Efficacy of LMA in reducing coughing was significantly different with ETT in adults under general anesthesia in various types of surgeries. Calculated number needed to treat (NNT) showed that using LMA would significantly reduce coughing even in one adult patient.
Conclusions: Coughing has shown various adverse effects on postoperative main results in some surgeries such as cataract, cranial, etc. Applying LMA could positively decrease postoperative coughing in adults.

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Introduction

General anesthesia may induce respiratory complications in which the protective effect of airway reflexes will be decreased. Respiratory complications are among serious issues during each surgery that should be accurately managed to inhibit associated morbidity such as cardiac arrest during the peri-, intra-, and postoperative management. The ability to protect patent airway and provide effective positive pressure ventilation (PPV) is a principal during any anaesthesiological events (1).

Endotracheal tube (ETT) is commonly applied for managing respiration in a setting of general anesthesia which is mostly used in severely injured patients, or anesthetized patients to inhibit asphyxiation or airway obstruction. EET has been proposed as the main standard method for maintaining airway from aspiration (2). Applying this device needs sufficient operator expertise and has some limitation from different anatomical points of view including (3) local trauma, stress-response

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reflex, and malpositioning of the ETT.

The laryngeal mask airway (LMA), invented in 1983 by Dr Archie I. J. Brain, is a supraglottic airway device suggested as a beneficial alternative for managing and monitoring respiration during spontaneous or controlled ventilation in adults and children (4). Compared with ETT, the prevalence of using LMA is increasing due to its less invasive characteristics and minimal associated cardiovascular, respiratory, and postsurgical airway complications and disturbances (5). Using LMA has some advantageous over ETT, including no manipulation of patients` neck, jaw, and head, no compression of facial nerves, lower hemodynamic stress response, and low incidence of cerebral hemorrhage, fast and easy placement and stable positioning, no tracheal edema, improved oxygen saturation, and lower incidence of sore throat in adults (6,7). However, there are various possible disadvantages of LMA such as: gastric insufflation and aspiration, inadequate alveolar ventilation, and impossibility of suctioning the airway or using drugs endotracheally (8,9).

Postoperative respiratory tract complications are important to be controlled due to the possibility of threatening surgery outcomes (10). Postoperative coughing can increase the venous pressure that can lead to increased cerebral blood flow, intracranial pressure, and regional brain oxygen saturation (11).

In this systematic review, we study the differences reported in literature between ETT and LMA during general anesthesia in adults regarding the incidence of coughing as an air-related complication.

