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Type 1 Tympanoplasty- Impact of Perforation Size and Site on Closure and Audiological Improvement

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ABSTRACT:

Introduction: Tympanoplasty is the procedure of choice for the management of Chronic Suppurative Otitis Media of Tubotympanic type.

Methods: Type 1 Tympanoplasty was done in 100 cases of chronic suppurative otitis media (safe type) by underlay technique using temporalis fascia graft via postaural or permeatal approach. All the patients fulfilled the accepted criteria for tympanoplasty.

Results and interpretation: The successful closure of tympanic membrane perforation was higher in medium (94.33%) & small perforations (89.28%) than the larger perforations (78.94%). However the success percent was not statistically significant. The successful closure of tympanic membrane perforation was 100% in case of posterior placed perforations and was also relatively high in central perforations (90.27%) than the anterior perforations (75%). However this difference in tympanic membrane closure success based on site of perforation was also statistically insignificant. The success rate with post auricular approach (91.46%) was not statistically different from the success rate with the permeatal approach (83.33%). The success rate in smokers (66.66%) was significantly lower than in non-smokers (96.20%). Postoperative patients showed significant improvement in hearing following successful closure of tympanic membrane perforation. Larger perforations have more audiological gain than medium and small sized perforations also showed more audiological gain for central and posterior perforations than anterior perforations. No otitis media or iatrogenic sensorineural hearing loss in a follow-up of three months.

Conclusion: Follow-up of the cases was done at 6 weeks and 12 weeks after operation. The overall success rate for graft take up was 90% at the end of 3 months of follow-up.

Keywords: Chronic Suppurative Otitis Media, sensorineural hearing loss, Tympanoplasty, tympanic membrane perforation, temporalis fascia graft.

Introduction

Chronic suppurative otitis media is a very common disease in developing countries affecting mainly the younger population. The disease is associated with various factors like low socio economic condition, overcrowding, lack of concern about hygiene, poverty among others. Patients suffering from chronic suppurative otitis media of tubotympanic type with permanent perforation are handicapped not only because of hearing loss but also from recurrent otorrhea.

Tympanoplasty type 1 is defined as simple surgical repair of a tympanic membrane perforation without ossicular reconstruction.

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Perforation of tympanic membrane with intermittent discharge and hearing loss of conductive type are the indication of Tympanoplasty type 1. The aim of the operation includes perforation closure with a dry stable grafted membrane and improvement in hearing levels. The concept of surgical repair of tympanic membrane perforation was started by Berthold (1878)[1] with thick skin graft by overlay technique. Wullstein and Zollner[2] rediscovered the procedure using split skin grafts. Since then different techniques and graft materials have been used. Grafting the tympanic membrane with autologous temporal fascia helps in restoration of its integrity as fascia is a thin, non-shrinking and a tissue with low metabolic rate resembling tympanic membrane in texture and structure. Both the techniques overlay and underlay have been used with variable success.

Success rate in the range of 90% are frequently quoted. Despite the high success rate and the routine nature of the procedure, the effect of many influencing factors remains unresolved. These include the age of the patients; size of the perforation, site of the perforation, length of the ear has been dry prior to surgery, the presence of infection at the time of surgery and status of the opposite ear. [3-9]

The size of the perforation often has been mentioned as a determining aspect. Some reports indicate that large perforations are more prone to the reperforation. The size of perforation was found to be related to a worse prognosis in large defects.[11, 12]

Several authors have reported a higher incidence of graft failure in anterior perforations. This has been attributed to a combination of factors, including anterior perforation being technically more challenging to repair owing to more difficult access, resulting in an increased risk of graft misplacement, the anterior portion of tympanic membrane also have relatively poor perfusion.[12,13,14]

There are three recognized surgical approaches accessing the tympanic membrane for myringoplasty; endaural, postauricular, permeatal/transcanal. In general, the site of perforation and surgeon's experience determine the favored approach. The endaural approach is preferred for posteriorly based or central perforations, whereas the post-aural approach allows more superior access to anteriorly based perforation. The permeatal approach is an option for small central perforation in which the ear canal is wide enough to allow good visualization of the tympanic membrane through an ear speculum.

The objectives of the study are firstly to investigate the impact of perforation size & site, secondly to investigate the impact of other variables (previous tympanoplasty, approach used, status of opposite ear and smoking status) and thirdly to determine audiological gain following successful closure of tympanic membrane perforations.

