Original Research Article

Assessment of middle ear risk index in predicting the outcome of treatment of CSOM

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) accounts for highly prevalent and serious health problems especially in developing countries. Even though there are good numbers of studies demonstrating the success rate of the procedures to treat CSOM, there is lack of uniformity in assessing the predictors for the outcome of the same. If we can predict the outcome of the surgical procedure depending upon the pathologic condition of the middle ear, the cost effectiveness of the surgery can be improved, and this will also improve the patient's compliance. The objective of this study is to evaluate a group of patients who underwent surgical treatment for chronic CSOM with reference to the prognostic significance of Middle ear risk index (MERI).
Methods: It is a retrospective observational study of patients who underwent surgical treatment for CSOM from the year 2008 to 2020.
Results: Out of 1010 surgeries done, total of 287 cases were included in study. In our study the success rate in mild risk index was 76.9%, moderate was 62.2% and only 18% in severe risk index.
Conclusion: The outcome of surgery in the patients who undergo surgical treatment for CSOM can be predicted well using MERI. Presence of cholesteatoma and granulation tissue reduces the favourable outcome of surgery justifying the numerical value given in the score. However, presence of ear discharge and history of smoking doesn't alter the outcome of surgery as long as complete clearance of disease is done.

Keywords: Chronic suppurative otitis media, Middle ear risk index, Scoring system, Belluci's classification

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear and mastoid cavity which often results in long term changes in the tympanic membrane including the perforation. It accounts for highly prevalent and serious health problems especially in developing countries.[1] Owing to its large number of cases patients are frequently subjected to surgeries to clear the disease. This highlights the importance to assess the severity of the disease and predict the outcome of the surgical management.[2]

Tympanoplasty is a surgical procedure which includes eradication of disease from middle ear and reconstruction of the hearing mechanism with or without tympanic membrane repair. It has been well accepted as the surgery of choice for CSOM.[3]

There are many studies mentioning about its various prognostic factors and their influence over the successful outcome of surgery in terms of hearing improvement and graft uptake.[3] Even though there are good numbers of studies demonstrating the success rate of these procedures, there is lack of uniformity in assessing the predictors for the outcome of the same.[4]

Since the outcome of tympanoplasty is largely dependent on various predisposing factors present pre-operatively, many systems were introduced to help to deduce them. Many studies have considered pre and intraoperative findings as risk factors as described below.[3-6]

Depending on status of ear discharge on presentation, Bellucci suggested four discrete stages of prognosis. Black introduced the Surgical, Prosthetic, Infection, Tissues, and Eustachian tube (SPITE) system. Determining the prognosis of hearing improvement based on ossicular status and its reconstruction was proposed by Wullstein. Austin subsequently developed a system that included the residual ossicular remnants. Kartush has divided these into intrinsic and extrinsic factors.

In 2001 Katrush and Becvaroski revised a system called Middle ear risk index (MERI), which included known preoperative and intra operative risk factors.[3] It stratifies these factors into prognostic categories. If we can predict the outcome of the surgical procedure depending upon the pathologic condition of the middle ear, the cost effectiveness of the surgery can be improved, and this will also improve the patient's compliance.

The objective of this study is, to evaluate a group of patients who underwent surgical treatment for chronic suppurative otitis media with reference to the prognostic significance of MERI.

METHODS

It is a retrospective observational study, which includes the systematic analysis of case files of patients who underwent surgical treatment for chronic suppurative otitis media from the year February 2008 to February 2020 done at department of ENT and head and neck. Various surgical modalities included are tympanoplasty with or without cortical mastoidectomy for mucosal CSOM and mastoid exploration for squamosal CSOM. Cases with inadequate data were excluded and we considered all the cases that were operated under a single surgeon in order to maintain the uniformity. Total of 1010 ear surgeries were done among which after filtering a total of 287 cases were analyzed.

All the demographic data of patient, presenting complaints, ear examination findings, type of surgery that they underwent, intra operative findings and the post-operative follow up were meticulously documented.

Interpretation of pre-operative and post-operative hearing assessment which was done in terms of pure tone audiometry was also noted down. Later they were scored according to the MERI system and categorized into different risk groups. The surgical outcomes of these groups were compared and analyzed. All the collected data was entered into PSPP software and required results were noted.

RESULTS

A total of 287 cases diagnosed with chronic suppurative otitis media were considered for studying. Our study showed 137 (47.7%) of them were female and majority of them were male constituting 150 (52.3%) of the total cases. When distribution according to age was analyzed it showed that maximum number of cases were between 21 to 30 years of age (26%), followed by 31 to 40 years old (25%) and least in 71-80 years (1%) old. Among 287 cases, maximum side of involvement was in left side 43% (124) followed by right side accounting for 40% (115) and rest 17% (48) were bilateral in presentation.

