

The effect of the laryngeal mask airway on the outcomes of the endoscopic tympanoplasty

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Abstract

Aim: Chronic otitis media is a common disease characterized by a tympanic membrane perforation and conductive hearing loss. Tympanoplasty is performed to provide a healthy middle ear and to create an intact eardrum. In recent years, endoscopic tympanoplasty has become more popular for the repair of the tympanic membrane. This method saves time for the surgeon and provides a comfortable opportunity for the patient.

Endotracheal intubation (ET) and laryngeal mask airway (LMA) are two different airway systems used in general anesthesia. It is known that LMA provides shorter operating times for surgeries requiring general anesthesia.

The aim of this study was to evaluate the outcomes of endoscopic tympanoplasty in patients who underwent endoscopic tympanoplasty with LMA or ET anesthesia, and to compare this method that regards to graft success rates. We also investigated the duration of surgery and operation time, and pain scores in both groups.

Materials and Methods: In this retrospective study, we included the patients who were performed endoscopic type 1 tympanoplasty with tragal cartilage graft. Visual evaluation of eardrums and audiologic datas of the patients were performed. The cases with cholesteatoma and/or ossicular chain problem were not included to study. Patients were evaluated in two different groups as LMA and endotracheal tube (ET) group. Preoperatively perforation types and audiological data; intraoperatively operation and surgical times; postoperatively 3th month surgical success, pain scores and audiological results were recorded in each group. And these results were evaluated statistically to compare the differences between LMA and ET group.

Results: Ninety-three patients were included in the study and 36 of them underwent endoscopic tympanoplasty with LMA and 57 patients with ET. The surgery time was similar in both groups ($p > 0.05$), but the operation time was statistically significantly shorter in the LMA group ($p < 0.05$). Graft success rates and hearing gain were higher in the LMA group but not statistically significant.

Conclusions: We observed that endoscopic tympanoplasty with LMA or ET had similar surgery time, graft success rate, and pain scores, but total operation time was significantly shorter in the LMA group. As a result, LMA can be considered as a suitable method for endoscopic tympanoplasty.

Keywords: Chronic otitis media; endoscopic tympanoplasty; laryngeal mask airway

INTRODUCTION

Tympanic membrane perforation may be occurred as a sequel of middle ear infection or as a result of head trauma. The perforation may lead to hearing loss as well as low quality of life. If regeneration of the tympanic membrane is inadequate, surgery will be necessary to repair the membrane. Tympanoplasty is the main surgical procedure to create a healthy and functional membrane. Myringoplasty / tympanoplasty is the standard surgical procedure performed to make the perforated eardrum intact (1).

In general anesthesia, laryngeal mask airway (LMA) has been used since 1980s (2). This method can be

performed without laryngoscope and neuromuscular blockers. Endotracheal tube (ET) insertion may lead to cardiovascular reactions, coughing and laryngotracheal spasm during anesthesia. Many authors stated that LMA not leads to these complications as well as ET (2-4). In Contrast, LMA can be inadequate to prevent aspiration because of limited obstruction of upper airway. And also, use of LMA limits the patient to position during surgery.

We prefer LMA in ear surgeries in recent times to prevent postoperative cough which may affect surgical outcomes and to earn time by passing neuromuscular blockage. In this retrospective study, we aimed to investigate whether LMA was a suitable airway type for endoscopic tympanoplasty by comparing the ET airway type.

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MATERIALS and METHODS

The ethical consent of this study was approved by the local ethical committee (Aydın Adnan Menderes University, Faculty of Medicine, Non-interventional Clinical Research Ethics Committee- 2019/160). The patients who were performed endoscopic tympanoplasty between August 2016 and September 2019 were included to this retrospective study. The only indication of all cases was the chronic otitis media and all ears were dry at least 3 months before the surgery. Preoperatively radiologic imaging with computer tomography of temporal bone was performed to detect any ossicular chain problem or presence of cholesteatoma. The cases with cholesteatoma, ossicular chain problem and revision surgery were not included to this study. The perforation types were recorded as anterior, posterior, central and subtotal. Pure-tone audiometric analysis was performed according to American Academy of Otolaryngology- Head and Neck Surgery guideline. Preoperative and postoperative hearing thresholds, air-bone gaps were documented, and hearing gain was calculated for each patient. Postoperative air-bone search of 20 dB and below was considered as audiological successful. The preoperative perforation types and audiological evaluations and the postoperative 10th day, 1st month and 3rd month evaluations were made by the same physician. The surgery time was considered as the duration time between surgeon started and finished surgery and the operation time was considered as the duration time between anesthesiologist started and finished.