MATERIALS AND METHODS

The study was prospective in nature and was carried out in the outpatient department of otorhinolaryngology, Rao Tularam Memorial Hospital, Jaffarpur, New Delhi from July 2016 to August 2017.

The assessment of the patients was established on the basis of history, clinical examination and audiometric test- pre operative assessment and post-operative follow up was done. The complete ontological evaluation was directed to assess the exact nature and extent of disease, any complications and audiological status. 100 patients (of either sex) who fulfilled the inclusion criteria were considered for the study.

Inclusion criteria included were chronic suppurative otitis media, mild to moderate conductive hearing loss, patients between 15 to 45 years of age, and adequate cochlear reserve.

Exclusion criteria included was patients having tympano-sclerosis, ossicular chain disorder, presence of cholesteatoma and retraction pocket, sensorineural deafness, with complications of chronic suppurative otitis media, patients having sinonasal inflammation and patients having any systemic illness such as Diabetes Mellitus, Hypertension etc.

The patients were classified as per the following criteria:

1. The **size of the perforation** was graded as small (less than 50%), medium (50-75%) and large (> 75%) of the total tympanic membrane area.
2. **Site of perforation**: Perforation was classified as *anterior*, *central* and *posterior*.
3. Patients were also grouped according to **surgical approach**, as smokers or non-smokers, previously operated tympanoplasty or not, and unilateral or bilateral.

A thorough history, clinical examination, investigations and tests as mentioned in the Performa were carried out.

Technique:

Permeatal approach: On patients having adequately wide external auditory meatus permeatal approach was used. Under the operating microscope, the edges of the perforation were freshened and perforation was made raw with the help of endomeatal/circular knife. A horizontal incision was given starting from 12 O'clock position extending laterally in the whole of the posterior meatal wall upto 6 O'clock position and tympanomeatal flap was elevated. Tympanic sulcus was identified and tympanomeatal flap placed anteriorly. Undersurface of handle of malleus made raw. A slightly dried temporalis fascia graft which was prepared earlier, introduced posteriorly and spread anteriorly under the tympanomeatal flap and the annulus, medial to the denuded drum remnants and lateral to the handle of malleus. Middle ear cavity filled with medicated gelfoam to prepair bed. Tympanomeatal flap was replaced over the graft so that the cut edge of the skin was adjacent to the original line of incision. Small pieces of gelfoam soaked with antibiotic ointment were placed over the graft and the reposed skin of external auditory canal.

Postaural approach: Under anaesthesia and aseptic conditions parts were cleaned and draped. Postaural incision was given just behind the postauricular sulcus starting from the attachment of pinna above and to the mastoid process below. The incision was extended upwards and mastoid wound retractor applied. A right angle elevator was put at the upper end and temporalis fascia over the temporalis muscle exposed. About 1-2 ml of 2% xylocaine with adrenaline was infiltrated below the fascia and temporalis fascia graft was harvested, spread and prepared accordingly. A T-shaped incision was given deep upto the bone cutting the mastoid Periosteum which was retracted posteriorly and anteriorly. Posterior meatal wall was elevated and a cut was given in posterior meatal wall medial to the bony and cartilaginous junction. A gauze pack was introduced in the canal and was taken out from the cut given in posterior meatal wall. The pinna was retracted anteriorly with it and mastoid wound retractor applied. Under the operating microscope, a horizontal incision was given starting from 12 O'clock position extending laterally in the whole of the posterior meatal wall upto 6 O'clock position and tympanomeatal flap was elevated and rest of the tympanoplasty was done following the steps as described earlier.

Post-operative care and follow-up: Patients were given broad spectrum antibiotics for 5-7 days, analgesics, oral and nasal decongestants and multivitamins. Stitches were removed after 7 days. Patient was observed for improvement in hearing, graft up take and complications, if any, at 3 weeks, 6 weeks and 12 weeks after operation. Gel foam pieces if not absorbed was removed after 3 weeks before assessing the cases.

At 12 weeks, observation on otoscopic examination graft take up was graded as follows:

1. Graft taken up- if no remnant perforation in any quadrant.

2. Graft partially taken- if perforation remains in any quadrant.

3. Graft not taken- if perforation remains as such.

Group 1 was considered as successful closure of perforation while Group 2 & 3 while considered as failure. Audiometry was done post operatively at 6 and 12 weeks and audiological improvement was measured in successfully completed type 1 tympanoplasties.

Data was analyzed by using SPSS 17. Chi-square and paired t-test was used for statistical comparison. P value of < 0.05 was considered significant while p value <0.01 was considered highly significant.