We witnessed 232 (81%) cases were mucosal type of CSOM and rest 55 (19%) were squamosal type of CSOM. One case was congenital cholesteatoma and 4 were recurrent cases among which one was squamosal (Figure 1).
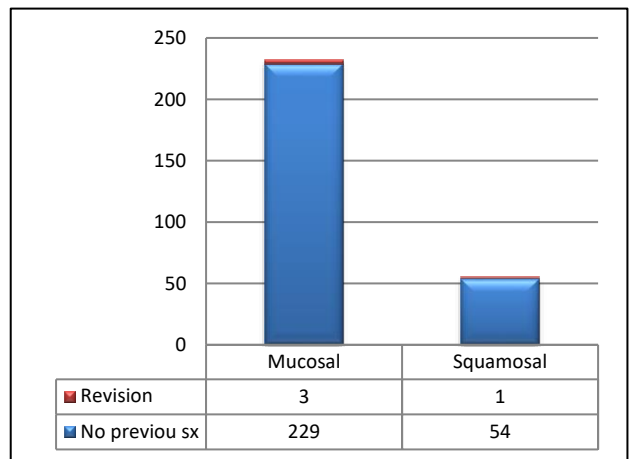

	Mucosal	Squamosal
Revision	3	1
No previou sx	229	54

Figure 1: Types of CSOM.

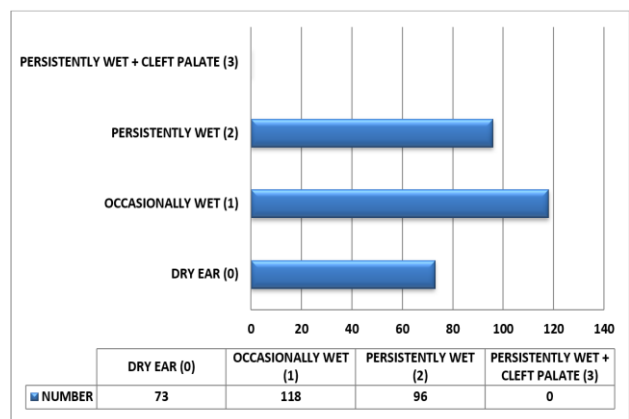|	DRY EAR (0)	OCCASIONALLY WET (1)	PERSISTENTLY WET (2)	PERSISTENTLY WET + CLEFT PALATE (3)
NUMBER	73	118	96	0

Figure 2: Belluci's risk value.

When the different modes of surgery was analysed, 161 (56 %) cases had undergone microscopic surgery and rest 126 (44%) cases endoscopic surgery. We found that 74% had undergone simple tympanoplasty, 7% had undergone cortical mastoidectomy with tympanoplasty and rest 19%

had undergone modified radical mastoidectomy with tympanoplasty. We found that maximum number of cases underwent type 1 tympanoplasty, followed by type 3 and type 4. Only 1 case had undergone type 2 tympanoplasty. When the factors of middle ear risk index were noted, 252

cases had tympanic membrane perforation, 57 cases had granulation tissue, 55 cases had cholesteatoma, 4 cases were revision cases and 40 cases had history of smoking (Table 1).

Table 1: Middle ear risk index (MERI).

Risk factors	Finding	Risk value	Number of cases seen	
Otorrhea	Dry	0	73	
	Occasionally wet	1	118	
	Persistently wet	2	96	
	Wet with cleft palate	3	0	
Perforation	Absent	0	35	Retraction- 34, Bulge- 1
	Present	1	252	LCP- 109, MCP-88 SCP-40, Subtotal-15
Cholesteatoma	Absent	0	232	
	Present	2	55	Congenital-1, Acquired-54
Ossicular chain	Malleus, incus and stapes present	0	179	
	Defect of incus	1	22	
	Defect of incus and stapes	2	16	
	Defect of incus and malleus	3	44	
	Defect of malleus incus and stapes	4	26	
	Ossicular head fixation	2	0	
	Stapes head fixation	3	0	
Middle ear granulation/ effusion	No	0	230	
	Yes	2	57	
Previous surgery	None	0	283	
	Staged	1	0	
	Revision	2	4	Cholesteatoma-1, Mucosal-3
Smoker	No	0	247	
	Yes	2	40	

When the tympanic membrane of operated ear was analysed, maximum numbers had large central perforation (109), medium central perforation was noted in 88 cases and 40 cases had small central perforation. Least numbers had subtotal perforation accounting for 15. 34 cases had retraction pockets which were explored and found to have cholesteatoma. 1 case showed a bulged tympanic membrane which later diagnosed as congenital cholesteatoma (Table 1).

