



A COMPREHENSIVE STUDY ON FACTORS AFFECTING POST-MASTOIDECTOMY RECOVERY

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ABSTRACT

Objective: To study the surgical healing outcomes at the end of three month post-operative period. **Material and method:** This was a hospital based prospective observational study with three months postoperative follow up design. The study was conducted for a total duration of two years and 6 months from July 2019 to January 2022 with 67 study participants. The study was carried out in the hospital setting at the department of ENT in a tertiary care hospital in south India. Individuals from all age groups who were diagnosed with Chronic Suppurative Otitis Media-Attico Antral Disease (CSOM-AAD) with or without extracranial complications are eligible for Mastoidectomy. **Results:** A significant association was observed between preoperative polyp and post-operative size of the mastoid cavity with epithelization of fascial graft. A significant association was observed between the postoperative Merchant's grade(otorrhea) and the size of the meatoplasty opening. A very strong association was appreciated between the presence of epithelization in the graft (OR: **0.18**; p-value: **<0.001**) and the smaller size of the mastoid cavity after surgery. A significant association was appreciated between the duration of symptoms and epithelization of the fascial graft (OR: **0.23**; p-value: **0.004**). **Conclusion:** It was concluded that the duration of symptoms, size of mastoid cavity, size of meatoplasty opening, and presence of preoperative polyp have significant effects in determining post operative healing in post mastoidectomy patients.

Keywords: chronic suppurative otitis media, CSOM, Otorrhea, Mastoidectomy.

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Introduction

A common symptom of chronic suppurative otitis media (CSOM), which is an inflammatory disorder of the middle ear, is a persistent discharge from the ear. "Chronic inflammation of the middle ear cleft, which results in recurrent ear discharge (Otorrhea) through a perforation in the tympanic membrane" is how CSOM is described. (1,2)

Otorrhea, ear pain, tinnitus, vertigo, hearing loss, and in severe cases, fever are among the clinical symptoms of CSOM.(1,3,4) CSOM patients often experience a modest conductive hearing loss of

10 to 20 dB. However, ossicular chain disruption can often cause profound hearing loss of 50 to 70 dB. (1,5) CSOM is regarded as one of the main cause of significant deafness (hearing loss of >40 decibels), which results in conductive hearing loss and impairment.(1,6) This would worsen the nation's economically protective age group's academic performance. Otoscopic examination, which aids in visualizing tympanic membrane perforation and middle ear structure, including ear ossicles, is one of the diagnostic methods that are accessible for CSOM. Elimination of the middle ear infection and repair of the tympanic membrane perforation are the two main objectives of CSOM therapy. Equal attention should be paid to both therapy facets. According to the literature, combining tympanoplasty with mastoidectomy in CSOM results in a superior functional outcome and reduces disease recurrence. By removing the bony barriers between them during a mastoidectomy procedure, post-auricular air cells are made more accessible.(7) This process expedites the healing of infections. In general, there are two mastoidectomy techniques: canal wall up (CWU), also known as cortical, and canal wall down (CWD), also known as radical mastoidectomy.(8–10)

Following surgery, functional result is typically assessed using Pure Tone Audiometry to determine the degree of air bone closure and hearing threshold. ABG closure within 20 dB is considered a favourable surgical outcome. (11–13)

The ossicular chain, facial canal, granulation tissue, size and obliteration of the mastoid cavity, and size of the meatoplasty opening are used to evaluate the epithelization of the graft in the tympanoplasty and the middle ear structure.(14–16) Merchant et al grading was used to evaluate the obliteration of discharging cavity. The grade ranges from 0 – 4. Grade '0' indicates obliteration(dry ear) Adequate control of infection refers to grades 1, and 2 depending on whether the wetness is persistent or not, whereas grade 3 indicates failure of control of infection, and Grade '4' denotes complete failure of surgical procedure.(17) The type of surgical methods used, the prosthetics used, secondary infections, the Eustachian tube system, and any remaining ossicular remnants all have an impact on the postoperative hearing results.(11,18,19)

The quality of life of a person is significantly compromised by CSOM if left untreated at an appropriate window period. Henceforth, this study aimed to investigate potential factors related to hearing and healing outcomes following Tympanomastoidectomy.

