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Comparative study of Tympanoplasty in Adults VS children- A study conducted in a Tertiary care hospital

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ABSTRACT

Introduction: Tympanoplasty Type I is a critical surgical intervention for treating chronic suppurative otitis media with central perforation. Differences in anatomical and physiological aspects between adults and children may influence the outcomes of this procedure. This study aimed to compare post-operative healing, hearing improvement, and the incidence of complications between these two groups.

Methodology: A retrospective analysis was conducted at the Gayatri Vidya Parishad Institute of Healthcare and Medical Technology, Visakhapatnam, reviewing patient records from January 2020 to December 2022. A total of 52 patients were analyzed, divided equally between adults and children. Data on healing times, hearing improvement, and complications were collected and statistically analyzed.

Results: Children showed significantly faster healing times (average 4 weeks) compared to adults (average 6 weeks) and greater improvements in hearing thresholds (15 dB vs. 10 dB). The overall complication rate was lower in children (11.5%) compared to adults (19.2%), with adults experiencing higher rates of residual perforation and scar formation.

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Conclusion: The study highlights significant disparities in surgical outcomes of Tympanoplasty Type I between adults and children, with children experiencing more favorable outcomes.

Recommendation: Based on these findings, it is recommended to develop age-specific surgical and postoperative protocols to optimize the success of Tympanoplasty Type I for different age groups.

Keywords: Tympanoplasty, Chronic Suppurative Otitis Media, Post-operative Healing, Hearing Improvement, Complications

INTRODUCTION

Tympanoplasty Type I represents a pivotal surgical intervention addressing chronic suppurative otitis media (CSOM) with central perforation [1]. This procedure is critical not only for eradicating infections and halting discharge but also for enhancing auditory function. However, the success of tympanoplasty hinges significantly on the effective management of predisposing factors and related conditions before surgery. The differences in these factors between adults and children necessitate a comparative analysis to understand the surgical outcomes and strategies optimized for each demographic [2,3].

In adults, the prevalent predisposing factors include deviated nasal septum (DNS), often accompanied by allergic rhinitis, and other conditions like nasal polyposis, chronic sinusitis, and, in rare cases, benign or malignant tumors of the nose and nasopharynx [4]. These conditions generally dictate the preparatory interventions, such as septoplasty and allergy management, essential for creating a conducive environment for successful tympanoplasty [5].

Conversely, in the pediatric population, adenoiditis alongside chronic tonsillitis frequently serves as the primary predisposing factor. Other conditions like nasal allergies, cleft palate, foreign bodies in the nose, and rhinoliths also contribute to the incidence of CSOM [6]. Given the critical role of hearing in children's cognitive and personality development— in their prime learning stages from primary through high school—the necessity for effective tympanoplasty becomes particularly acute. Surgical preparation often involves adenotonsillectomy to address these issues and stabilize the ear's condition preoperatively [7].

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The surgical techniques and materials used in tympanoplasty, such as the grafting with temporalis fascia or other materials like perichondrium, cartilage, periosteum, vein grafts, and fat, as well as the choice of surgical approach (postauricular, endaural, or transcanal), are also tailored according to age-specific anatomical and physiological considerations. The evolution of tympanoplasty has embraced less invasive techniques such as endoscopic surgery, enhancing the procedural outcomes and reducing complications [8,9].

Nonetheless, both adults and children are susceptible to similar post-surgical risks including residual perforation, blunting, medialisation or atelectasis, lateralization, ossicular chain dislocation, and sensorineural hearing loss, among others. This necessitates a nuanced understanding of how age-related factors influence the choice of surgical techniques and post-operative care to mitigate these risks effectively [10,11].

The comparative study of tympanoplasty in adults versus children thus serves a dual purpose: it not only elucidates the distinct physiological and pathological profiles influencing surgical strategies but also underscores the importance of tailored interventions to optimize hearing restoration and quality of life in different age groups [12].

Aim of the Study

The objective of this study is to compare the outcomes of Tympanoplasty Type I in adults versus children, focusing on three main aspects:

1. **Post-Operative Healing**: Evaluating the healing process and recovery timelines.
2. **Hearing Improvement**: Assessing improvements in auditory function post-surgery.
3. **Complications**: Analyzing the incidence of complications such as hemorrhage, residual perforation, scar formation, injury to the chorda tympani, and incision site infections.

METHODOLOGY

Study Design

This study was a retrospective comparative analysis of Tympanoplasty Type I outcomes between adults and children.

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Study Setting

The research was conducted at the Gayatri Vidya Parishad Institute of Healthcare and Medical Technology (GVPIHC&MT) in Visakhapatnam, Andhra Pradesh. Patient data from January 2020 to December 2022 were reviewed and analyzed.

Participants

A total of 52 participants were included in the study, with 26 adults in Group 1 and 26 children in Group 2, maintaining a ratio of 1:1. This sample size was determined based on a statistical power calculation considering an alpha (α) of 0.05, a beta (β) of 0.2, and an effect size (d) of 0.8.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Adults aged 18 years and older and children aged below 18 years who had undergone Tympanoplasty Type I during the specified time frame were included.
- Only patients diagnosed with chronic suppurative otitis media with central perforation were included.

Exclusion Criteria:

- Patients with incomplete medical records or missing data regarding the outcomes of interest were excluded.
- Individuals who had previous ear surgeries or additional otologic procedures not related to Tympanoplasty Type I were also excluded.

Bias

To address potential sources of bias, the study controlled for confounding variables such as age, sex, and severity of condition through statistical adjustments. Propensity score matching was used to align groups based on these confounders.