Figure 1: Tympanic Membrane Showing Perforation with Healthy Looking Middle Ear Mucosa

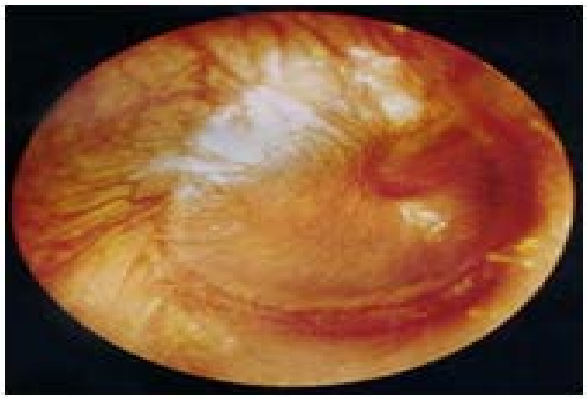

Figure 2- Tympanic Membrane Graft after Six Weeks Post-Operative

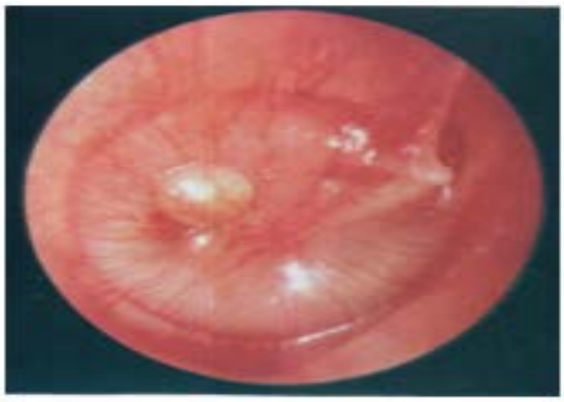

Figure 3: Tympanic Membrane Graph Showing Complete Vascularization After three Months of Tympanoplasty

RESULT

The present study was carried out in the department of Otorhinolaryngology at Jawahar Lal Nehru Medical College and Hospital, Aligarh, Uttar-Pradesh, India for a period of two years from February 2012 to August 2013.

The study included 100 patients who underwent type 1 Tympanoplasty for chronic suppurative otitis media (safe type). Out of total 100 patients 38(38%) were male and 62(62%) were female and highest prevalence was in age group of 15-25 year.This group had 56(56%) of total 100 patients.

Table 1: Classification of cases on the basis of gender

	NO. OF CASES	PERCENTAGE
MALE	38	38
FEMALE	62	62
TOTAL	100	

Table 2: Classification of cases on the basis of age

	NO. OF CASES	PERCENTAGE
15 – 25 YRS	56	56
25 – 35 YRS	32	32
35 – 45 YRS	12	12
TOTAL CASES	100	

Table 3: comparison between rural and urban population

AREA	NO. OF CASES	PERCENTAGE
RURAL	67	67%
URBAN	33	33%
TOTAL	100	

Table 4: showing site of ear involvement

Ear	No. Of cases	Percentage
Right only	22	22%
Left only	37	37%
Both ear	41	41%
Total	100	

Table 5: Showing duration of ear discharge.

Duration of ear discharge	**No. of cases**	**Percentage**
0-2 years	25	25%
2-5 years	14	14%
5-10 years	35	35%
More than 10 years	26	26%
Total	100	100

Table 6: showing symptoms during course of disease from one ear or both ears

Symptom	No. of Cases	Percentage
H/O Intermittent Discharge		
Mucoid	20	20%
Mucopurulent	59	59%
Purulent	15	15%
Blood Mixed	-	-
No Discharge	6	06%
Pain		
Dull Ache	30	30%
No Pain	70	70%
Hearing Loss		
Mild	63	63%
Moderate	37	37%
Itching	18	18%
Vertigo	-	-

Table 7: showing duration of dry ear prior to surgery

Duration	No. of cases	Percentage
6 weeks – 8 weeks	68	68%
More than 8 weeks	32	32%
Total	100	100

Table 8: showing results of tuning fork tests

Test	No. of cases	Percentage
Rinne ′s test Positive Negative	- 100	- 100%
Webers test Lateralized to affected or worse ear Central	86 14	86% 14%
Absolute bone conduction Normal (Equal to examiner)	100	100

Table 9: showing complication in immediate post–operative period (within 7 days)

Complication	No. of Cases	Percentage
Severe Pain	15	15%
Vertigo	9	9%
Wound Infection	4	4%

Table 10: showing delayed complications

Complication	No. of Cases	Percentage
Otitis Externa	8	8%
Granulations	5	5%
Worsening In Hearing	-	-
Stenosis of External Auditory Canal	-	-

Otitis Externa present in 8 cases which were treated with antibiotics. Few patients developed granulation in delayed post-operative period and were treated by cauterizing with trichloroacetic acid.

