Study of different types of graft materials use in type - I tympanoplasty

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Abstract

Background: The present study was undertaken to compare the results of various autogenous tissues as grafting materials for the repair of the tympanic membrane defect. As all the materials used previously were not easily available. So the present study comprised of the materials, which were easily available in adequate amount. These were temporalis fascia, tragal perichnodrium, areolar tissue and Ear lobule fat. Methods: In 100 subjects tympanoplasty operation was performed in 100 ears. The age of subjects ranged from 11 years to 50 years with mean age being 28.9 years. 33 cases were male and 67 cases were female. Majority (62%) of them were residing in rural areas and rest (38%)were from urban population. The period of study was from May 2015 to Dec 2016 starting from the pre-operative assessment to postoperative follow up all findings were noted in specific proforma. All of them attended ENT outpatient department of M.G.M. Medical College and L.S.K. Hospital, Kishanganj, Bihar, with the chief complaints of discharging ear of varying duration. Slight impairment of hearing of varying degree was also complained of. Few of them presented with active stage of the disease and they were treated conservatively so that they attained the criteria as mentioned previously for myringoplasty operation of the present study. Results: Temporal fascia - None of the operated case reached the excellent result of post operative A-B gap closure by 0 - 10 dB. 23 cases showed good A-B gap closure of 11 - 20 dB followed by 9 cases with fair A – B gap closure of 21 - 30 dB and 5 cases showed poor result of >30 dB A-B gap closure. Tragal perichondrium - None of the operated case reached the excellent result of post operative A-B gap closure by 0 -19 dB 5 cases showed good A-B gap closure by 11 -20 dB, followed by 3 cases of fair A-Bgap closure 21 -30 dB and 1 case of poor result with >30 dB A- B gap closure. Areolar tissue – None of the operated case reached the excellent result of post operative A-B gap closure by 0 -10 dB. 6 cases showed good A-B gap closure by 11 - 20 dB, followed by 2 cases of fair i.e. 21 - 30 dB A- B gap closure. Ear Lobule fat - 8 out of 45 cases showed excellent result with post operative A-B gap closure by 0 - 10 dB followed by 32 cases with good A-B gap closure by 11 - 20 dB, followed by 5 cases of fair i.e. 21 - 30 dB A-B gap closure. Conclusion: Tympanoplasty using Fat from ear lobule has high success rate of 90% for tiny small perforations. It is an office procedure which is cost effective with minimum post operative morbidity. But it is an underused procedure. We should practice it more for the benefit of our patients. Further long term study with more number of patients and verities of graft materials are necessary to achieve detailed and accurate results.

Key Words: Temporal fascia, Tragal perichondrium, Areolar tissue, Ear Lobule fat.

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INTRODUCTION

Otologists have attempted to close tympanic membrane perforation for 300 yrs. It has been in the past 50 yr. that closure with autograft material has been consistently successful. Homografts have seen successful for the past 35 yrs. Various trials to close the tympanic membrane perforation had been performed till the date by various methods and by many authors. Many of them in early days tried to promote the healing of the perforation by cautery using different chemicals, like Silver nitrate bead by Rossa (1876), and Politzer (1885): Trichloroacetic acid by Okuneff (1895). Regarding covering of the

