DOI: 10.7860/JCDR/2023/64048.18641

Original Article

Ear, Nose and Throat Section

Role of Middle Ear Risk Index in the Selection of Middle Ear Surgery and Factors Determining Outcome: A Cross-sectional Study

MANISHA DASH[1], PRASAD T DESHMUKH[2]

ABSTRACT

Introduction: Chronic Otitis Media (COM) is a major cause of preventable hearing loss. Tympanoplasty is a crucial surgical step in managing COM and restoring hearing loss. Various prognostic factors are believed to influence the success of graft take-up. The Middle Ear Risk Index (MERI) is a numerical grading system used to assess the severity of the disease and predict the outcome of tympanoplasty for individual patients.

Aim: To investigate the role of preoperative MERI in the selection of middle ear surgery.

Materials and Methods: This cross-sectional study was conducted on a sample size of 40 patients (40 ears) who were treated at the Department of ENT, Acharya Vinobha Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra, India, from December 2020 to December 2022. Only patients free from co-morbidities and COM-related complications who underwent surgical intervention were included. The patients were evaluated for their MERI score, and the outcome of the surgical intervention was then correlated. Statistical analysis was performed with SPSS version 25.0 at a significance level of $p<0.05$.

Results: The MERI was utilised as a tool for assessing surgical outcomes. A lower MERI score indicated a less invasive choice of middle ear surgical procedure and was associated with a better outcome in terms of graft uptake, which was statistically significant. Patients requiring tympanoplasty alone had mild MERI scores (1-3), while more extensive surgeries such as canal wall up or canal wall down were associated with moderate or severe MERI scores (4-6 or 7-12), and this association was found to be significant ($p=0.001$). Interestingly, out of the total 40 patients, five with Eustachian Tube (ET) dysfunction had severe MERI scores (7-12) and experienced graft rejection. Patients with lower grades of ET dysfunction had higher chances of graft uptake, and this association was statistically significant ($p=0.001$).

Conclusion: This study demonstrated that lower MERI scores were associated with better postoperative outcomes. In a country like India, where the cost of surgery and time away from work are major considerations, it is important to establish a standardised approach to predict the surgical outcome, whether it involves tympanoplasty alone or in combination with other middle ear surgeries like cortical mastoidectomy or canal wall down mastoidectomy, and counsel the patient accordingly. This plays a crucial role in informed decision-making.

Keywords: Chronic otitis media, Tympanomastoidectomy, Tympanoplasty

INTRODUCTION

Manifestation attributed to COM is one of the most common reasons for patients to present to otorhinolaryngologists with ear problems. Conversely, COM represents one of the most common otological problems encountered by otorhinolaryngologists. COM is one of the most important public health concerns, particularly in developing countries [1]. It can be due to poor socio-economic standards, poor nutrition, lack of health education, and unhygienic conditions. It is a major cause of deafness in India. Early identification and proper management of these cases are of vital importance, particularly in alleviating complications associated with this disease. According to the World Health Organisation (WHO), the prevalence of COM in the world is 65-330 million people, with 60% of them experiencing hearing loss. The incidence rate is 9 cases per 100,000 population [2].

Tympanoplasty is a relatively common procedure performed by otologists for various indications, such as creating a safe ear, repairing perforated tympanic membranes, removing or eradicating disease, and improving hearing [3]. The primary goal of tympanoplasty is the restoration of the integrity of the tympanic membrane [4]. In a country like India, where the cost of surgery and time away from work are major considerations, establishing a standard approach to predict the outcome of surgery and counsel the patient accordingly plays a crucial role [5]. The MERI is one of the various methods employed to predict the results of surgery. It considers both preoperative and postoperative middle ear conditions [5].

The MERI score is a prognostic evaluation tool for patients under-going tympanoplasty or middle ear surgeries and is assigned as follows: MERI 0=Normal; MERI 1-3=Mild disease; MERI 4-6=Moderate disease; MERI 7-12=Severe disease. It takes into consideration parameters such as the criteria of Belluci to determine the degree of ottorhoea, Austin/Kartush criteria of ossicular status, perforation, presence or absence of middle ear effusion, granulations, and cholesteatoma [6,7].