Tympanoplasty success rates for differing tympanic membrane perforation sizes and other variables.

At 6 weeks and 12 weeks, observation on otoscopic examination graft take up was graded as follows:

Graft taken up- if no remnant perforation in any quadrant.

Graft partially taken- if perforation remains in any quadrant.

Graft not taken- if perforation remains as such.

Group 1 was considered as successful closure of perforation while Group 2 & 3 while considered as failure.

At 6 weeks 90 patients had successful graft uptake and by the end of 12 weeks all 90 of these patients had successful perforation closure.

Table 11: Graft uptake at 12 weeks

Variable	Cases	Perforartion Closure	Success Rate
A. Perforation Size			
1.Small	28	25	89.28%
2.Medium	53	50	94.33%
3.Large	19	15	78.94%
Total	100	90	90%
B. Perforation Site			
1.Anterior	12	9	75.00%
2.Central	72	65	90.27%
3.Posterior	16	16	100.00
Total	100	90	%
			90%

Table 12: The overall success rate (90%)

Technique	Cases	Perforation Closure	Success Rate
1.Post Aural			
2.Per Meatal	82	75	91.46%
Total	18	15	83.33%
	100	90	90%
Revision			
Yes	5	4	80%
No	95	86	90.52%
Total	100	90	90%
Smoker			
Yes	21	14	66.66%
No	79	76	96.20%
Total	100	90	90%
Opposite Ear			
Normal	59	53	89.83%
Diseased	41	37	90.24%
Total	100	90	90%

AB gap (air– bone conduction gap) per case was calculated as mean of AB gap at four frequencies (500Hz, 1000Hz, 2000Hz & 4000 Hz) pre operatively and post operatively.

Pure tone audiometry at 6 weeks:

Table 13: perforation size

Perforation size	No. of cases	Mean pre-operative AB gap	Standard deviation	Mean post-operative AB gap	Standard deviation
Small	25	26.0	1.88	18.2	0.837
Medium	50	32.3	2.27	20.9	1.69
Large	15	38.1	1.03	21.8	1.09

Table 14: perforation site

Perforation site	No. of cases	Mean pre-operative AB gap	Standard deviation	Mean post-operative AB gap	Standard deviation
Anterior	9	20.5	1.37	17.8	1.1
Central	65	33.6	3.42	21.1	2.39
Posterior	16	29.1	1.24	19.0	0.697

Table 15: Mean preoperative AB gap.

Variable	Cases	Pre-op AB gap	Post-op AB gap	Audiometric improvement
A]perforation size				
Small	25	26.0	18.2	7.8
Medium	50	32.3	20.9	11.4
Large	15	38.1	21.8	16.3
B]perforation site				
Anterior	9	20.5	17.8	2.7
Central	65	33.6	21.1	12.5
Posterior	16	29.1	19.0	10.1

Mean pre-operative AB gap of 100 pts. = 31.5 db

Mean post-operative AB gap at 6 wks. = 20.4 db

Pure tone audiometry at 12 weeks

Table 16: Perforation size

Perforation size	No. of cases	Mean pre-operative AB gap	Standard deviation	Mean post-operative AB gap	Standard deviation
Small	25	26.0	1.88	17.9	1.03
Medium	50	32.3	2.27	20.7	1.54
Large	15	38.1	1.03	21.2	1.24

Table 17: Perforation site

Perforation site	No. of cases	Mean pre-operative AB gap	Standard deviation	Mean post-operative AB gap	Standard deviation
Anterior	9	20.5	1.37	17.4	0.642
Central	65	33.6	3.42	20.8	2.57
Posterior	16	29.1	1.24	18.2	0.71

Mean pre-operative AB gap of 100 pts. = 31.5 db
Mean post-operative AB gap at 12 wks. = 20.0 db

For each variable the total number of patients were divided into two groups
Group 1 included patients with successful closure of tympanic membrane perforation
Group 2 included patients with failure of closure of tympanic membrane perforation
Statistical calculation