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tympanic membrane perforation various prosthetic materials used like Pig bladder mucosa by Marcus Banzer (1640), wall of fish air bladder by Autenreith (1815). Moist cotton ball was used by Yearsley (1848). Toynbee (1853) described a covering containing of thin rubber membrane with silver thread attached to its centre. This could be used by patient himself/herself. Other prosthetic covering used by many authors like Paper patch by Blake (1887), thin varnish membrane by Dohlman (1923), cellophane foil fixed to the drum by ointment by Nasiell (1928, 1938). Majority of the cases attending the otolaryngology outpatient department are complaining of ear problem with or without discharge associated with impairment of hearing. Most of them belonged to lowsocio economic group and live in rural areas. They are of varving age starting from the very younger age group to middle aged person. They also suffered from various duration of illness. Few of them can only remember the first evidence of discharging episode of ear. It has been seen that sometime with disappearance of the discharge, they felt that the diseased ear healed up completely, but again with recurrence of discharge they sought for better treatment. Many of them suffered from longstanding disease and with safe variety of tubotympanic type of chronic suppurative otitis media, with central perforation. Clinically the term chronic suppurative otitis media generally refers to middle ear infection with nonhealing perforation of the tympanaic membrance (Brown et al. 1988). In its early stage of this disease if it is not treated properly than in can cause further damage of the middle ear structures and thereby prone to have the chance of other serious complication on later life. Being ENT surgeon, one cannot avoid his/her responsibility to help the poor sufferer. Though, it is a global problem but more in the developing countries like our India. So, it is our duty to do the right things in right time so that we can arrest the disease process and restore functioning integrity of middle ear. In treating the "Chronic ear" modern otological surgery aims to produce a safe ear with improvement in hearing (Zaman et al 1988). Various trials had been made to combat the disease process, to repair the drum perforation and to restore the hearing. Myringoplasty is the simple procedure among all the (1960) tympanoplastic surgery. Wright stated "Myringoplasty which could better be called 'Wullstein type I tympanoplasty' and where a perforation of the tympanic membrane is the only defect in the ear structure. Most authorities consider it the most successful of various tympanoplasties". According to House (1960)'Myringoplasty is the procedure of surgery closing a perforation in the eardrum". So myringoplasty can be performed in the early stage of dry central perforation of varying size and impaired hearing (Palva et al, 1969).

This operation thereby could restore the vibratory area of the membrane and afford round window protection. Thus improving hearing and lessening tinnitus, it might also lessen the susceptibility of the middle ear mucosa to infection via Eustachian tube and external auditory meatus (Shambaugh *et al*, 1980). This present study was undertaken to compare the easily available autogenous graft material i.e. temporalis fascia, tragal perichondrium areolar tissue and ear lobule fat with regard to their suitability for use as tympanic membrane grafts. The study also compared the result of these grafts in various aspect though of prime interest was the permanent closure of tympanic membrane perforation and hearing restoration of the successfully grafted ear.

MATERIAL AND METHODS

The present study was carried out in the otolaryngology Department of M.G.M. Medical College and L.S.K. Hospital, 100 subjects were selected from the outpatient department of otolaryngology, 47 subjects were male and 63 were female ranging from 13 to 48 years. All the subjects were judged clinically and with investigations i.e. routine haemogram, X-ray of mastoid (Law's lateral oblique view), X-ray of paranasal sinuse (Occipito-mental view) and special test where required. Pure tone audiometry was performed in both air conduction and bone conduction in all subjects. Selection criteria's of the individual for this present study were;

- 1. Adult subjects were preferred.
- 2. Chronic suppurative otitis media with central perforation though location and size of the perforation were variable.
- 3. Dry ear for at least three months.
- 4. Other ear was normal.
- 5. Pure–conductive type of deafness was confirmed by pure–tone audiometry.
- 6. Except the ear disease there was no other disease condition, which could affect the results of the study.

Before operation every ear was inspected under operative microscope. In this study group tympanoplasty operations were performed using various autogenous tissues as grafting materials i.e. temporalis fascia were used in 36 ears, tragal perichodrium used in 9 ears, areolar tissue in 9 ears, and Ear Lobule fat in 46 ears. All the selected 100 ears were operated under operative microscope model Zeiss OPMI-1 using the magnification of 0.4 to 0.6 with 12.5 x eye piece and 200mm lens. 100 ears were operated under local anaesthetic infiltration with 2% lignocaine in adrenaline (1:1,00,000). Inj. Pethidine intramuscularly. In. phenargan (75mg)(25mg)intramuscularly. The premeditation was administered $\frac{1}{2}$ an hour before the patient was taken to operation theatre.

10 ears were operated under general anaesthesia with endotracheal intubation with hypotensive technique. After shaving and antiseptic dressing of the planned temporal area. Subjects were taken to operation theatre. The subject was placed supine on the operating table with the head supported on a rubber ring and rotated to the opposite side. The entire table was tilted head up slightly (about 30°). The neck was in extended position. Antiseptic dressing with Betadine solution and rectified spirit then the operated area was covered with sterile drapes. Then local anaesthetic infiltration of the ear was done in 90 cases. Local infiltration in the selected sites (temporal area – for temporalis fascia and areolar tissue, tragal region- for tragal perichondrium, and ear lobule for fat was also done.