However, it is a common experience that, despite meticulous technique, perfect placement, and utmost care to avoid graft displacement and postoperative infections, residual perforation or persistent discharge continues to be a challenge during postoperative follow-up visits worldwide. Achieving consistent good hearing is still difficult, especially in developing countries where financial constraints are a concern, and a second-stage correction surgery is often out of reach for surgeons. This study aims to help surgeons, predominantly practicing in developing countries where financial constraints exist, to better counsel patients regarding outcomes and provide them with some form of assurance. The aim of this study is to establish the MERI as a preoperative prognostic tool in selecting middle ear surgery. The primary objective is to determine the association between the tool and the outcome of the graft, as well as the type of procedure performed. The secondary objective is to assess the graft uptake and ET function affecting the MERI.

MATERIALS AND METHODS

This is a cross-sectional study conducted on a sample size of 40 patients (40 ears) who were treated at the Department of ENT, Acharya Vinobha Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra, India, from December 2020 to December 2022. The study focused on patients with COM, specifically squamous COM (active or inactive), who met the inclusion criteria. The study was time-bound, and all eligible subjects during the study period were included. The study was granted ethical approval by the committee with Ref No {DMIMS(DU)/IEC/2020-21/933}, approved on 22/12/2020.

Inclusion criteria: Patients between 15 and 60 years of age, unilateral or bilateral COM ith or without cholesteatoma and with satisfactory cochlear reserve were included in the study.

Exclusion criteria: Patients with sensorineural deafness, those with associated co-morbidities, such as hypertension and diabetes mellitus or with adenotonsillitis, cleft palate, and nasal polyps, or those presenting with complications of COM and the ones not willing to undergo surgical treatment were excluded from the study.

Relevant medical history was obtained, and a clinical ENT examination was performed. Baseline investigations were carried out, including specific examinations such as Ear Examination Under a Microscope (EUM) (KarlKaps D 35614 AsslarEuropastrasse) to assess perforation and retraction, Dynamic Slow Motion Video Endoscopy (DSVE) to evaluate ET function, and pure tone audiometry using ALPS AD 2000 to determine the type and degree of hearing loss. High-Resolution Computed Tomography (HRCT) of the temporal bone was performed when necessary. Surgical interventions were conducted as appropriate.

All selected patients included in the study underwent comprehensive and diligent examinations and investigations. The evaluation of the patients in this study was as follows:

- Comprehensive clinical examination of the ear, nose, and throat.
- Complete blood count and relevant blood investigations.
- Specific investigations, including ear EUM to assess perforation of the tympanic membrane, cholesteatoma, and retraction pockets.
- Pure tone audiometry and impedance audiometry using ALPS AD 2000 and Tympanica Impedance Audiometer, respectively, to assess and grade hearing impairment.
- HRCT of the temporal bone to identify associated abnormalities and any other incidental findings.

The risk factors considered in the study included Belluci criteria to determine the degree of ottorhoea [7], Austin/Kartush criteria for assessing ossicular status [7], presence of perforation, middle ear granulations/effusion, history of previous surgery, and smoking. The MERI score was assigned as follows: MERI 0=Normal; MERI 1-3=Mild disease; MERI 4-6=Moderate disease; and MERI 7-12=Severe disease [7]. [Table/Fig-1]: Shows the MERI scoring system [7].

The ET dysfunction grading is as follows [6]:

- **Grade 0:** Normal ET with no mucosal oedema or congestion. Medial cartilaginous lamina and lateral wall motions are normal. Tubal lumen opens well during swallowing.
- **Grade 1:** Oedema and congestion of the mucosa limited to the pharyngeal orifice of the ET. Normal lateral wall motion, and the tubal lumen opens with swallowing.
- **Grade 2:** Reduced lateral wall motion due to oedema and congestion involving the lumen (2A) and abnormal tubal muscle contraction (2B). Tubal lumen partially opens with swallowing.
- **Grade 3:** Tubal lumen fails to open with swallowing due to gross oedema (3A) and abnormal tubal muscle contraction (3B).
- **Patulous (P):** Patulous tubes show a noticeable concavity in the superior portion of the lateral wall of the ET lumen, with persistent patency of the lumen extending toward the isthmus. The medial and lateral cartilaginous lamina remain separate even at rest.