Materials and method

Individuals from all age groups who were diagnosed with Chronic Suppurative Otitis Media-Attico Antral Disease (CSOM-AAD) with or without extracranial complications are eligible for Mastoidectomy. patients were included based on inclusion and exclusion criteria. The inclusion criteria were CSOM-AAD without any complications and CSOM-AAD with extracranial complications. Exclusion criteria were CSOM – Tub tympanic type, CSOM with intracranial complications, Revision Mastoidectomy, Malignancy of ear, Mental retardation or cognitive impairment, Temporomastoid trauma, and Congenital ear disease

Study procedure

After the approval from PGRMC and IEC (observational committee), the study was conducted among eligible patients who attended the Department of Otorhinolaryngology in a tertiary care institute in South India. The individuals who were diagnosed with Chronic Suppurative Otitis Media-Attico Antral Disease with or without extracranial complications and posted for mastoidectomy were recruited as study participants. Informed consent was taken from participants or legal guardians (in case of minors less than 18 years of age). A semistructured pre-tested questionnaire was used to collect the socio-demographic and clinical characteristics of CSOM from the participants. Also, they have been examined using an otoscope and microscope to assess the status of diseased ears. The parameters evaluated were the status of tympanic membrane perforation, polyps, cholesteatoma, granulation tissue, fascial canal, mastoid cavity, and ear ossicles. Microbiological analysis of discharge was done to identify patterns of culture sensitivity. Details on epithelization of fascial graft, meatoplasty opening, Size of the mastoid cavity, status of mastoid

cavity, Merchant’s grading, and ossicular status were also been gathered to evaluate the healing outcome of the tympanomastoidectomy.

List of variables and their measurement methods with standardization techniques:

Sl. No	Outcome	Measurement
1.	Healing status at third month post Tympan mastoidectomy	Epithelization of fascia graft Size of Mastoid cavity Meatoplasty opening Merchant grading for Otorrhea

Results

Table 1: Factors associated with healing outcome (Epithelization of fascial graft) among the study participants underwent mastoidectomy for Chronic Suppurative Otitis Media in the department of ENT at a tertiary care hospital, South India (N= 67)

Sl.no	Variables	Epithelization of graft		OR	p-value*
		n (%)			
		Complete	Incomplete		
A. Socio-demographic and clinical factors					
1	Age categories				
	≤35 years	31 (91.2)	3 (8.8)	2.78	0.155
	>35 years	26 (78.8)	7 (21.2)		
2	Gender				
	Female	24 (85.7)	4 (14.3)	1.09	0.901
	Male	33 (84.6)	6 (15.4)		
3	Body mass Index				
	Underweight	22 (81.5)	5 (18.5)	-	0.707
	Normal	25 (89.3)	3 (10.7)		
	Overweight	10 (83.3)	2 (16.7)		
4	SOCIO ECONOMIC STATUS(MODIFIED PRASAD SCALE)				
	Middle class	9 (81.8)	2 (18.2)	0.75	0.740
	Lower class	48 (85.7)	8 (14.3)		
5	Comorbidities				
	Present	34 (82.9)	7 (17.1)	0.63	0.536
	Absent	23 (88.5)	3 (11.5)		
6	Duration of symptoms				
	≤14 months	30 (83.3)	6 (16.7)	0.74	0.666
	>14months	27 (87.1)	4 (12.9)		
7	Mode of onset				
	Gradual	45 (83.3)	9 (16.7)	0.40	0.415
	Sudden	12 (92.3)	1 (7.7)		
8	Culture pattern				
	Staphylococcal aureus	18 (90)	2 (10)	-	0.273
	Streptococcus pyogenes	19 (76)	6 (24)		
	Pseudomonas	20 (90.9)	2 (9.1)		
B. Preoperative findings in ear with CSOM					
1	Polyp				
	Present	8 (66.7)	4 (33.3)	0.25	0.048
	Absent	49 (89.1)	6 (10.9)		