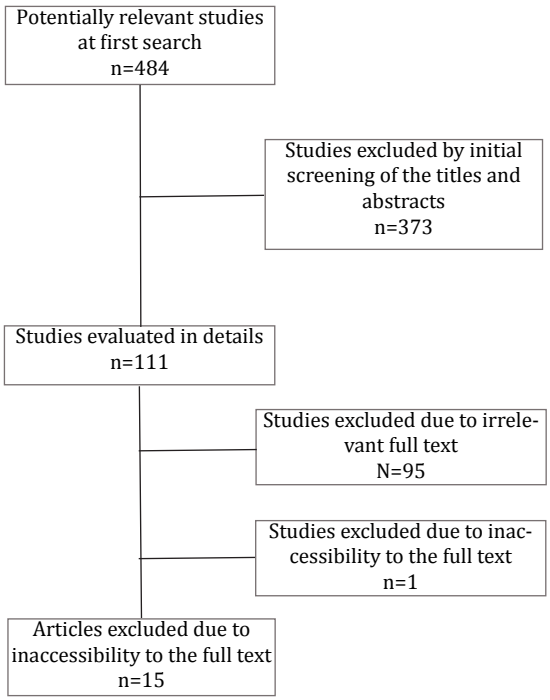
Methods

We searched PubMed to retrieve all the relevant articles to the clinical question of this study with the following search term: (laryngeal airway mask OR LMA) and (endotracheal tube OR ETT). Coughing was considered as the outcome of the included studies. No date limitation was included in search strategy of this study. Only English language articles were selected to be extracted. Reference lists of the included articles were also searched manually to prevent missing any relevant article. Irrelevant articles were omitted by studying the title, abstract, and eventually the full text of the obtained articles, at first search. Inclusion criteria were all the randomized controlled clinical trials that studied the efficacy of LMA and ETT in adults undergoing general anesthesia during any surgical operation. Exclusion criteria were all the different types of articles and case reports, studies on pediatrics, experimental studies, non-English language articles, and those that did not compare LMA and ETT. Data on authors, patients' characteristics, surgery type, percent of coughing in each study, and odds ratio as the effect size of each article are expressed in Table 1.

Results

Overall, 484 articles were found at the initial search that some were excluded after studying the title, abstract, and the full text. Eventually, 15 articles were included in this study for data extraction as the most relevant studies to the question of this review. Flowchart of the main studies is presented in Figure 1.

Figure 1. Flowchart of the included studies



Detailed data, regarding authors, year, country, studied patients, incidence of coughing, odds ratio, and the quality indices of the included studies are provided in Table 1.

Patients included in two groups of all the studies were the same regarding the depth of anesthesia and applied anesthetic method; thus anesthetic strategy did not affect the postoperative coughing incidence. The presented NNT shows the importance of applying LMA for adults under general anesthegia. The majority of the included studies shows the NNT of 1 that means a beneficial effect of LMA can be observed even by applying in one patient under general anesthesia compared with ETT and coughing could be significantly decreased.

Table 1. Data on the incidence of cough in adults in each study

Author Year Reference	Patients: LMA[1]/ ETT[2]	Patients` characteristics	Surgery	Premedication	Ventilation LMA/ETT	Cough LMA/ETT	NNT[3]	Randomization of patients, similarity at the start of the experiment, lost to follow up
Peirovifar 2012 (10)	40/40	ASA I-II	Ophthalmic surgeries	2 mg midazolam	Mechanical/ Mechanical	2/16	3	A computer-generated randomization, Y, N
Akhtar 1992 (12)	15/15	ASA I-III	Intra-ocular ophthalmic	Temazepam 20 mg 90 min before surgery	Mechanical/ Mechanical	0/13(87%)	1	NR[4], Y[5], N[6]
Sharma 2011 (13)	20/20	ASA I Age:18-60 yrs[7]	Peripheral limb	Oral diazepam 5 mg	-	0/10	1	A computer-generated randomization, Y, N
Eghbal 2013 (14)	45/45	ASA I-II, Age: (49.32 ± 3.81 to 52.32 ± 1.49) yrs	External dacryocystorhinostomy	Midazolam (0.03 mg/kg) and fentanyl (2 µg/kg)	Mechanical/	1/29 3%/64.44%	2	NR, Y, N
Perello´-Cerda 2013 (15)	21/21	Mean Age: LMA: 51±16 ETT: 52±14 yrs	Supratentorial craniotomy	Intravenous midazolam (1 to 2 mg)	Mechanical/ Mechanical	2 (9.5%) / 18 (87.5%)	1	Sealed envelopes labelled with software-generated randomized numbers, Y, N
Ryu 2014 (16)	36/37	ASA I-II Age: 19–70 yrs	Thyroidectomy	Midazolam 0.03 mg kg-1	Mechanical/ Mechanical	1/8	5	A computer-generated random number table, Y, N
Cork 1994 (17)	LAM (Spontaneous 13, Controlled 9)/ ETT (Spontaneous 9, Controlled13)	Age: 39±5 to 45±5 yrs	Peripheral orthopedic	No	Spontaneous/ Mechanical	LAM (Spontaneous 2, Controlled 1) / ETT (Spontaneous 5, Controlled 8)	2	Coin flips, Y, N
Denny 1993 (18)	42/37	Age: 72.4±1.61 to 72.6±1.98 yrs	Cataract	Temazepam 10 or 20 mg 1hr before surgery	Mechanical/ Mechanical	During the recovery 1/24	2	NR, Y, N
Dyer 1995 (19)	50/50	ASA I; Age:18-65 yrs Size: Female(ETT 8, LMA:3) Male(ETT 9, LMA 4)	Orthopedic	Temazepam 20-30 mg, 2 h before operation	Mechanical/ Mechanical	19/2		NR, Y,N
Idrees 2000 (20)	25; 25	ASA I-II	Peripheral limb	Midazolam 7.5 nig orally	Unknown/ Unknown	1/6	5	By a coin flip method, Y, N
Maltby 2000 (21)	49/48	ASA I-II Age: 43± 16 to 45±14 yr	Laparoscopic Cholecystectomy		Mechanical/ Mechanical	8/38	2	A computer-generated table of random numbers, y, N
Maltby 2002 (22)	50/55	ASA I-III; Age: 44± 13 to 44 ±15 yrs Size: Female (ETT 7, LMA:4) Male (ETT 8, LMA 5)	Laparoscopic Cholecystectomy	-	Mechanical/ Mechanical	2/48	1	A computer-generated table of random numbers, y, N
Maltby 2002 (23)	104/105	ASA I-III; female; Age:35±8 to 37±9 yrs	Gynecologic laparoscopy	-	Mechanical/ Mechanical	8/91	1	A computer-generated table of random numbers, y, N
Thomson 1992 (24)	15/14	ASA I-II; Age: 49.1± 25.1 to 56.7±18.6 yrs	Ophthalmic	-	Mechanical/ Mechanical	0/13	1	NR, Y, N
Webster 1999 (25)	35; mechanical, 34, spontaneous, 32	ASA I-II	Endoscopic septoplasty	-	Spontaneous/ Spontaneous	3/7, 12	5	NR, Y, N