Risk factor	Finding	Risk value
Ottorhoea	Dry	0
	Occasionally wet	1
	Persistently wet	2
	Wet with cleft palate	3
Perforation	Absent	0
	Present	1
Cholesteatoma	Absent	0
	Present	2
Ossicular chain	Malleus, incus and stapes present	0
	Defect of incus	1
	Defect of incus and stapes	2
	Defect of incus and malleus	3
	Defect of malleus, incus and stapes	4
	Ossicular head fixation	2
	Stapes fixation	3
Middle ear granulation/effusion	No	0
	Yes	2
Previous surgery	None	0
	Staged	1
	Revision	2
Smoker	No	0
	Yes	2

[Table/Fig-1]: Shows MERI scoring system [7].

STATISTICAL ANALYSIS

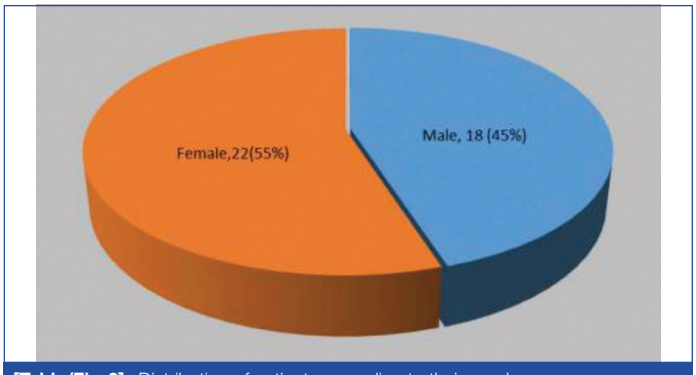
Data were gathered and statistically analysed using the statistical sequencer of the Statistical Package for Social Science (SPSS) version 25.0. The Chi-square ($\chi 2$) test of independence was used to examine and compare the qualitative data. Differences were considered statistically significant if the p-value was less than or equal to 0.05.

RESULTS

The demographic parameters assessed included the age group and gender distribution, which are depicted in [Table/Fig-2] and [Table/Fig-3], respectively.

Age group (years)	No. of patients (n)	Percentage (%)
15-24	16	40
25-34	8	20
35-44	8	20
45-54	5	12.5
55-60	3	7.5
Total	40	100

[Table/Fig-2]: Distribution of patients according to their age in years.



[Table/Fig-3]: Distribution of patients according to their gender.

Forty patients were analysed according to the MERI score (0-12). Mild MERI scores (1-3) were observed in 11 patients (27.5%), while moderate (4-6) and severe (7-12) scores were observed in

10 patients (25%) and 19 patients (47.5%), respectively. The mean score of 6 (moderate) was observed in the present study. The patient distribution according to the MERI score is shown in [Table/Fig-4].

MERI score	No. of patients	Percentage
Normal (0)	0	0
Mild (1-3)	11	27.5
Moderate (4-6)	10	25
Severe (7-12)	19	47.5
Total	40	100
Mean±SD	**6.30±2.97(1-11)**	

[Table/Fig-4]: Distribution of patients according to Middle Ear Risk Index (MERI) Score.

Sixteen patients underwent tympanoplasty: Of these, 11 (68.75%) had a mild MERI score, and 5 (31.25%) had a moderate score. Out of the 20 patients who underwent cortical mastoidectomy, 5 (25%) had a moderate MERI score, while 15 (75%) had a severe score. All four patients who underwent canal wall down mastoidectomy had a severe MERI score. Therefore, the study demonstrates a linear relationship between the severity of the score and the magnitude of the procedure. The chi-square value was 30.85, and the p-value was found to be significant [Table/Fig-5].

Procedure performed	No. of patients	Normal (0)	Mild (1-3)	Moderate (4-6)	Severe (7-12)
Tympanoplasty	16 (40%)	0	11(68.75%)	5 (31.25%)	0 (0%)
Cortical	20 (50%)	0	0 (0%)	5 (25%)	15 (75%)
Canal wall down	4 (10%)	0	0 (0%)	0 (0%)	4 (100%)
Total	40 (100%)	0	11 (27.5%)	10 (25%)	19 (47.5%)

[Table/Fig-5]: Association between procedure performed and MERI Score.

An attempt was made to determine an association between the MERI score and graft acceptance in this study. Graft acceptance was noted in 9 (81.82%) out of 11 patients with a mild MERI score, 10 (100%) out of 10 patients with a moderate MERI score, and 11 (57.89%) out of a total of 19 patients with a severe MERI score. The association between the MERI score and graft acceptance is shown in [Table/Fig-6].