Graft Preparation

First of all graft preparations were performed according to the graft material as followed: Temporalis fascia and Areolar tissue was taken out from the same site of operated ear by extension of postauricular incision for Type –I.Tympanoplasty. The temporalis fascia areolar tissue was identified and taken out of adequate size. Perichondrium was taken from the tragus of the same ear. A vertical incision was made lightly on medial aspect of the tragus starting from the incisura terminlis to the intertragic notch. Then the tragus was separated from the surrounding soft tissues. The whole of the tragus with its perichondrium was cut from the rest of the aural cartilage and taken out enmass. The perichondrium was then separated from the cartilage. The cartilage was then placed again in its normal position; the incision was closed by suture in layer. The perichondrium graft is preserved and kept on a glass slide.

Fat from ear lobule: A small 6 - 8 mm horizontal incision was gives on the skin behind the ear lobule of same ear. Adequate amount of fat according to the size of perforation was collected from ear lobule and kept in normal saline.

Operative Procedure

The edge of the perforation of the tympanic membrane was trimmed out in 42 cases of large and moderate size perforation using post aural approach and deepithelization by 15% Trichloroacetic was done in 58 cases of small (Tiny) perforations by applying it circumferentially with Zollner needle permeatelly. A curve incision was made starting from the upper attachment of the auricle and continuing in the postaural fold downward upto the tip of the mastoid process. The incision then deepened to periosteum. The pinna along with the elevated posterior meatal skin then retracted anteriorly with Plester's retractor. The tympanomeatal flap was then elevated. The handle of the malleus was freed from the tympanic membrane. The medial aspect of the perforated tympanic membrane was then inspected for any remaining squamous epithelium, if any, removed meticulously.

Graft Placement

After elevating the posterior tympanomeatal flap in 42 cases of large and moderate size perforation. The graft so preserved: Temporalis fascia, Tragal perichondrium and areolar tissue was placed by underlay technique i.e. the graft material was placed in between the handle of the malleus and the elevated tympanomeatal flap. The tympanomeatal flap was then reflected back over the grafting tissue to its original position. The ear canal was then filled up with Gelfoam soaked with ciprofloxacin cas drop. The canal was packed lightly with slender roller gauze impreganted with Soframycin ointment. Light bandage was applied.

Postoperative

Post-auricular stitches were removed after 7 days. The light canal pack was removed after 10 days without disturbing the Gelfoam layer. After 3 weeks the ear canal was inspected for the condition of external canal and position of the graft with vascular pattern. Then follow up were carried out with specific proforma routinely at 6 weeks, 12 weeks, 6 months interval. After 12 weeks, pure tone audiometry was performed on successful closure cases. The results of change in hearing were compared with preoperative audiometric values.

RESULTS

100 Patients suffering from unilateral chronic suppurative otitis media had undergone Type -I tympanoplasty. 90 cases were operated under local anaesthesia and 10 cases were operated under general anesthesia. Four types of autogeneus tissues were used as grafting material. Temporalis fascia was used in 36 cases, Tragal perichondrium in 9 cases, Areolar tissue in 9 cases, and Fat from Lobule of same ear in 46 cases. Routine hemogram, X-Ray Mastoids (Law's Lateral oblique view), X-ray paranasal air sinuses (Occipito-mental view) X-Ray Nasopharynx and pure tone audiometry was performed in both air and bone conduction. Both pre and post operative audiometric results were compared to find out the hearing change with these four graft materials. The age of the subjects in this present study ranged from 13 years to 48 years. The maximum numbers of subjects were in age group 21-30 year, followed by 24 subjects in 10-20 years, 34 subjects in 21-30 years, 30 subjects in 31-40 years, 12 subjects in 41-50 years, of age group respectively. Mean age was 28.9 years.

Table 1: Age Distribution			
Age (in years)	No. of subjects		
0-10	-		
11-20	24		
21 – 30	34		
31 - 40	30		
41 - 50	12		

The age of the subject in this present study ranged from 13 years to 48 years. The maximum numbers of subjects were in age group 21-30 year, followed by 30 subjects in 30-40 years, followed by 24 and 12 subjects in 11-20 year and 40-50 years age group respectively. Mean age was-28.9 years.