Table 18: Size of perforation

Perforation size	Successful closure	Failure of closure	Success %
Small	25(27.78%)	3(30%)	89.28%
Medium	50(55.55%)	3(30%)	94.33%
Large	15(16.66%)	4(40%)	78.94%
Total	90	10	90.00%

P = 0.157

Table 19: Site of perforation

Perforation site	Successful closure	Failure of closure	Success %
Anterior	9 (10.00%)	3(30%)	75.00%
Central	65(72.22%)	7(70%)	90.27%
Posterior	16(17.78%)	0(0%)	100.00%
Total	90	10	90.00%

P = 0.091

Table 20: Technique used

Technique	Successful closure	Failure of closure	Success %
Post aural	75(83.33%)	7(70%)	91.46%
Per meatal	15(16.67%)	3(30%)	83.33%
Total	90	10	90.00%

P = 0.298

Table 21: Revision tympanoplasty

Revision tympanoplasty	Successful closure	Failure of closure	Success %
Yes	4 (04.44%)	1(10%)	80.00%
No	86(95.55%)	9(90%)	90.52%
Total	90	10	90.00%

P = 0.444

Table 22: Smoking status

Smoker	Successful closure	Failure of closure	Success %
Yes	14(15.55%)	7(70%)	66.66%
No	76(84.44%)	3(30%)	96.20%
Total	90	10	90.00%

P= 0.00

Table 23: Status of opposite ear

Status of opposite ear	Successful closure	Failure of closure	Success %
Normal ear	53(58.89%)	6(60%)	89.83%
Diseased ear	37(41.11%)	4(40%)	90.24%
Total	90	10	90.00%

P = 0.946

The success rate of type 1 tympanoplasty in our study was 90%.

The successful closure of tympanic membrane perforation was higher in medium & small perforations than the larger perforations. However the success percent was not statistically significant. (p = 0.157)

The successful closure of tympanic membrane perforation was 100% in case of posteriorly placed perforations and was also relatively high in central perforations (90.27%) than the anterior perforations (75%). However this difference in tympanic membrane closure success based on site of perforation was also statistically insignificant. (p = 0.091)

Two techniques were used for type 1 tympanoplasty in our study namely postaural approach and permeatal approach. The difference between the success rates of two approaches was not significant. (p = 0.298)

5 cases in our study were undergoing revision tympanoplasty and the success rate of tympanoplasty in those cases was not statistically significant from the success rate of tympanoplasty in patients who were undergoing tympanoplasty for the first time. (p =0.444)

However in our study the success rate of tympanoplasty was significantly lower in patients who were smokers (66.66%) than in patients who were nonsmokers (96.20%). This difference in success rate was statistically significant. (p= 0.000).

There was no statistically significant difference in success rate of tympanic membrane perforation closure in patients who had disease in one ear (89.83%) as compared to patients who had disease in bilateral ears (90.24%) (p=0.946)

The audiological improvement following successful closure of tympanic membrane perforation was noted at 6^{th} and 12^{th} week. The audiological gain was found to be higher in cases of larger perforation than in cases of medium and smaller perforations. The increase in audiological gain was directly proportional to the size of the perforation. However the audiometric improvement was statistically significant in all cases of small, medium and large types of perforation. The pre-operative and post-operative AB gap difference however was not statistically significant at 6^{th} and 12^{th} weeks for each small, medium or large type of perforation.

Similarly the increase in audiological gain was found to be higher in cases of central and posterior perforation than in cases of anterior perforations. However the audiometric improvement was statistically significant in all cases of anterior, central and posterior perforations. The pre-operative and post-operative AB gap difference was not statistically significant at 6^{th} and 12^{th} weeks for each anterior, central or posterior type of perforation.

DISCUSSION

The present study has been undertaken to assess the impact of size & site of perforation on closure of tympanic membrane perforation following type 1 tympanoplasty and to assess air conduction audiometric gain following successful tympanoplasty for various, pre-operatively categorized tympanic membrane perforation size & site.

The cases were studied post operatively for

1. Graft uptake at 6 weeks and 12 weeks
2. Audiological improvement at 6 and 12 weeks

In our study, most of the cases were of younger age group. These cases presented in the second and third decade of the life. This might be due to an increase in the general level of awareness among this age group of people. Most patients were concerned about the hearing loss and ear discharge. The remaining few in middle age group were worried about their social life.