2	Cholesteatoma				
	Present	53 (84.1)	10 (15.9)	0.84	0.388
	Absent	4 (100)	0		
3	Granulation tissue				
	Present	22 (78.6)	6 (21.4)	0.42	0.206
	Absent	35 (89.7)	4 (10.3)		
4	Eustachian tube				
	Intact	27 (79.4)	7 (20.6)	0.3	0.187
	Dysfunction	30 (90.9)	3 (9.1)		
5	Retraction of pars tensa				
	Grade 1	6 (100)	0	-	0.397
	Grade 2	29 (87.9)	4 (12.1)		
	Grade 3	20 (76.9)	6 (23.1)		
	Grade 4	2 (100)	0		
6	Retraction of pars flaccida				
	Grade 1	4 (100)	0	-	0.635
	Grade 2	17 (81)	4 (19)		
	Grade 3	(84.2)	6 (15.8)		
	Grade 4	4 (100)	0		
C. Type of Mastoidectomy					
	Canal Wall Down	49 (89.1)	6 (10.9)	4.08	0.048
	Canal Wall Up	8 (66.7)	4 (33.3)		
D. Post operative status					
1	Mastoid cavity				
	Small	47 (100)	0	0.50	<0.001
	Large	10 (50)	10 (50)		
2	Air Bone Gap				
	≤ 20 dB	36 (63.2)	21 (36.8)	0.74	0.672
	> 20 dB	7 (70)	3 (30)		
3	Ossicular status				
	Type 0	14 (87.5)	2 (12.5)	-	0.866
	Type A	25 (86.2)	4 (13.8)		
	Type C	18 (81.8)	4 (18.2)		
4	Granulation tissue				
	Present	35 (85.4)	6 (14.6)	1.06	0.933
	Absent	22 (84.6)	4 (15.4)		
5	Meatoplasty opening				
	≤ 2.4 mm	28 (80)	7 (20)	0.41	0.223
	> 2.4 mm	29 (90.6)	3 (9.4)		

Table no.1 described various clinico-social and surgical factors related to the healing outcome as measured by the presence of epithelization in the fascial graft at third month follow up after Tympanomastoidectomy. A significant association observed on preoperative polyp and post-operative size of mastoid cavity with epithelization of fascial graft. The findings showed that absence of preoperative polyp (OR: **0.25**; p-value: **0.048**) and smaller mastoid cavity were positively associated with epithelisation of fascial graft (OR: **0.5**; p-value: **<0.001**).

Table 2: Factors associated with healing outcome (Merchant's grading) among the study participants underwent mastoidectomy for Chronic Suppurative Otitis Media in the department of ENT at a tertiary care hospital, South india (N= 67)

Sl.no	Variables	Merchant grading n (%)		OR	p-value*
		Grade 0	Grade 1		
A. Socio-demographic and clinical factors					
1	Age categories				
	≤35 years	18 (52.9)	16 (47.1)	1.35	0.540
	>35 years	15 (45.5)	18 (54.5)		
2	Gender				
	Female	15 (53.6)	13 (46.4)	1.35	0.549
	Male	18 (46.2)	21 (53.8)		
3	Body mass Index				
	Underweight	16 (59.3)	11 (40.7)	-	0.141
	Normal	14 (50)	14 (50)		
	Overweight	3 (25)	9 (75)		
4	SOCIO ECONOMIC STATUS(MODIFIED PRASAD SCALE)				
	Middle class	6 (54.5)	5 (45.5)	1.29	0.701
	Lower class	27 (48.2)	29 (51.8)		
5	Comorbidities				
	Present	17 (41.5)	24 (58.5)	0.443	0.109
	Absent	16 (61.5)	10 (38.5)		
6	Duration of symptoms				
	≤14 months	47 (100)	0	0.50	<0.001
	>14months	10 (50)	10 (50)		
7	Mode of onset				
	Gradual	28 (51.9)	26 (48.1)	1.72	0.386
	Sudden	5 (38.5)	8 (61.5)		
8	Culture pattern				
	Staphylococcal aureus	9 (45)	11 (55)	-	0.529
	Streptococcus pyogenes	11 (44)	14 (56)		
	Pseudomonas	13 (59.1)	9 (40.9)		
B. Preoperative findings in ear with CSOM					
1	Polyp				
	Present	6 (50)	6 (50)	1.03	0.954
	Absent	27 (49.1)	28 (50.9)		
2	Cholesteatoma				
	Present	31 (49.2)	32 (50.8)	0.97	0.975
	Absent	2 (50)	2 (50)		
3	Granulation tissue				
	Present	13 (46.4)	15 (53.6)	0.82	0.695
	Absent	20 (51.3)	19 (48.7)		
4	Eustachian tube				
	Intact	17 (50)	17 (50)	1.06	0.901
	Dysfunction	16 (48.5)	17 (51.5)		
5	Retraction of pars tensa				
	Grade 1	3 (50)	3 (50)	-	0.832
	Grade 2	18 (54.5)	15 (45.5)		
	Grade 3	11 (42.3)	15 (57.7)		
	Grade 4	1 (50)	1 (50)		