All surgeries were performed under general anesthesia with ET or LMA. All surgeries were performed by the same surgeon. The airway method was randomly determined by the anesthetist. Patients were prepared in suitable position and ears were sterilized before surgery. Infiltration with 2% lidocaine and 1:100,000 adrenaline was applied to tragus. Rigid telescope (0- degree, 18-cm-long, 4.00 mm) (Karl-Storz, Tuttlingen, Germany) was used in all operations. The sclerotic perforation margins were removed by using a pick. The intact tympanic membranes were separated from manubrium mallei for over-under tympanoplasty technique. Tragal cartilage and perichondrium were prepared separately, and also, thickness and diameter of tragal cartilage was harvested according to perforation size. Harvested tragal cartilages were engrafted over the manubrium and under the tympanic membrane. Perichondrium pieces were used in some cases if the cartilage and tympanic membrane connection was not tight. Gel foam (Pfizer, New York, USA) was put in the middle ear and outer ear canal to stabilize the graft with tympanic membrane. The operation and surgery times were recorded for each patient. And also, the complications related to airway types were noted.

It was recommended to all patients to use oral antibiotics (amoxicillin 1gr) for one week after the surgery. The gel foam in outer ear canal was extracted at postoperative 10th day. The postoperative follow-ups were performed at 10th day, 1st month and 3rd month and at the 3rd month

postoperative audiological evaluation were performed for all cases. The audiological results of the patients who had reoperation at 3rd month did not included to statistical evaluation. The Visual Analog Scale (VAS) was used to evaluate the postoperative 24th-hour pain levels of the patients. The patients were informed about the pain evaluation survey. The patients rated their postoperative pain level from 1 (the least pain) to 10 (the most pain) using a VAS.

Statistical Analysis

Statistical analysis of the results was evaluated with Statistical Package for Social Sciences 16.0 (SPSS, IBM Company, Chicago, USA). Paired t test and independent-samples t test was used to compare the differences between each group. The differences were accepted statistically significant at $P < 0.05$.

RESULTS

One hundred five patients were performed endoscopic tympanoplasty in 38 months. Some of these patients could not include to study because of inadequate patient data and we evaluated the results of 93 patients.

The information of patients who performed endoscopic tympanoplasty is demonstrated in Table 1. The age and gender percentages were similar in each group ($p > 0.05$). In this table, we observed that endotracheal intubation were preferred for subtotal perforations mostly.

Table 1. Preoperative information of endoscopic tympanoplasty patients (N:93)

	Endotracheal Tube (N:57)	Laryngeal Mask (N:36)
Age	27.3±11.3	26.3±10.1
Sex		
Female	25 (43.9%)	16 (44.4%)
Male	32 (56.1%)	20 (55.6%)
Perforation		
Anterior	15 (26.3%)	8 (22.2%)
Central	20 (35.1%)	15 (41.7%)
Posterior	14 (24.6%)	10 (27.8%)
Subtotal	8 (14.0%)	3 (8.3%)

Surgery times were found longer in ET group according to LMA group, but it was not statistically significant ($p > 0.05$) (Table 2). Use of LMA for general anesthesia significantly shortened the total operation time when compared to use of ET ($p < 0.05$). Graft success rates were found higher in LMA group than those in ET group. The rates were 94.4% and 91.2% in the groups but the difference was not statistically significant ($p > 0.05$). Postoperative pain scales and hearing gains were found similar in each group ($p > 0.05$). Three patients in ET group and 1 patient in LMA had more than 20 dB ABG. One patient had worse conductive type hearing after surgery in LMA group.

There was no patient with decreasing of bone conducted thresholds after surgery. No complication was observed in LMA applied patients, but laryngospasm was observed in two cases of ET group.

