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Original Article

The Efficacy of Endoscopic Ventilation Tube Insertion in Pediatric Populations

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BACKGROUND/AIMS
The aim of the present study was to evaluate the effectiveness of endoscopic ventilation tube insertion procedure among pediatric populations.

MATERIAL and METHODS
This was an intervention study with a ventilation tube inserted in patients between May 2016 and August 2018. All patients aged <18 years were included except those with syndromic diseases and chronic suppurative otitis media. Ventilation tube insertion was performed with endoscopic and microscopic techniques.

RESULTS
A total of 790 ventilation tube insertions were performed in 395 patients. Of the 395 patients, 200 were treated with microscopic interventions, and 195 had endoscopic surgery. The mean operation times were 5.31±2.11 min for endoscopic intervention and 9.05±3.53 min for microscopic intervention. The complication rate was 12 (6.15%) out of 195 patients at the endoscopic group (8 of them had a perforation of the tympanic membrane and 4 of them displayed granulation tissue). In the microscopic groups, 15 (7.5%) complications were seen from 200 patients (all 15 patients had tympanic membrane perforation).

CONCLUSION
The endoscopic ear ventilation tube insertion procedure reduces operation times. In addition, the complication rate of this technique appears to not significantly differ from the microscopic technique.

Keywords: Endoscopic, microscopic, ventilation tube insertion

INTRODUCTION

The existence of serous or mucous fluid in the middle ear cavity that persists >3 months is defined as chronic serous otitis media (CSOM) (1). A minimum 3-month follow-up period is recommended to prevent unnecessary surgical processes (2). The insertion of the ventilation tube is one of the most frequent ongoing surgical applications at otorhinolaryngology clinics to diagnose CSOM (3).

Two distinct techniques were identified for this surgical intervention. The microscopic technique was first described by Armstrong in the early 1950's (4). Then, in the early 2000's, endoscopic technique studies started to appear (5, 6). The aim of the present study was to show the difference in operation time and complication rates of these two different techniques when compared against each other.

MATERIAL and METHODS

A total of 395 patients who underwent ventilation tube insertion at the University of Gaziantep Otorhinolaryngology Department between May 2016 and August 2018 were included in the study. Only patients who were aged <18 years with a diagnosis of CSOM were included. All the patients underwent a complete ear, nose, and throat examination and tympanogram tests in at least three separate occasions in the 3-month follow-up period. Only patients who displayed type B tympanogram and any signs of serous fluid during their ear examination during the 3-month follow-up period were diagnosed with CSOM, and the indication of an operation was accepted. Patients with chronic suppurative otitis media

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or any syndromic diseases (Down syndrome and Treacher Collins syndrome) that could cause hearing loss and craniofacial anomaly that result in the deformity of the external ear canal or non-recurrent acute otitis media were excluded from the study.

Operational Procedure

Of the 395 patients, 200 were treated with microscopic interventions, and 195 had endoscopic surgery. All operations were performed under general anesthesia. All patients' heads were positioned with an anesthesiologist on both sides with attention toward the endotracheal tube. The sterilization of the surgical side was completed with an antiseptic solution that clears the auricula and surgical drapes. The patients were separated into two groups according to the types of surgical intervention. The operation time was calculated, in both groups, from the start of the myringotomy to the completion of the ventilation tube insertion.

Endoscopic group: A 3 mm, 0°, 18 cm rigid endoscope (Storze, Berlin, Germany) was connected to a camera and display screen. Then, it was introduced into the external ear canal, avoiding any skin in the ear canal. An anti-fog solution (liquid soap) was used to maintain clear vision. An anteroinferior or anterosuperior portion of the tympanic membrane was incised by a myringotomy knife. Thereafter, an adequate size suction probe was introduced toward the incision, and the glue material in the middle ear was suctioned. Finally, a ventilation tube was inserted on the tympanic membrane with an aid of needle or alligator forceps. The same procedure was applied to the side of the other tympanic membrane (Figure 1).

