



HEARING THRESHOLD BEFORE AND AFTER TYMPANOPLASTY AT HASAN SADIKIN GENERAL HOSPITAL IN 2018-2020

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ABSTRACT

Background: Tympanoplasty is a middle ear reconstructive surgical procedure as one of the management in tympanic membrane perforations. Over time, more hearing improvements are seen with tympanoplasty, with the highest threshold improvement ranging from 1-5 dB. **Objective:** To determine the hearing threshold before and after tympanoplasty in patients at RSUP Dr. Hasan Sadikin. **Method:** The study was conducted in a retrospective-descriptive method using secondary data from patient medical records in RSUP Dr. Hasan Sadikin Bandung. **Result:** There were 50 research subjects who underwent tympanoplasty and were examined for hearing threshold using audiometry before surgery and 12 weeks post-operatively. Results were more male than female and most of the subjects came from the adult age group. In 58% of subjects, there was an increase in post-tympanoplasty hearing threshold of 1-5 dB. Type I tympanoplasty provided the most hearing threshold improvement (52%). **Discussion:** From the results of the study, it was found that subjects who underwent type 1 tympanoplasty were the most subjects who experienced an improvement in the hearing threshold of 1-5 dB in the adult age group (26-45 years). **Conclusion:** Based on the result of the study, there was an increase of hearing threshold after tympanoplasty.

Keywords : Tympanoplasty, hearing threshold

Introduction

An effective method for addressing tympanic membrane perforation, a condition involving a hole in the eardrum, is through the utilization of a surgical technique called tympanoplasty. Tympanoplasty serves as a reconstructive surgical procedure that specifically targets the middle ear, aiming to restore and enhance the mechanism responsible for sound conduction. By repairing the damaged or ruptured tympanic membrane, this procedure helps to rectify any impairment in hearing caused by the perforation, thereby improving auditory function and overall quality of life for individuals affected by this condition.¹

Zollner and Wullstein (1952) divided tympanoplasty procedures into 5 types. Type I or myringoplasty, which only reconstructs the perforated tympanic membrane. Type II is a procedure for perforating the tympanic membrane with erosion of the malleus, and involving grafting of the incus or remnant of the malleus. Type III is indicated when two ossicles have been destroyed, but the stapes is intact and mobile and the graft is placed into the stapes. Type IV tympanoplasty is performed in the presence of a destroyed ossicle (including all or part of the stapes arch), and this procedure will involve placing a graft in or around the stapes foot that is still mobile. Type V tympanoplasty is performed when the stapes foot is fixed.¹

Since the introduction of tympanoplasty, there have been many graft materials and methods of placement to close tympanic membrane perforations. Among them are medial tympanoplasty (underlay), lateral tympanoplasty (overlay), sandwich film tympanoplasty, crown cork tympanoplasty, swinging door tympanoplasty, laser assisted spot welding technique, fascia pegging, and microclip technique. Among all the techniques, the most popular for closing tympanic membrane perforations are the medial and lateral techniques.¹

Over time, tympanoplasty has undergone advancements and improvements aimed at enhancing hearing capabilities and effectively treating various ear diseases. The success of tympanoplasty relies not only on the fundamental principles of the surgical procedure. Consequently, the choice of the appropriate type of tympanoplasty is carefully planned, taking into consideration the current state of the middle ear and the integrity of the hearing chain. By assessing the condition of the middle ear and evaluating the extent of damage to the auditory system, medical professionals can tailor the tympanoplasty approach to suit the individual patient's needs, thereby maximizing the chances of a successful outcome. These considerations highlight the evolving nature of tympanoplasty and the importance of a personalized approach in addressing ear-related conditions, ultimately leading to improved auditory function and overall well-being.²

The degree of deafness depends on the size and position of the tympanic membrane defect, the integrity of the auditory chain, and the development of the inner ear. Mucous edema and granulation affect the conductive mechanism. Low hearing gain can be caused by exposure and expansion when the operation is too narrow.²

Reconstructive procedures to improve hearing can be carried out with many innovations accompanied by special reference graft materials. Age at the time of surgery cannot be used as a basis for estimating the

success of the operation.³

According to several studies, it has been suggested that there is an improvement in the post-tympanoplasty hearing threshold, even if it is only a modest increase of 5 dB. Extensive data gathered from various research endeavors indicate that the range of the highest observed improvement in hearing threshold typically falls within the 0-5 dB range. However, it is important to note that as of now, no definitive value has been established as a benchmark to determine whether there has been a significant improvement in the post-tympanoplasty hearing threshold for patients with chronic suppurative otitis media, whether it be an increase of 5 dB, 10 dB, 15 dB, or even more.