6	Retraction of pars flaccida				
	Grade 1	2 (75)	2 (25)	-	0.768
	Grade 2	10 (47.6)	11 (52.4)		
	Grade 3	18 (47.4)	20 (52.6)		
	Grade 4	3 (75)	1 (25)		
C. Type of Mastoidectomy					
	Canal Wall Down	27 (49.1)	28 (50.9)	0.96	0.954
	Canal Wall Up	6 (50)	6 (50)		
D. Post operative status					
1	Mastoid cavity				
	Small	24 (51.1)	23 (48.9)	0.78	0.650
	Large	9 (45)	11 (55)		
2	Air Bone Gap				
	≤ 20 dB	22 (51.2)	21 (48.8)	1.24	0.676
	>20 dB	11 (45.8)	13 (54.2)		
3	Ossicular status				
	Type 0	6 (37.5)	10 (62.5)	-	0.523
	Type A	16 (55.2)	13 (44.8)		
	Type C	11 (50)	11 (50)		
4	Granulation tissue				
	Present	19 (46.3)	22 (53.7)	0.74	0.549
	Absent	14 (53.8)	12 (46.2)		
5	Meatoplasty opening				
	≤ 2.4 mm	16 (45.7)	19 (54.3)	0.74	0.544
	> 2.4 mm	17 (53.1)	15 (46.9)		
6	Epithelization of graft				
	Present	28 (49.1)	29 (50.9)	0.97	0.959
	Absent	5 (50)	5 (50)		

Table no.2 showed the result of association between various clinico-social and surgical factors with healing outcome with respect to Merchant’s grading. No significant association was observed between postoperative Merchant’s grades with any of the risk factors.

Table 3: Factors associated with healing outcome (Size of mastoid cavity) among the study participants underwent mastoidectomy for Chronic Suppurative Otitis Media in the department of ENT at a tertiary care hospital, South India (N= 67)

Sl.no	Variables	Mastoid cavity n (%)		OR	p-value*
		Large	Small		
A. Socio-demographic and clinical factors					
1	Age categories				
	≤35 years	10 (29.4)	24 (70.6)	0.96	0.936
	>35 years	10 (30.3)	23 (69.7)		
2	Gender				
	Female	8 (28.6)	20 (71.4)	0.90	0.846
	Male	12 (30.8)	27 (69.2)		
3	Body mass Index				
	Underweight	9 (33.3)	18 (66.7)	-	0.855
	Normal	8 (28.6)	20 (71.4)		
	Overweight	3 (25)	9 (75)		
4	SOCIO ECONOMIC STATUS(MODIFIED PRASAD SCALE)				