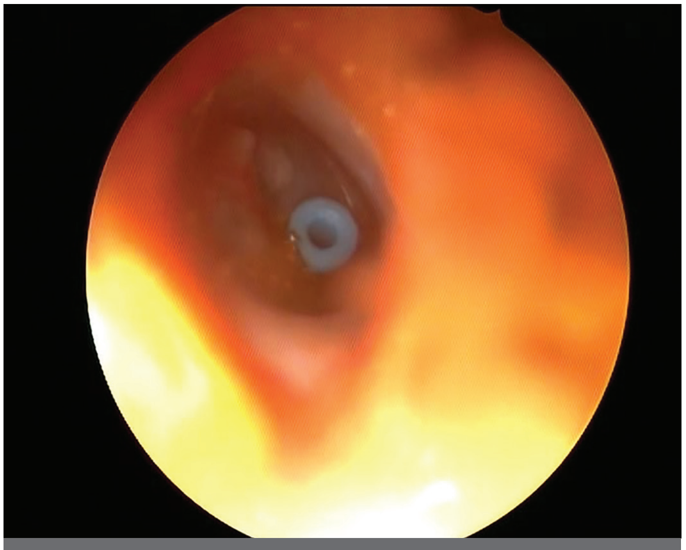

FIGURE 1. Endoscopic image of ventilation tube

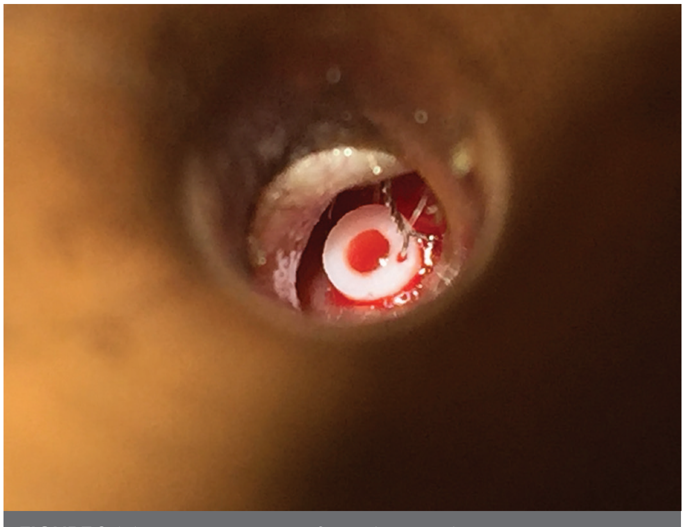

FIGURE 2. Microscopic image of ventilation tube

Microscopic group: A traditional microscope (Leica M525; Zurich, Switzerland) was used to visualize the tympanic membrane with the aid of an ear speculum. A meticulous approach was needed to ensure that the external ear skin was not touched otherwise this could result in a hemorrhage that obscures vision. Additionally, the head must be tilted with the aid of anesthesia for the adequate surgical vision of the anteroinferior or anterosuperior portion of the tympanic membrane. After these preparations, the surgical steps of microscopic ventilation tube insertion were applied in both tympanic membranes with the same methods that were described in the endoscopic group (Figure 2).

All patients in both groups were evaluated a week after the surgery and then monthly until tube extrusion. The study was approved by the ethics committee of the University of Gaziantep. Informed consents were obtained from all participants in the study. The SPSS 21 (IBM, USA) software program was used for statistical analysis. Student's t-test was used to identify the statistical difference between surgical procedure times. An odd ratio was obtained to determine if there is any increased risk for complications between endoscopic and microscopic surgical techniques.

RESULTS

A total of 395 patients had ventilation tube insertions applied in both ears (790 ears) with 195 patients undergoing the endoscopic method (390 ears) and 200 undergoing the microscopic method (400 ears). Of the 395 patients, 165 (41.8%) were female, and 230 (58.2%) were male. The total mean age of the patients was 5.85±3.51 (min 1–max 17) years.

The patients were divided into two groups according to the type of surgical intervention. The average times of the surgery were 5.31±2.11 (min 3–max 12) min in the endoscopic group and 9.05±3.53 (min 5–max 20) min in the microscopic group. There was a statistically significant difference between these two methods of ventilation tube insertion ($p<0.001$) as shown in Table 1.

The complication rate was 12 (6.15%) out of 195 patients (8 of them had perforation of the tympanic membrane and 4 of them displayed granulation tissue) in the endoscopic method. There were 15 (7.5%) complications from a total of 200 patients. All 15 patients had tympanic membrane perforation in the microscopic method. The odds ratio was found to be 0.809 between these two different techniques, and overall it was 1.015. There was no additional significant risk between techniques that will lead to a complication.