MERI score	No. of patients	Graft accepted	Graft not accepted
Normal (0)	0 (0%)	0 (0%)	0 (0%)
Mild (1-3)	11 (27.5%)	9 (81.82%)	2 (18.18%)
Moderate (4-6)	10 (25%)	10 (100%)	0 (0%)
Severe (7-12)	19 (47.5%)	11 (57.89%)	8 (42.11%)
Total	40 (100%)	30 (75%)	10 (25%)
2-value	6.57, p-value=0.037, Significant, p<0.05		

[Table/Fig-6]: Association between MERI Score and outcome of graft.

Out of the 35 patients with normal ET function, 11 (31.43%) patients had a mild MERI score, 10 (28.57%) had a moderate score, and 14 (40%) patients had a severe MERI score. The remaining 5 patients with dysfunctional ET of various grades had a severe MERI score [Table/Fig-7].

Eustachian tube dysfunction	No. of patients	Normal (0)	Mild (1-3)	Moderate (4-6)	Severe (7-12)
Normal	35 (87.5%)	0 (0%)	11(31.43%)	10 (28.57%)	14 (40%)
Grade-1	1 (2.5%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Grade-2	2 (5%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)
Grade-3	2 (5%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)
Total	40 (100%)	0 (0%)	11 (27.5%)	10 (25%)	19 (47.5%)
2-value	**6.31, p-value=0.38, Not Significant, p>0.05**				

[Table/Fig-7]: Association between Eustachian Tube Dysfunction and MERI score.

The study aimed to correlate graft acceptance with an increase in the grading of Eustachian dysfunction. Out of the total 40 patients studied, 35 patients had normal ET function. Among these patients, graft acceptance was observed in 30 (85.71%) patients. The remaining five patients who had ET dysfunction experienced graft rejection. The calculated chi-square value was 17.14 with a significant p-value [Table/Fig-8].

Eustachian tube dysfunction	No. of patients	Graft accepted	Graft not accepted
Normal	35 (87.5%)	30 (85.71%)	5 (14.29%)
Grade-1	1 (2.5%)	0 (0%)	1 (100%)
Grade-2	2 (5%)	0 (0%)	2 (100%)
Grade-3	2 (5%)	0 (0%)	2 (100%)
Total	40 (100%)	30 (75%)	10 (25%)
χ^2-value	**17.14, p-value=0.001, Significant, p<0.05**		

[Table/Fig-8]: Association between Eustachian Tube Dysfunction Grade and outcome of graft.

DISCUSSION

The purpose of this study was to determine the relationship between the preoperative MERI and the planned type of middle ear surgery, as well as the factors influencing the success of tympanic membrane graft uptake. The aim was to assist surgeons, particularly those practicing in developing countries where financial constraints are common, in providing better counseling to patients regarding outcomes. The authros sought to offer reassurance and avoid the need for repeated surgeries for the same condition.

Surgical intervention was performed on all 40 patients in the present study, which involved procedures such as tympanoplasty, canal wall up/cortical mastoidectomy, and canal wall down mastoidectomy. Tympanic membrane reconstruction was carried out for all patients. In this study, the authors attempted to establish an association between the MERI score and the required procedure for each patient. It was observed that a large number of patients (40%) requiring tympanoplasty had a mild and moderate MERI score, while patients requiring canal wall up or canal wall down procedures (60%) had moderate or severe MERI scores. Thus, the present study demonstrated a linear relationship between the severity of the score and the magnitude of the procedure, which was found to be statistically significant (p=0.0001).

These findings align with the observations made by Pinar E et al., who reported a significantly higher mean MERI score in canal wall down tympanoplasties compared to canal wall up tympanoplasties [8]. Zhu X et al., also noted an increased need for more extensive surgeries, such as canal wall down, with higher MERI scores [9]. The requirement for canal wall down surgery increased in the low-risk, intermediate-risk, and high-risk categories, respectively. Similar observations were echoed in a study by Shishegar M et al., [10].