Table 2. The evaluation of two airway methods for endoscopic tympanoplasty

	Endotracheal Tube (N:57)	Laryngeal Mask (N:36)	P value
Surgery Time (min.)	34.7±4.3	33.6±3.1	0.118
Operation Time (min)	56.6±5.5	51.7±4.1	0.000
Graft Success Rates (%)	52 (91.2%)	34 (94.4%)	0.421
Visual Analog Scale	4.36	4.29	0.774
Hearing Thresholds (dB)			
Preoperative	32.2±6.4	32.9±5.9	0.518
Postoperative	20.2±6.9	19.5±6.6	0.484
Air-Bone Gap (dB)			
Preoperative	21.8±5.7	19.9±3.9	0.116
Postoperative	9.8±6.3	7.2±5.0	0.089
Gain	12.0±5.2	12.7±4.3	0.314

DISCUSSION

Surgery is the main treatment method to repair tympanic membrane and to restore effective hearing in chronic otitis media. The goal of surgery is to create an intact tympanic membrane as well as functional middle ear without any complication. Traditionally, microscopic tympanoplasty has been performed to reach these goals. The use of microscope in tympanoplasty may cause difficulties in reaching some hidden areas in the middle ear and we may need to burr bony outer canal of ear. Endoscopic tympanoplasty have been getting more popular for providing broad view angle and also this approach was accepted more conservative when compare to classical microscopic tympanoplasty (5).

For minor otologic preventions, local anesthesia and/or sedation anesthesia could be preferred but we use general anesthesia for the more complicated surgical procedures like tympanoplasty (6). The airway for general anesthesia is provided by ET or LMA. LMA is a safe and effective ventilation method to provide airway in general anesthesia (3). This method is appropriate for shorter operations. Beside this, cardiovascular stress is an important problem during anesthesia because of tracheal irritation related to intubation and extubation. Use of LMA can reduce this cardiovascular stress risk (7). Also, this method has some advantages like requiring no muscular blocker that is important and significant advantage in facial nerve monitoring. It was observed that LMA caused less cough which affects grafting success and prosthesis dislocation negatively (4). A study that was investigated the effect of ET and LMA on the middle ear pressure revealed that ET led to increase of middle ear pressure when compared to LMA method (8). Increased middle ear pressure may lead to liquid deposition in the middle ear and even to hemotympanium, beside this it also may lead to nausea and vomiting (9). All of these situations may affect the graft stability after the tympanoplasty.

Pain scores were found similar in ET and LMA groups for endoscopic tympanoplasty as an expected result

because the same anesthetic agents were used in these two groups. Ayala et al. shared their LMA experience in ear surgery and mentioned some advantages for LMA like easy insertion and extraction, avoidance of muscle relaxation and shorter surgery times (2). Also, no usage of neuromuscular agents for LMA, provides advantage in the cases which required facial monitoring (2,10). Laryngeal stimulation and cardiovascular reflexes are activated during endotracheal intubation and extubation and these complications are not commonly seen in use of LMA for head and neck surgery (10). Tracheal hematoma, laryngeal edema, laryngeal hematoma, and cord vocal paralysis related to the ET have been reported (11). That report also mentioned that decreased sore throat and laryngopharyngeal problems was observed in LMA group compared to the ET group (11). Laryngeal dysphonia following ET was observed %14.4 of the patients (12). On the other hand, some complications such as chondronecrosis and parapharyngeal abscess were described in use of LMA (13,14). Arytenoid dislocation, vocal cord paralysis and mucosal injury was mentioned after use of LMA by different author (15).

LMA provided significant advantage in total operation time, on the other hand, surgical outcomes were similar with the ET group. Endoscopic tympanoplasty is a delicate procedure. Minimal changes in middle ear pressure, inadequate or overloaded gel foam under graft, shift of graft may lead to surgical failure. Postoperative cough can be a big problem for the stabilization of the graft in the early postoperative period. For this reason, LMA would be more conservative anesthetic method to prevent cough attacks, laryngospasm, and increase of middle ear pressure that may affect graft stabilization in endoscopic tympanoplasty.

LIMITATIONS

We had some limitations in this study. Firstly, follow-up times were not long enough because the socioeconomic and demographic characteristics of the hospital hinterland. Secondly, this study included retrospective data and prospective analysis could be more useful for more accurate information.

CONCLUSION

This paper is the first which describes use of LMA in endoscopic tympanoplasty. In this paper, we showed that endoscopic tympanoplasty with LMA provided significant shorter operation times and similar surgical outcomes.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: The ethical consent of this study was approved by the local ethical committee (Aydn Adnan Menderes University, Faculty of Medicine, Non-interventional Clinical Research Ethics Committee-2019/160).

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