Table 2: Distribution of size and size of central perforation			
Small < 50% area of Tympanic Membrane			
A Antorior	Tiny < 5% area - 30 cases Perforation		
A. Anterior	Moderate > 5% area- 8 cases		
D. Destariar Tiny < 5% area - 14 cases Perforation			
B. POSLEHOI	Moderate > 5% area- 6 cases.		
	50% area of tympanic membrane Big central		
Large	Perforation = 42 cases.		

The perforation of various sizes and sites of pars tensa were recorded in study. All of them had central perforation. They were divided into small < 50% area of tympanic membrane and large > 50% area of tympanic membrane. Small perforations 58 in number were divided in to Anterior (Tiny <5% area – 30 cases, Moderate > 5% to < 50% 8 cases) and posterior (Tiny < 5% area 14 cases and moderate > 5% to < 50% area 6 cases) according to the position in relation to handle of maleus. Large perforations contained only central perforation occupying >50% area of tympanic membrane of which 42 cases were seen.

X- Ray Mastoids Sclerotic - 76 cases Cellular - 24 cases	Table 3: Pre – Opera	tive Investigation Profile
	X- Ray Mastoids	Sclerotic - 76 cases Cellular - 24 cases

	Hazy - 23 cases
X-ray PNS	(Mucosal Thickening)
	Normal - 77 cases.

In all 100 cases haemogram values were within normal limits. X-Ray mastoids (Law's lateral oblique view) revealed sclerotic pattern in 76 cases and cellular pattern in 24 cases. X-Ray paranasal sinuses (occipitomental view) revealed Hazy (mucosal thickening) in 23 cases while 77 cases were normal. They were treated conservatively with nasal decongestive drops and antibiotics. No. cases, however, showed abnormal X-Ray nasopharynx or gross deformity of septum. None of them

required any special tests. Pre operative and post operative audiometric assessment was performed in all 100 subjects both in air and bone conduction. There audiometry values were averaged at 500 Hz, 1KHz, 2KHz, 3KHz, 4KHz. Conductive deafness was detected in all cases. Cochlear reserve was found to be within normal limit in all cases. Average air conduction threshold ranged from 22.8 dB to 47.7dB with the mean value of 32.3 dB. The average bone conduction threshold ranged from 6.6 dB to 13 dB and the mean value 8.30 dB. The average air bone gap (A-B gap) was noted within range from 16.2 dB to 41.1 dB with the mean value 27.6 dB.

Tuble 4. Impairment of freating in relation to rige	n to Age	Relation	in	Hearing	of	Impairment	Table 4:	
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.ge	Group	Age (Year)	Average A-B gap range (dB)	Mean A-B gap (dB)
-	I	11-20	25.0 to 26.6	26.2
tion	II	21 - 30	24.6 to 30.0	26.3
	Ш	31 – 40	27.2 to 35.0	28.9
n	IV	40-50	25.3 to 41.0	35.6

In 24 cases of group I (11-20 years) average air – bone gap ranged from 25.0 dB to 26.6 dB with mean average 26.2 dB. In group II (21-30 yrs) 34cases had average air bone gap ranging from 24.6 dB to 30.0 db with mean of 26.3. In group (III) (31- 40 year) 30 cases and group IV (41 – 50 years) 12 cases average air bone gap ranged 27.2 dB to 35.0 dB and 25.3 dB to 41dB with mean average 28.9 dB and 35.6 dB respectively.

Table 5: Audiometric	assessment with	respect to	site of
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perforation				
	No of cases	Average A – B gap range (d B)	Mean A – B gap (d B)	
Anterior perforation	36	18.3 - 31.2	22.7	
Posterior perforation	22	19.6 - 32.3	23.3	
Central perforation	42	25.9 - 41.1	38.3	

Out of 100 cases 36 cases were of anterior perforation followed by 22 cases and 42 cases of posterior and central perforation. The average air- bone gap ranges from 18.3 (d B) to 31.2 (d B) with mean of 22.7 (d B) for anterior perforation. The average air bone gap for posterior and central perforation ranged from 19.6 to 32.3 (d B) and 25.9 to 41.1 (d B) with mean of 23.3 and 38.3 (d B) respectively. These sites were decided according to their relation to handle of maleus.