According to Belluci's risk value, majority of cases had history of occasionally wet discharge. 96 of them were persistently wet.73 cases were dry with no history of discharge and none had cleft palate (Figure 2).

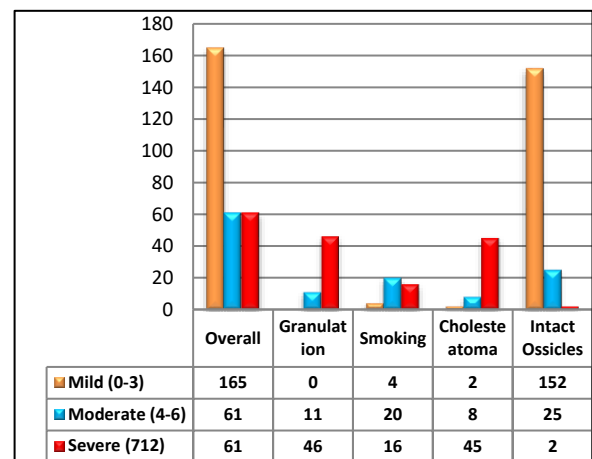Among the total cases studied, 62.4% had ossicular continuity (Table 2).

	Overall	Granulation	Smoking	Cholesteatoma	Intact Ossicles
Mild (0-3)	165	0	4	2	152
Moderate (4-6)	61	11	20	8	25
Severe (712)	61	46	16	45	2

Figure 3: Different groups of MERI.

Table 2: Ossicular risk value.

Ossicular risk value	Number	Percentage
0	179	62.4
1	22	7.7
2	16	5.6
3	44	15.3
4	26	9

After noting down all the required data scoring was done and final scores were added up and were divided into different groups of risk index (Figure 3).

It showed 165 cases to be mild and 61 cases in both moderate and severe group of risk index. We noted that maximum numbers had score 2 followed by score 1 and least was score 10 (Table 3).

The preoperative pure tone audiometry showed an average air bone gap of 34.19±SD 12.21 dB HL with minimum being 9 dB HL and maximum being 62 dB HL. The postoperative pure tone audiometry showed an average air bone gap of 24.51±SD 10.73 dB HL with minimum being 8 dB HL and maximum being 60 db HL. Here we can see the average air bone gap gain of 9.68 dB HL (Table 4).

When we analysed the hearing loss according to WHO classification, we had seen 79 (27.5%) cases to have below 25 dB HL pre-operatively which improved to 176 (61.3%) cases post operatively. We saw 98 (34.1%) cases to have disabling hearing impairment (according to World Health Organization (WHO) above 41 dB HL) pre-operatively

which reduced to 23 (8.01%) cases post operatively. In our study the success rate in mild risk index was 76.9%, moderate was 62.2% and only 18% in severe risk index. (Table 5)

Table 3: Scoring as per middle ear risk index.

Score value	Frequency	Percentage
1	69	24
2	85	29.6
3	37	12.9
4	34	11.9
5	19	6.6
6	23	8
7	12	4.2
8	4	1.4
9	3	1
10	1	0.35

Table 4: Comparison between pre-operative and post-operative air bone gap.

ABG	Pre-operative (dB HL)	Post-operative (dB HL)
Minimum	9	8
Average	34.19±12.21 (SD)	24.51±10.73 (SD)
Maximum	62	60

Table 5: Degree of hearing loss in different risk index.

Degree of hearing loss (dB HL)	Overall		Mild		Moderate		Severe	
	Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative
Normal 10 to 15	9	67	9	57	0	10	0	0
Minimal 16 to 25	70	109	55	70	14	28	1	11
Mild 26 to 40	110	88	76	36	25	21	9	31
Moderate 41 to 55	84	20	25	2	20	2	39	16
Moderately severe 56 to 70	14	3	0	0	2	0	12	3
Severe 71 to 90	0	0	0	0	0	0	0	0
Profound more than 91	0	0	0	0	0	0	0	0

DISCUSSION

One of the most well documented problems in developing countries with respect to health is CSOM. In spite of extensive studies and development of new surgical

techniques over decades, yet the outcome of it varies from patient to patient.[5] This is due to the fact that disease progress and the treatment largely depends on various contributing factors. Owing to its high prevalence rate, we do come across large number of cases and frequent

undertaking of surgeries in order to clear the disease and restore the hearing is mandatory.[7] Trying to establish a uniform system to predict the outcome of surgery and counsel the patient accordingly plays an important role in country like India, especially where the cost of surgery and absence from work are major issues.