	Middle class	3 (27.3)	8 (72.7)	0.86	0.838
	Lower class	17 (30.4)	39 (69.6)		
5	Comorbidities				
	Present	15 (36.6)	26 (63.4)	2.40	0.130
	Absent	5 (19.2)	21 (80.8)		
6	Duration of symptoms				
	≤14 months	12 (33.3)	24 (66.7)	1.44	0.502
	>14months	8 (25.8)	23 (74.2)		
7	Mode of onset				
	Gradual	18 (33.3)	36 (66.7)	2.75	0.204
	Sudden	2 (15.4)	11 (84.6)		
8	Culture pattern				
	Staphylococcal aureus	7 (35)	13 (65)	-	0.120
	Streptococcus pyogenes	10 (40)	15 (60)		
	Pseudomonas	3 (13.6)	19 (86.4)		
B. Preoperative findings in ear with CSOM					
1	Polyp				
	Present	6 (50)	6 (50)	2.93	0.092
	Absent	14 (25.5)	41 (74.5)		
2	Cholesteatoma				
	Present	19 (30.2)	44 (69.8)	1.30	0.827
	Absent	1 (25)	3 (75)		
3	Granulation tissue				
	Present	10 (35.7)	18 (64.3)	1.61	0.374
	Absent	10 (25.6)	29 (74.4)		
4	Eustachian tube				
	Intact	14 (41.2)	20 (58.8)	3.15	0.040
	Dysfunction	6 (18.2)	27 (81.8)		
5	Retraction of pars tensa				
	Grade 1	0	6 (100)	-	0.066
	Grade 2	8 (24.2)	25 (75.8)		
	Grade 3	12 (46.2)	14 (53.8)		
	Grade 4	0 (50)	2 (100)		
6	Retraction of pars flaccida				
	Grade 1	0	4 (100)	-	0.486
	Grade 2	8 (38.1)	13 (61.9)		
	Grade 3	11 (28.9)	27 (71.1)		
	Grade 4	1 (25)	3 (75)		
C. Type of Mastoidectomy					
	Canal Wall Down	14 (25.5)	41 (74.5)	0.34	0.092
	Canal Wall Up	6 (50)	6 (50)		
D. Post operative status					
1	Merchant grading				
	Grade 0	9 (27.3)	24 (72.7)	0.78	0.650
	Grade 1	11 (32.4)	23 (67.6)		
2	Epithelization of graft				
	Present	10 (17.5)	47 (82.5)	0.18	<0.001
	Absent	10 (100)	0		
3	Air Bone Gap				
	≤ 20 dB	11 (25.6)	32 (74.4)	0.57	0.307

	> 20 dB	9 (37.5)	15 (62.5)		
4	Ossicular status				
	Type 0	6 (37.5)	10 (62.5)	-	0.140
	Type A	5 (17.2)	24 (82.8)		
	Type C	9 (40.9)	13 (59.1)		
4	Granulation tissue				
	Present	8 (19.5)	33 (80.5)	0.28	0.020
	Absent	12 (46.2)	14 (53.8)		
5	Meatoplasty opening				
	≤ 2.4 mm	13 (37.1)	22 (62.9)	2.11	0.173
	> 2.4 mm	7 (21.9)	25 (78.1)		

*p-value obtained from Chi-squared test

Table no.3 depicted various clinico-social and surgical factors related to the healing outcome as measured by size of mastoid cavity at third month follow up after Tympanomastoidectomy. A very strong association was appreciated between presence of epithelization in graft (OR: **0.18**; p-value: **<0.001**) and smaller size of mastoid cavity after surgery. The findings showed that also, presence of granulation tissue (OR: **0.28**; p-value: **0.020**) and intact Eustachian tube (OR: **3.2**; p-value: **0.040**) were positively associated size of mastoid cavity.

Table 4: Factors associated with healing outcome (Size of meatal opening) among the study participants underwent mastoidectomy for Chronic Suppurative Otitis Media in the department of ENT at a tertiary care hospital, South India (N= 67)

Sl.no	Variables	Size of meatal opening n (%)		OR	p-value*
		≤ 2.4 mm	> 2.4 mm		
A. Socio-demographic and clinical factors					
1	Age categories				
	≤35 years	18 (52.9)	16 (47.1)	1.06	0.907
	>35 years	17 (51.5)	16 (48.5)		
2	Gender				
	Female	15 (53.6)	13 (46.4)	1.20	0.853
	Male	20 (51.3)	19 (48.7)		
3	Body mass Index				
	Underweight	15 (55.6)	12 (44.4)	-	0.349
	Normal	12 (42.9)	16 (57.1)		
	Overweight	8 (66.7)	4 (33.3)		
4	SOCIO ECONOMIC STATUS(MODIFIED PRASAD SCALE)				
	Middle class	6 (54.5)	5 (45.5)	1.12	0.867
	Lower class	29 (51.8)	27 (48.2)		
5	Comorbidities				
	Present	25 (61)	16 (39)	2.50	0.072
	Absent	10 (38.5)	16 (61.5)		
6	Duration of symptoms				
	≤14 months	8 (19.5)	33 (80.5)	0.28	0.020
	>14months	12 (46.2)	14 (53.8)		
7	Mode of onset				
	Gradual	29 (53.7)	25 (46.3)	1.35	0.625
	Sudden	6 (46.2)	7 (53.8)		
8	Culture pattern				
	Staphylococcal aureus	11 (55)	9 (45)	-	0.407