These 395 patients were then divided into different groups as categorized by age: <5 years and >5 years. Descriptive findings in both groups are displayed in Table 2.

TABLE 1. Values of ventilation tube insertion according to different procedures

Operation time	Endoscopic technique	Microscopic technique	p
Min-Max	3.0-12.0	5.0-20.0	0.001
Mean± Std. Deviation	5.31 ±2.11	9.05±3.53	
Median	5.0	8.0	

TABLE 2. Comparison of endoscopic and microscopic techniques of ventilation tube insertion according to operation times at different age groups

	Operation time (<5 years)	Operation time (>5 years)	p
Endoscopic technique	5.99±2.23	4.27±1.37	0.002
Microscopic technique	9.64±3.99	8.36±2.76	0.001
Total (both techniques)	7.73±3.67	6.5±3.02	0.001

The complication rates were 9.5% for the aged <5 years group and 4% for the aged >5 years group. To determine the age as a risk of complication, the odds ratio was found to be 0.48.

DISCUSSION

The visualization ability of endoscopes in otologic surgery provides better access for the middle ear and even further location pathologies (7). There are several reports about the insertion of the ventilation tube with the endoscopic technique (8-11). The present study compared the operation time and complication rates of these two different techniques among different pediatric groups with a larger number of participants.

Many of the previous reports concluded that the operation time of the endoscopic technique was shorter than that of the microscopic method (9, 11, 12). Many variables may impact the duration of these procedures. Age is one of these factors that affect the course of the surgery (12). The human auricula is approximately 80% of its adult size at aged approximately 4–5 years, and it reaches full adult size at aged approximately 9 years (13). The bone formation of the external ear canal is nearly complete at aged approximately 3 years (13). This growth pattern of the human auricula and external ear canal might explain the difference of operation times that differs before and after the age of 5 years.

Lee et al. (14) suggested that referring patients who are over the age of 6 years to an endoscopic approach could result in effective surgical outcomes including the reduction of complication rates. According to the current study's complication results between different ages and with respect to the odd ratio, it appears that age may not have a strong relationship with complication rates, which was also consistent with the study by Nassif et al. (10).

Different diameters of endoscopes are also available that include 2.7–3 and 4 mm. In the present study, a 3 mm endoscope was used that could obtain a clear vision that was also emphasized in an earlier study (15). In addition, the usage of a 2.7 mm endoscope was suggested by some authors for better vision (5, 8, 10). According to this research, the use of a 3 mm diameter endoscope did not lead to the conversion of any endoscopic procedure to a microscopic approach.

One of the major obstacles to performing a standard endoscopic technique is bleeding (9, 16, 17). To prevent bleeding, which results in a blurred vision of operation field, meticulous attention must be performed to ensure that the external ear canal is not touched. A careless endoscope maneuver can lead to the tearing of the external ear canal that results in hemorrhaging. Placing a piece of sponge soaked with epinephrine 1/1000 or pontocaine 2% (or any vasoconstricting agent) to the external ear canal and waiting for 2 min are enough to allow adequate homeostasis (10).

When looking into another perspective of these two techniques, endoscopic ear surgery was found to be superior to microscopic ear surgery when considering time and cost (18, 19, 20). According to Patel et al. (18), the endoscopic application was found to be AUS$ 2978.79 cheaper and 56 min quicker than the microscopic method. Tseng et al. (19) also reached similar cost-effective findings regarding endoscopic ear surgery at a different center. It is the opinion of the researchers that health caregivers must keep in mind their ability to utilize their resources efficiently and fairly (21).

One of the limitations of the present study is that surgery was not performed for patients who had external ear deformity caused by a syndromic disease. Another limitation of the present study was the inability to use different diameters of endoscopes to evaluate different variables for surgical intervention.

In conclusion, the endoscopic ear ventilation tube insertion procedure reduces operation times. In addition, the complication rate of this technique appears to not significantly differ from the microscopic technique.

Ethics Committee Approval: Ethics committee approval was received for this study from University of Gaziantep Ethical Committee (Approval Date: 10.10.2018, Approval Number: 2018/233).

Informed Consent: Informed consent was obtained from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The author have no conflicts of interest to declare.

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