Among the different systems used, middle ear risk index is one such system which takes into account of both pre-operative and intra operative findings of middle ear to predict the outcome of surgery.

This study was conducted to evaluate a group of patients who underwent surgical treatment for chronic suppurative otitis media with reference to the prognostic significance of MERI.

Among the various factors, age is one of it. Generally, the outcome of pediatric tympanoplasty is lower due to higher incidence of eustachian tube dysfunction.[4,8] The same scenario was observed even in our study, however due to less number of pediatric cases (10.8%) the conclusion cannot be drawn.

When we analyzed the data according to Belluci's classification of ear discharge we found that maximum number of cases belonged to Belluci's type 2 (scoring 1, occasionally wet). Since many surgeons are of the opinions that dry ear yield better results, they prefer waiting for ear to be dry for a period of 3 months. When the ear is persistently wet, it might be due to chronic source of infection in mastoid cavity or eustachian tube malfunction.[1,8] This scoring helps in deciding the time and type of surgery required. However, we did not find any statistically significant difference in different types of Belluci's classification. So, we can conclude that as long as the disease is cleared with suitable type of surgery, the results will be good.

Cholesteatoma occurs more commonly in children than adults, which was found to be true in our study that among 55 cases diagnosed 11 (20%) were pediatric cases which accounts for almost 1/3rd of total pediatric cases diagnosed. It might due to immature eustachian tube function leading to retraction pockets and developing cholesteatoma.[5] We found that 82% of cases diagnosed with cholesteatoma belonged MERI severe index. Presence of cholesteatoma reduces the graft uptake and hearing outcome which was found to be true in our study with only 23.3% success rate. It also might be because of canal wall down procedure done for the same.

When it comes to status of ossicles, cases with intact ossicles with only perforation of tympanic membrane gives better surgical outcomes.[2] Majority of our cases ie; 62.4% belonged to this category. Cholesteatoma cases cause more ossicular pathology which was found to be true in our study. We found the defect in both malleus and incus to be more common in ossicular pathology followed by defect in all 3 ossicles.

Presence of granulation tissue has negative effect in the outcomes of surgery according to Yurttafl et al whose study concluded that graft uptake rate was only 44.4%.[9] We also found that only 22.8% of them restored to less than 25 dB HL post operatively. 75% of cases belonging to severe risk index (61) had granulation tissue (46).

Cigarette smoking has a significant negative effect on the long-term results in chronic suppurative otitis media surgery. Bevcroski et al conducted an extensively study and concluded that cigarette smoking causes more pre-operative severity which was found to be true in our scenario. They also stated that more extensive surgery is required to clear the disease and there is 3 folds increase in chance of long-term graft failure. In view of all the effects of smoking including local, systemic and regional effects, in 2001 the scoring of smoking in MERI was changed from 1 to 2.[3] In our study we found that smokers had post op success rate of 57.5% which not very much different from that of non-smoker which contributed 61.9%. So, we can conclude that as long as the disease is completely cleared, even though, pre-operative severity was more, the hearing outcomes are still achievable.

According to Sarfaraj et al; 93.11% success was seen with mild MERI score. 80.55% with moderate MERI score and 62.85% with severe MERI score.[5] In our study the success rate in mild risk index was 76.9%, moderate was 62.2% and only 18% in severe risk index.

Riyat et al stated patient with mild MERI Scores had a more favorable prognosis than patients with severe MERI scores which was found to be true in our study.[1] This might be because of the fact shown by the previous studies that patients with higher MERI scores have more severe air conductive hearing threshold damages, either pre or post tympanoplasty, compared to patients with lower MERI scores. So even though in our study the overall average air bone gap gain post operatively was 9.68 dB HL which is good outcome but due to the severe pre-existing pre-operative hearing loss in severe index indicated only 18% of success rate.

CONCLUSION

The outcome of surgery in the patients who undergo surgical treatment for chronic suppurative otitis media can be predicted well using MERI. Thus, it will be helpful in educating the patients for the better management and in predicting the outcome in terms of achieving dry ear and hearing improvement. Presence of cholesteatoma and granulation tissue reduces the favorable outcome of surgery justifying the numerical value given in the score. However, presence of ear discharge and history of smoking doesn't alter the outcome of surgery as long as complete clearance of disease is done.

Ethical approval: The study was approved by the Institutional Ethics Committee

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