50

	р	erforation	
	No. of	Average A-B gap	Mean A-B
	cases	range (d B)	gap (d B)
Small			
perforation	58	18.9 to 31.9	22.9
< 50% area			
Large			
perforation	42	25.9 to 41.1	38.3
>50% area			

Out of 100 cases 58 were of small size perforation that is <50% of tympanic membrane area. The average air-bone gap range was 18.9 to 31.8 (d B) with mean of 22.9 dB. Remaining 42 cases were of large perforation occupying >50% of tympanic membrane area. The average air- bone gap ranged 25.9 to 41.1 (d B) with mean of 38.3 (d B). These results were irrespective of graft material used.

Table	7: Graft materials used in	type–I Tympano	plasty
	Materials used	No. of cases	
	Temporalis fascia	36	
	Tragal perichondrium	9	
	Areolar tissue	9	
	Fat from ear lobule	46	

In the present study of 100 cases Temporalis fascia was taken in 36 cases followed by Tragal perichondrium with 9 cases followed by areolar tissue with 9 cases and fat from same ear lobule in 46 cases. The results in various aspects were observed as mentioned below. Criteria for assessment of hearing improvement as proposed by Kartush in Glosscock 5th edition was used

Closure of A-B gap with in

Table 8: Results	of	typ	e –l	tyn	пра	noplasty	with	respect	to	age
		~	4.0	10		e 11				

On Type -I tympanoplasty successful closure of 22 (93%) out of 24 cases of perforation in age group 11 - 20 years with mean improvement of 9.3 dB followed by successful closure of 32 (95%) out of 34 cases of perforation. In 21 – 30 years age group with mean hearing improvement of 9.8 dB was seen. There was 26 (87%) out of 30 cases who showed successful closure of their perforations in age group 31 - 40 years followed by successful closure of 9 (77%) out of 12 cases in age group 41 - 50 years with mean hearing improvement of 8.6 and 8.27 dB respectively.

Table 9: Results of type -I Tympanoplasty with different sites of

perforation							
Perforati on site	No. of cas es	Successf ul closure of perforati on	Mean preoperat ive A-B gap (dB)	Mean post operati ve A-B gap (dB)	Mean improvem ent in hearing (dB)		
Anterior	36	33 (93%)	22.7	15.5	7.2		
Posterior	22	20 (92%)	23.3	15.8	7.5		
Central	42	37 (89%)	38.3	28.4	9.9		

In 33 (93%) out of 36 cases of anterior perforation successful closure of perforation and mean improvement in hearing of 7.2 dB was noted, followed by 20 (92%) out of 22 cases of posterior perforation with mean improvement in hearing of 7.5 dB. There was 37 (89%) out of 42 cases of central perforation who showed successful closure and mean improvement of hearing was 9.9 dB.

Table 10: Results of typ	e -l Tympanoplasty v	with different sizes of
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	0 – 10 dB	Excellent				per	foration		
	11 – 20 dB	Good	_				Mean	Mean	
	21 – 30 dB	Fair			No.	Successful	pre	post	Mean
	> 30 dB	Poor		Perforation	of	closure of	operative	operative	improvement
e ai	r bone gap o	of 11 – 20 d	B or below was	size r below was	cases	perforation	A-B gap (dB)	A-B gap (dB)	of hearing (dB)

58

42

Small

Large

Post operative air bone gap of 11 considered successful.

Age (year s)	No. of case s	Successful closure of perforatio n	Mean pre – operativ e A-B gap (dB)	Mean Post operativ e A-B gap (dB)	Mean improveme nt in hearing (dB)
11 – 20	24	22 (93%)	26.2	16.9	9.3
21 – 30	34	32 (95%)	26.3	16.5	9.8
31 – 40	30	26 (87%)	28.9	20.3	8.6
41 –	12	9 (77%)	35.6	27.3	8.27

Out of 58 cases of small perforation 53 (92%) cases showed successful closure with mean hearing improvement of 7.3 dB and out of 42 cases of large perforation, 37 (89%) cases showed successful closure of perforation with mean hearing improvement of 9.9 dB.

22.9

38.3

15.6

28.4

53 (92%)

37 (89%)

Table 11: Results of type -I Tympanoplasty with respect to mastoid

	pneumatizatio	on
Mastoid cellular	No. of ears	Successful closure of
pattern	operated	perforation
Sclerotic	76	70 (93%)
Cellular	24	20 (86%)

73

9.9

Out of 76 operated cases of sclerotic mastoid 70(93%) showed successful closure of perforation. And out of 24 operated cases of cellular mastoid 20 (86%) showed successful closure of perforation.