On associating the acceptance of graft with the MERI score, which is divided into mild, moderate, and severe, the authors found that graft acceptance was 9/11 (81.82%) and 10/10 (100%) with mild and moderate MERI scores, respectively. However, it dwindled to 11/19 (57.89%) in patients with a severe MERI score. Since the MERI score represents a cumulative version of risk factors, we can state that as the risk factors increase, the chances of graft acceptance decline. In the present study, this difference was found to be statistically significant with a p-value of 0.037.

Studies by Pinar E et al., Sevil E and Doblan A, and Zhu X et al., have also observed that graft acceptance is highest with a mild MERI score and declines with moderate/severe MERI scores [8,9,11]. These observations align with the findings of the present study. In contrast to our findings, a study by Verma JK et al., did not find a significant difference in graft success rates among the three groups [12].

Regarding the association between the MERI score and ET function, all patients with ET dysfunction had a severe MERI score. In patients with normal ET function, the distribution of MERI scores was as

follows: mild in 11 (31.43%) patients, moderate in 10 (28.57%) patients, and severe in 14 (40%) patients. The association between MERI score and ET function yielded a p-value of 0.38, which was not statistically significant. However, the authors did not come across a study that specifically relates the MERI score to ET function, hence comparison was not possible. This aspect requires further research since ET function is a major criterion in understanding the pathogenesis, development, and severity of middle ear infection, as well as determining the outcome of corrective surgeries.

ET dysfunction has been attributed to many diseases of the middle ear cleft, ranging from Serous Otitis Media (SOM) to squamosal (unsafe) COM, and is considered one of the most important factors in determining the success of tympanoplasty. Out of the 40 patients, 35 had normal ET function, and graft acceptance was observed in 30 of these patients (85.71%). However, graft rejection was observed in all cases. This difference was found to be statistically significant (p-value=0.001). Shiromany A and Belaldavar B observed that out of 37 patients with normal ETF, 33 (90.2%) had a gratifying outcome, while failure was observed in four patients (9.8%) [13]. Among the 11 patients with partial dysfunction of the ET, a success rate of 63.6% (7 patients) was observed. Studies conducted in the past have shown that there is an association between the surgical outcome of the disease and all the other pathological factors in consideration [14,15]. However, a majority of the studies in the literature have focused on a single factor exclusively [16-20]. Therefore, such prognostic factors should be taken into consideration prior to surgeries to determine the candidacy of the patient for a specific type of surgery and estimate the expected outcome.

Limitation(s)

The study had certain limitations, such as a small sample size of patients included in both age groups, the absence of histopathological correlation and the fact that it was not a multicenter study.

CONCLUSION(S)

The MERI was used as a tool for surgical outcomes. Diseases requiring tympanoplasty alone had a mild MERI (1-3), while more extensive middle ear surgeries were associated with moderate or severe MERI scores (4-6 or 7-12), which were found to be significant. Graft acceptance was highest with mild and moderate MERI scores, but it decreased in patients with severe MERI, which was also found to be significant. Interestingly, all patients with ET dysfunction had a severe MERI score (7-12) and experienced graft rejection. The association of graft acceptance with ET function was statistically significant with $p<0.05$. In a country like India, where the cost of surgery and time away from work are major considerations, it is important to establish a standardised approach to predict the surgical outcome, whether it involves tympanoplasty alone or in combination with other middle ear surgeries like cortical mastoidectomy or canal wall down mastoidectomy, and counsel the patient accordingly. This plays a crucial role in informed decision-making.