The changes observed in the hearing threshold after tympanoplasty are influenced by a multitude of factors. Among these factors, the efficacy of the surgical techniques employed plays a crucial role. The skill and proficiency of the surgical team involved in performing the procedure significantly impact the overall outcome. Additionally, the pre and postoperative pathological conditions that manifest in the middle ear contribute to the changes in hearing threshold. Factors such as the extent of damage to the middle ear structures, the presence of any additional complications, and the patient's individual healing process all come into play when evaluating the success of tympanoplasty in improving auditory function.⁴

Therefore, the general objective of this study was to determine the hearing threshold before and after tympanoplasty in patients at Dr. Hasan Sadikin General Hospital in the period January 2018 - December 2020. The results of this study are expected to be a reference for further research and can be used as a guide in everyday clinical practice knowledge at Dr. RSUP. Hasan Sadikin, Bandung.

Methods

A retrospective descriptive study has been conducted. The data sources are in the form of patient medical records and Audiogram Examination Recap Aid Books at the THTKL Audiology Poly for the period January 2018 - December 31, 2020.

Sampling of this research was done by total sampling technique. The inclusion criteria of this study were samples that were examined for pure tone audiometry before and after tympanoplasty. Exclusion criteria for subjects in this study were patients with sensorineural hearing loss, middle ear tumors, congenital cholesteatoma, palatoschisis or other craniofacial malformations.

Descriptive statistical measures are adjusted to the research objectives. All statistical calculations were carried out using Microsoft Excel 2021 software.

Results

During the period January 2018– December 2020, 419 subjects underwent tympanoplasty, but only 50 subjects met the criteria for research subjects. Characteristics of research subjects based on age and genders shown in Table 1

Table 1. Distribution of Samples by Age and Gender

Demographic Characteristics	Total (N)	Percentage (%)
Ages (years old)		
0-5 (Toddler)	0	0
6-11 (Children)	1	2
12-25 (Teenager)	14	28
26-45 (Adult)	21	42
46-65 (Elderly)	14	28
> 65 (Seniors)	0	0
Sex		
Male	29	58
Female	21	42

Of the 50 subjects, there were more male patients than female and the largest age group of subjects was in the adult age group (26-45 years). With the youngest subject aged 6 years, and the oldest subject 62 years old.

The patient's hearing was examined using audiometry after tympanoplasty to assess the increase in the hearing threshold, the results

can be seen in table 2. Most of the post-tympanoplasty hearing thresholds in this study experienced an increase in the range of 1-5 dB, which means hearing became better post-tympanoplasty at 29 sample (58%).

Table 2. Hearing Threshold Improvement After Tympanoplasty

Sound Intensity Improvement	Total (N)	Percentage (%)
0 dB	21	42
1-5 dB	29	58
> 5 dB	0	0

In Table 2, the improvement in the hearing threshold that occurred in subjects was 1-5 dB with a total of 29 subjects (58%).

Table 3. Hearing Threshold Improvement Based on Tympanoplasty Type

Tympanoplasty	Hearing Threshold Improvement (dB)	Total (N)	Percentage %
Type I	0	1	3,85
	1-5	25	96,15
	> 5	0	0
Type II	0	2	40
	1-5	3	60
	> 5	0	0
Type III	0	5	83,33
	1-5	1	16,67
	> 5	0	0
Type IV	0	6	100
	1-5	0	0
	> 5	0	0
Type V	0	7	100
	1-5	0	0
	> 5	0	0

In Table 3, it can be seen that the most subjects were those who underwent Tympanoplasty type I with a total of 26 subjects (52%). And of the total subjects who underwent Tympanoplasty type I the most there was an improvement in the hearing

threshold of 1-5 dB with a total of 25 subjects(96.15%). On the other hand, patients who had type IV and type V tympanoplasty did not find that there was a change in hearing threshold after tympanoplasty.