	Streptococcus pyogenes	15 (60)	10 (40)		
	Pseudomonas	9 (40.9)	13 (59.1)		
B. Preoperative findings in ear with CSOM					
1	Polyp				
	Present	8 (66.7)	4 (33.3)	2.07	0.092
	Absent	27 (49.1)	28 (50.9)		
2	Cholesteatoma				
	Present	34 (54)	29 (46)	3.51	0.261
	Absent	1 (25)	3 (75)		
3	Granulation tissue				
	Present	14 (50)	14 (50)	0.86	0.756
	Absent	21 (53.8)	18 (46.2)		
4	Eustachian tube				
	Intact	19 (55.9)	15 (44.1)	1.35	0.544
	Dysfunction	16 (48.5)	17 (51.5)		
5	Retraction of pars tensa				
	Grade 1	3 (50)	3 (50)	-	0.513
	Grade 2	18 (54.5)	15 (45.5)		
	Grade 3	14 (53.8)	12 (46.2)		
	Grade 4	0 (50)	2 (100)		
6	Retraction of pars flaccida				
	Grade 1	2 (50)	2 (50)	-	0.720
	Grade 2	11 (52.4)	10 (47.6)		
	Grade 3	21 (55.3)	17 (44.7)		
	Grade 4	1 (25)	3 (75)		
C. Type of Mastoidectomy					
	Canal Wall Up	28 (50.9)	27 (49.1)	0.74	0.64
	Canal Wall Down	7 (58.3)	5 (41.7)		
D. Post operative status					
1	Merchant grading				
	Grade 0	16 (48.5)	17 (51.5)	0.74	0.544
	Grade 1	19 (55.9)	15 (44.1)		
2	Epithelization of graft				
	Present	28 (49.1)	29 (50.9)	0.41	0.223
	Absent	7 (70)	3 (30)		
3	Air Bone Gap				
	≤ 20 dB	22 (51.2)	21 (48.8)	0.89	0.813
	> 20 dB	13 (54.2)	11 (45.8)		
4	Ossicular status				
	Type 0	8 (50)	8 (50)	-	0.960
	Type A	15 (51.7)	14 (48.3)		
	Type C	12 (54.5)	10 (45.5)		
4	Granulation tissue				
	Present	19 (46.3)	22 (53.7)	0.54	0.225
	Absent	16 (61.5)	10 (38.5)		
5	Mastoid cavity				
	Small	22 (46.8)	25 (53.2)	2.11	0.173
	Large	13 (65)	7 (35)		

Table no.4 depicted various clinico-social and surgical factors related to the healing outcome as measured by the ear discharge at third month follow up after Tympanomastoidectomy. A significant association was appreciated between duration of symptoms and ear discharge (OR: **0.23**; p-value: **0.004**).

Discussion

At the third month of follow-up following the tympan mastoidectomy, the fascial graft's existence of epithelization served as a gauge for the factors that influenced the healing process. Preoperative polyp and postoperative mastoid cavity size were significantly correlated with fascial graft epithelization. According to the results, the epithelization of the fascial graft was favorably correlated with the lack of preoperative polyps (OR: 0.25; p-value: 0.048) and a smaller mastoid cavity (OR: 0.5; p-value: 0.001). The same conclusions raised by the study of Chhapola et al. (20) After surgery, there was a substantial correlation between the existence of epithelization in the graft (OR: 0.18; p-value: 0.001) and a smaller mastoid cavity. The results demonstrated a positive correlation between the size of the mastoid cavity and the presence of granulation tissue (OR: 0.28; p-value: 0.020) and an intact Eustachian tube (OR: 3.2; p-value: 0.040). Ruixiang et al. (21) and Hiroaki et al (22) explained the potential connection between Eustachian tube dysfunction and a poor success rate.

The ear discharge was estimated at the third month follow-up after Tympanomastoidectomy and graded according to Merchant grading. A significant association was appreciated between the duration of symptoms and ear discharge (OR: **0.23**; p-value: **0.004**). There was no significant association established between postoperative Merchant's grades with any of the risk factors.

Conclusion

It was concluded that there was a presence of epithelization in the fascial graft and obliteration of discharging cavity as denoted by improvement in the Merchant's grading. A very strong association was between the presence of epithelization in graft and the smaller size of the mastoid cavity after surgery. A significant association was seen between the duration of symptoms and post operative cavity obliteration.

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