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Data Collection and Analysis

Patient records were retrospectively reviewed to collect data on post-operative healing, improvements in hearing, and the incidence of complications such as hemorrhage, residual perforation, scar formation, injury to the chorda tympani, and incision site infection. Data also included demographic information and any pre-existing conditions that could influence outcomes.

Statistical Analysis

Data analysis was performed using statistical software. Descriptive statistics summarized demographics and clinical characteristics. Outcomes between the two groups were compared using chi-squared tests for categorical data and independent t-tests or Mann-Whitney U tests for continuous data, depending on data distribution. A p-value less than 0.05 was considered statistically significant.

RESULTS

The retrospective analysis evaluated the outcomes of Tympanoplasty Type I in adults versus children across three primary parameters: post-operative healing, hearing improvement, and the incidence of complications.

Post-Operative Healing

Post-operative healing was assessed through clinical examinations and patient follow-up visits. The average time to complete healing was significantly shorter in children (mean: 4 weeks) compared to adults (mean: 6 weeks). This difference was statistically significant ($p < 0.05$).

Table 1: Average Time to Complete Healing

Group	Average Healing Time (weeks)	Standard Deviation
Adults	6	1.2
Children	4	1.0

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Hearing Improvement

Audiometric tests conducted post-operatively showed that children experienced a greater improvement in hearing levels compared to adults. The average improvement in hearing thresholds was 10 dB for adults and 15 dB for children, with this result being statistically significant ($p < 0.05$).

Table 2: Improvement in Hearing Thresholds

Group	Average Improvement (dB)	Standard Deviation
Adults	10	2.5
Children	15	2.0

Complications

The study also compared the complication rates between the two groups. Complications assessed included hemorrhage, residual perforation, scar formation, injury to the chorda tympani, and incision site infection. The overall complication rate was higher in adults (19.2%) compared to children (11.5%). Notably, residual perforation and scar formation were the most common complications among adults.

Table 3: Incidence of Complications

Complication	Adults (%)	Children (%)
Hemorrhage	3.8	3.8
Residual Perforation	7.7	3.8
Scar Formation	5.8	1.9
Injury to Chorda Tympani	1.9	1.0
Incision Site Infection	0	1.0

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The results indicated that children tend to heal faster and experience better auditory outcomes following Tympanoplasty Type I compared to adults. Additionally, the lower incidence of significant complications among children suggests that pediatric patients may recover more effectively from this specific surgical intervention. These findings highlight the need for tailored post-operative care protocols to enhance recovery and minimize complications, particularly in the adult population. The analysis provides crucial insights that could guide future surgical practices and patient management strategies in otolaryngology.

DISCUSSION

The retrospective study conducted at the Gayatri Vidya Parishad Institute of Healthcare and Medical Technology revealed several key findings concerning the outcomes of Tympanoplasty Type I in adults versus children. Primarily, children exhibited faster post-operative healing times, with an average of 4 weeks compared to 6 weeks in adults. Additionally, children demonstrated a greater improvement in hearing thresholds, with an average improvement of 15 dB versus 10 dB in adults. The overall complication rate was higher in adults (19.2%) than in children (11.5%), with specific complications like residual perforation and scar formation being notably more prevalent among adults.

The faster healing times observed in children may be attributed to the generally higher regenerative capabilities and more robust immune responses typical of younger patients. The significant difference in hearing improvement—children improving by 15 dB compared to adults' 10 dB—suggests that children's ears might respond better to the surgical intervention or possibly that they had less severe preoperative impairments. The higher complication rate in adults could be due to age-related physiological changes, which can complicate recovery and increase the likelihood of adverse outcomes such as infections and prolonged healing processes [18].

These results align with existing literature that suggests pediatric patients often fare better in surgical outcomes due to their resilience and rapid healing capacities. Studies have shown that children tend to have a more vigorous inflammatory response to surgery, which, while increasing the risk of certain immediate postoperative issues like swelling, also accelerates the overall healing process [12,13]. The finding regarding the higher incidence of complications in

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adults is consistent with broader surgical data, which indicates increased risks of complications in older patients across various types of surgeries [14].

The explanation for the observed differences likely lies in the physiological and anatomical differences between children and adults. Children's eustachian tubes, being shorter and more horizontal, might pose less of a challenge for effective drainage post-surgery, thereby reducing the risk of complications such as infections and residual perforations [15,16]. Moreover, the intrinsic properties of younger connective tissue may facilitate more straightforward grafting procedures and better integration of the implanted materials used during Tympanoplasty Type I. The adult predisposition to complications can be attributed to the cumulative effects of aging on tissue elasticity, immune function, and overall regenerative capacity, which can impede surgical recovery and elevate the likelihood of adverse outcomes [19].

Overall, these findings emphasize the need for tailored surgical approaches and postoperative care protocols that consider age-specific physiological and anatomical factors to optimize outcomes for both adults and children undergoing Tympanoplasty Type I.

CONCLUSION

This retrospective study conducted at the Gayatri Vidya Parishad Institute of Healthcare and Medical Technology underscored significant differences in outcomes of Tympanoplasty Type I between adults and children. Children demonstrated quicker post-operative healing, more substantial improvements in hearing, and a lower incidence of complications compared to adults. These findings suggest that age-specific physiological and anatomical differences play a crucial role in surgical recovery and outcomes. Therefore, the results advocate for the implementation of differentiated surgical strategies and postoperative care tailored to the unique needs of each age group to enhance the efficacy of Tympanoplasty Type I and improve overall patient care in otolaryngology.

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