Table 4. Demographic Characteristics of Tympanoplasty Type I

Ages	Hearing Threshold Improvement (dB)	Total (N)	Percentage %
0-5 years old (Toddler)	0	0	0
	1-5	0	0
	> 5	0	0
6-11 years old (Children)	0	0	0
	1-5	1	4
	> 5	0	0
12-25 years old (Teenager)	0	0	0
	1-5	9	36
	> 5	0	0
26-45 years old (Adult)	0	1	100
	1-5	10	40
	> 5	0	0
46-65 years old (Elderly)	0	0	0
	1-5	5	20
	> 5	0	0
> 65 years old (Seniors)	0	0	0
	1-5	0	0
	> 5	0	0

In Table 4, it can be seen that the age group of subjects who experienced the most improvement in hearing threshold after type I tympanoplasty was in the adult age group (26-45 years) with 10 subjects experiencing improvement in hearing threshold of 1-5 dB.

Discussions

From the results of the study, it was found that subjects who underwent type I tympanoplasty were the most subjects who experienced an improvement in the hearing threshold of 1-5 dB in the adult age group (26-45 years). This incident is probably related to educational factors in the adult age group who have been able to understand the procedures carried out, care after the procedures carried out so that there is an improvement in the hearing threshold. In the adult age group the need for communication between each other is very important both in socializing and in work needs so that in this age group the desire to improve ear health conditions is very high.⁶ Based on this study, there was a change in

the patient's hearing threshold of 1-5 dB after tympanoplasty of 58%. Changes in the threshold value of hearing is very significant even if only a few decibels. A successful tympanoplasty will increase the patient's hearing threshold.⁷

In the study, it was seen that as the number of subjects increased with the type of tympanoplasty performed (Types 2,3,4,5), the smaller the number of subjects who experienced improvement in hearing threshold. This is due to cases requiring an increased type of tympanoplasty, accompanied by extensive damage to the middle ear organ.

Reconstructive procedures to improve hearing can be carried out with many innovations accompanied by excellent reference graft materials.⁸ Age at the time of surgery cannot be used as a basis for predicting surgical success.⁹

Tympanoplasty, a surgical procedure aimed at repairing the tympanic membrane, has shown promising results in terms of both anatomical and functional success rates. In a study conducted by Huang et al, an impressive 95% success rate was reported for the repair of the tympanic membrane, indicating the effectiveness of the procedure in achieving desired outcomes.

Another study by Shetty demonstrated that 92% of cases undergoing myringoplasty, a type of tympanoplasty, exhibited normal hearing post-surgery. Additionally, the rate of graft resorption and complete closure and healing of the tympanic membrane was reported to be 88%. These findings further support the positive outcomes associated with tympanoplasty procedures.

However, it is important to note that not all cases yield favorable results. Tegnoor et al reported a 12% rate of tympanoplasty failures, suggesting that there can be instances where the procedure does not yield the desired outcomes.

Analyzing the data obtained from the study, it was observed that subjects who underwent Tympanoplasty Type I showed the most improvement in hearing threshold. This observation aligns with previous studies, which have reported success rates ranging from 80% to 95% for myringoplasty procedures. For instance, Kumar et al reported a 57% to 97% improvement in hearing function following tympanoplasty, while Nirwan et al documented a hearing gain of 10-30 dB in 95% of their cases. Similarly, Latoo et al reported a 10-20 dB increase in hearing for 86.67% of patients after surgery. These findings indicate the positive impact of tympanoplasty on improving hearing abilities.

Considering the research conducted thus far, it is recommended that further epidemiological studies be conducted on a larger scale to obtain more representative results. Such studies can provide valuable insights and serve as a basis for comprehensive audiometric examinations in patients undergoing or considering tympanoplasty interventions. This will enable researchers to delve deeper into understanding the changes in hearing thresholds among individuals with hearing impairments who undergo tympanoplasty.

In conclusion, the findings of various studies indicate an overall increase in hearing thresholds following tympanoplasty procedures. However, it is crucial to continue conducting research in order to gain a more comprehensive understanding of the outcomes and factors influencing post-tympanoplasty hearing improvements

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