[1]LAM: laryngeal airway mask; [2]ETT: endotracheal tube; [3]NNT: number needed to treat; [4]NR: not reported; [5]Y: yes; [6]N: no; [7]yrs: years

Discussion

Controlling and managing the ventilation during surgeries are important issues that can be compromised due to various risk factors such as coughing. Incidence of coughing may endanger controlled ventilation of patients under general anesthesia (19). The efficacy of LMA in reducing the incidence of coughing is compared with ETT, which is proposed as a potent stimulus of coughing in included studies.

In the current review, data obtained from all the

included studies showed the significant differences between LMA and ETT regarding the incidence of coughing during the recovery time of patients under general anesthesia in different types of surgeries.

NNT which has been presented in Table 1 for each study shows that applying LMA significantly reduces the incidence of coughing compared with ETT in surgeries with general anesthesia.

Higher incidence of coughing by using ETT during general anesthesia might be due to the insertion process of ETT in trachea, which can irritate the airway and lead to the incidence of postoperative respiratory complications (12).

Evaluating the incidence of coughing and other associated airway complications has a clinical importance for choosing the best treatment approach. It seems that the incidence of coughing during recovery time can increase the possibility of further postoperative complications in some specific surgeries.

According to the study of Akhtar et al., coughing could increase the intraocular pressure to more than 50 mmHg, which was unfavorable following cataract and intra-ocular ophthalmic surgeries and could lead to iris or vitreous prolapse (12); thus it should be inhibited. Similar results would happen regarding increased intracranial pressure by coughing during cranial surgeries (26). Intraocular increased pressure is specifically vital in patients undergoing eye injuries. In this regard, applying LMA could inhibit the possibility of compromising outcomes of some surgeries by reducing the incidence of coughing. Webster et al. mentioned that coughing could increase the possibility of bleeding following intranasal surgeries (25).

Sharma et al. mentioned that pulmonary functions were depressed in lower level compared with other surgeries during peripheral limb surgeries, therefore applying LMA could reduce the possibility of coughing and the consequence postoperative complications (27).

Conclusion

This study showed that using LMA as a suitable alternative for ETT in adults could significantly reduce the incidence of coughing, an airway complication following general anesthesia.

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Conflict of Interest

The authors declare no conflict of interest.

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