REFERENCES

[1] Bhat NA, De R. Retrospective analysis of surgical outcome, symptom changes, and hearing improvement following myringoplasty. J Otolaryngol. 2000;29(4):229-32.
[2] Lin AC, Messner AH. Pediatric tympanoplasty: Factors affecting success. Curr Opin Otolaryngol Head Neck Surg. 2008;16(1):64-68.
[3] Artono, Surarto B, Purnami N, Hutahaen F, Mahardhika MR. The association of IL-1 alpha level and tnf alpha expressions on bone destruction in chronic suppurative otitis media and cholesteatoma. Indian J Otolaryngol Head Neck Surg. 2020;72(1):01-07.
[4] Hunt L, Mulwafu W, Knott V, Ndamala CB, Naunje AW, Dewhurst S, et al. Prevalence of paediatric chronic suppurative otitis media and hearing impairment in rural Malawi: A cross-sectional survey. Brennan-Jones C, editor. PLoS ONE. 2017;12(12):e0188950.
[5] Dash M, Deshmukh P, Gaurkar SS, Sandbhor A. A review of the middle ear risk index as a prognostic tool for outcome in middle ear surgery. Cureus. 2022;14(11):e31038. Doi: 10.7759/cureus.31038.
[6] Mathew GA, Kuruvilla G, Job A. Dynamic slow motion video endoscopy in eustachian tube assessment. Am J Otolaryngol. 2007;28(2):91-97.
[7] Saidha PK, Kapoor S, Suri A, Gupta A, Kakkar V. Evaluation of the role of middle ear risk index as a prognostic tool in cases of tympanoplasty in chronic suppurative otitis media. Int J Otorhinolaryngol Head Neck Surg. 2021;7(4):622-26.
[8] Pinar E, Sadullahoglu K, Calli C, Oncel S. Evaluation of prognostic factors and middle ear risk index in tympanoplasty. Otolaryngol-Head Neck Surg. 2008;139(3):386-90.
[9] Zhu X, Zhang Y, Xue R, Xie M, Tang Q, Yang H. Predictors of anatomical and functional outcomes following tympanoplasty: A retrospective study of 413 procedures. Laryngoscope Investig. Otolaryngol. 2021;6(6):1421-28.
[10] Shishegar M, Faramarzi M, Rashidi Ravari M. Evaluation of middle ear risk index in patients undergoing tympanoplasty. Eur Arch Otorhinolaryngol. 2019;276(10):2769-74.
[11] Sevil E, Doblan A. Significance of the middle ear risk index in predicting tympanoplasty success in the elderly. Eur Arch Otorhinolaryngol. 2021;278(10):3689-95.
[12] Verma JK, Kumar R, Chaudhary K. Evaluation of tympanoplasty results and its association with middle ear risk index (MERI)-a prospective study. Int J Contemporary Med Res. 2021,8(8):115-19.
[13] Shiromany A, Belaldavar B. Effect of Eustachian tube function on tympanoplasty outcome in chronic otitis media patients: Cross-sectional study. Indian J Health Sci. 2016;9(3):279.
[14] Mohan Kumar J, Rajasekar MK. Evaluation of Eustachian tube function in chronic suppurative otitis media in relation to surgical treatment results. J Res Med Dent Sci. 2022;10(1):548-54.
[15] Priya K, Karthikeyan P, Coumare VN, Sambandan AP. Evaluation of Eustachian tube function in chronic suppurative otitis media (tubotympanic type) with reference to its treatment outcome. Indian J Otol. 2012;18(4):179-83.
[16] Wasson JD, Papadimitriou CE, Pau H. Myringoplasty: Impact of perforation size on closure and audiological improvement. J Laryngol Otol. 2009;123(9):973-77.
[17] Pignataro L, Berta LGD, Capaccio P, Zaghis A. Myringoplasty in children: Anatomical and functional results. J Laryngol Otol. 2001;115(5):369-73.
[18] Holmquist I. The role of eustachian tube in the myringoplasty. Acta Otolaryngol (stockh). 1968;66(4):289.
[19] Chaudhari A, Mankar A, Deshmukh P, Agrawal S. Administration of Clonidin as adjuvant to infiltration anaesthesia in tympanoplasty surgery. International Journal of Current Research and Review. 2020;12(14):25-29.
[20] Jain S, Gaurkar S, Deshmukh PT, Khatri M, Kalambe S, Lakhotia P, et al. Applied anatomy of round window and adjacent structures of tympanum related to cochlear implantation [AnatomiaAplicada Da Janela Redonda e Estruturas Adjacentes Relacionadas AoImplante Coclear]. Brazilian Journal of Otorhinolaryngology. 2019;85(4):435-46.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Resident, Department of Otorhinola Ryngology, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Professor and Head, Department of Otorhinola Ryngology, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Manisha Dash,
S-8, Shalinta PG Girls Hostel, D MIHER, Sawangi (M),
Wardha-442004, Maharashtra, India.
E-mail: manishaadash@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: May 22, 2023
- Manual Googling: Jul 05, 2023
- iThenticate Software: Oct 03, 2023 (17%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 21, 2023**
Date of Peer Review: **Jun 19, 2023**
Date of Acceptance: **Oct 05, 2023**
Date of Publishing: **Nov 01, 2023**