Table 12: Results of type -I	Tympanoplasty with	different grafting
	materials	

		mat	critais		
		Successf	Mean	Mean	Mean
	No.	ul	pre	post	improvem
Material	of	closure	operati	operati	ont of
used	cas	of	ve A-B	ve A-B	booring
	es	perforati	gap	gap	(dB)
		on	(dB)	(dB)	(ub)
Temporalis fascia	36	34 (95%)	36.2	26.9	9.3
Tragal perichondri um	9	8 (90%)	33.0	25.5	8.5
Areolar tissue	9	7(80%)	33.1	24.2	8.9
Fat from ear lobule	46	41 (90%)	21.65	14.7	6.85

34 (95%) out of 36 cases showed successful closure using temporalis fascia with mean hearing improvement of 9.3 dB followed by 8 (90%) out of 9 cases who showed successful closure using tragal perichondrium with mean hearing improvement of 8.5 dB. Successful closure of 7 (80%) cases out of 9 cases using Areolar tissue was noticed with 8.9 dB mean hearing improvement followed by success of 41 (90%) out of 46 cases using fat from ear lobule with mean hearing improvement of 6.8 dB.

Tak	Table 13: Overall successful closure in type -I Tympanoplasty						
Operated ear Successful closure of perforation							
	100	90 (90%)					

90 out of 100 cases showed successful closure of their perforation using four different autogenous graft materials irrespective of age of the subject, size and site of perforation or mastoid pneumatization.

DISCUSSION

Type – I Tympanoplasty operations were performed by Four graft materials (i) temporalis fascia in 36 cases (ii) tragal perichondrium in 9 cases and (iii)) Arcolar tissue 9 cases (IV) Ear lobule fat 46 cases and followed up for 3-6 month. Postoperative pure tone audiometry was performed using the same frequencies as pre-operatively and the air bone gap (dB) and the average threshold of hearing was recorded. These tests were performed only on successful closure cases after 12 weeks follow up period (Mendel *et al* 1980). The audiometric values were then compared with preoperative values. Various authorities used different criteria for assessing the results of myringoplasty like Proctor (1960) advocated a social hearing method; Portman (1963) favoured a hearing gain method. Elbroud (1970) used the mean air bone gap for each frequency. Booth (1972) expressed that subjective improvement of the patient and the air conduction gain was superior to the air bone gap. He mentioned that sometimes there was improvement in bone conduction also after myringoplasty. The successful heaving improvement in this study was considered according to criteria proposed by kurtush in Glasscock 5th edition as explained earlier. If post operative air bone gap was 11-20 dB or below, that is in the good range according to this criteria then we considered our tympanoplasty as successful.

Age	No. of	Successful	Successful
(yrs)	cases	cases	hearing
11-20	24	22 (93%)	16 (68%)
21-30	34	33 (95%)	29 (84%)
31-40	30	26 (87%)	22 (74%)
41-50	12	9 (77%)	7 (60%)

In the present study maximum successful closure of perforation 95% (33 cases) with maximum successful hearing improvement of 84% (29 cases) was in 21-30 yrs age group. In 11-20 yrs age group successful closure was of 93% perforations with successful hearing in 68% followed by 31-40 yrs age group with successful closure of 87% perforations and successful hearing in 74%. The least successful was 41-50 yrs age group with successful closure of 77% perforations and successful hearing in just 60%. Storahan et al (1971) mentioned that graft failure and poor hearing were observed more common in older age group (85% success in 21-30 yrs and 58% success in 31-40 yrs) where as successful closure and hearing improvement were universally good in youngest age group. In the present study of 100 cases using four autogenous graft materials successful closure was seen in 90% cases with successful hearing of 74% cases. Hough (1970) in his study achieved hearing improvement any average 81.1% ay cases.

CONCLUSION

Tympanoplasty using Fat from ear lobule has high success rate of 90% for tiny small perforations. It is an office procedure which is cost effective with minimum post operative morbidity. But it is an underused procedure. We should practice it more for the benefit of our patients. Further long term study with more number of patients and verities of graft materials are necessary to achieve detailed and accurate results.

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