Females are relatively more affected by the disease. **J D Wasson et al (2009)[5]** reported 54% females and 46% males, **Yama et al (2011)[16]** studied 129 patients and found 54.8% females and 45.2 % males suffering from the disease. In our study which included 100 patients, 38 (38%) are males and 62 patients (62%) are females which was similar to other studies.

Majority of cases (67%) were from rural area and of low socio-economic status. This might be due to ignorance on the part of patients, poverty and inadequate specialized medical facilities in our rural areas. This was further proved by the fact that as many as 61% of patients had long duration of the disease (5-10 or more years) and had ignored their ear problem for that long duration.

Ronald L. Johnson (1967)[17] observed in his series of 3,318 cases that chronic otitis media was fifteen times more in population with low-socio-economic status due to nutritional deficiencies, poor sanitation, overcrowding than in general population.

The incidence of ear involvement was greater on left side as compared to right. In 41% cases there was bilateral involvement of the ears. In our study, trauma was the causative factor of tympanic membrane perforation in 6 patients.

Most of the patients gave history of ear discharge which was intermittent and ranged from Mucoid (20%) to Mucopurulent (59%). 15% cases had purulent discharge. None of the patients had blood stained discharge. So in our study almost 94% patients presented with a history of discharge. Our study was similar to studies like *Rao* et al, *Gulati* ET al[18, 19] which reported discharge in 100% cases. In our study 6 cases had no discharge from the ear as these had traumatic perforation. The discharge was controlled by aural toilets, antibiotics both systemic and local depending upon the culture and sensitivity, and by the treatment of nose and throat pathology (Both medical and surgical). The ear was kept dry for at least six weeks prior to surgery.

Margins of perforation were irregular in six cases where trauma was the etiological factor. In rest of the 94% cases margins were regular.

Schwa Bach's and Absolute Bone Conduction tests were normal in all the cases implying that the cochlear reserve was normal.

The operative closure success rate of type 1 tympanoplasty was calculated as 90%. The success rate was in accordance with various studies conducted on outcome of tympanoplasty in children and adults.

Hung et al (2004)[3] showed graft integration rate of 85.7% in children and 82.4% in adults. Fishman ET. Al (2004)[4] had a success rate of 97%. Jose Carlos Bolin, De Lima ET. Al (2011)[6, 7] showed graft integration rate of 95%. Rehman et. al (2011)[20] showed 80% success. Khtoum et. al (2009)[21] found success rate of 85.7%. Umapathy et al (2003)[8] reported a success rate of 90.0%. Karkanevatos et al (2003)[22] reported a success rate of 83.3% which also compares favorably with this study. Biswas et al (2010) reported a graft uptake rate of 85%. The study conducted by Md Zakaria Sarker et al (2011)[12] showed success rate of 81.67%. Rizer et al (1997)[9] in a retrospective study of tympanoplasty with underlay technique using temporalis fascia reported 88.8% tympanic membrane perforation closure rate. Aming A. Seraj et al (1991)[23] reported 82.9% success rate for type-I tympanoplasty. It was retrospective study of 217 patients operated as type-I tympanoplasty using temporalis fascia as graft material with underlay techniques. Pelva et al (1987)[24] reported 97% success of tympanic membrane repair while J D Wasson[5] showed success of 80.5% in their study.

In our study of 100 patients, 28 perforations were classified as small, 53 as medium and 19 as large perforation. The success rate of tympanic

membrane perforation closure following type 1 tympanoplasty was 89.28% for small size perforation (25 out of 28), 94.33% for medium size perforation (50 out of 53) and 78.94% for large perforation (15 out of 19).

Although lower success rates were observed for patients with larger tympanic membrane perforations, statistical analysis demonstrated no significant difference in surgical success rates between the various perforation size categories.(p = 0.157) Thus, on the basis of this study, perforation size was not predictive or determinant of successful type 1 tympanoplasty.

The study conducted by J D Wasson et. al (2009)[5] on 130 patients showed success rate of 83.95 % for small perforation, 74.19% for medium perforation and 77. 8 % for large size perforation. The differences in success rate of different sizes of perforation were not statistically significant as was the case in our study.

The study conducted by Ashfaq Ahmad Sheikh et. al (2006)[15] on 100 patients showed success rate of 87.5% for small perforations, 81.2% for medium perforations and 70% for large perforations. The differences in success rate of different sizes of perforation were not statistically significant as was the case in our study.

This result of our study was also in accordance with the study conducted by Pignataro L et. al (2001)[25] who conducted the study in 41 children, Yung MW et. al (1995)[26] who showed success rate of 92.5% in large perforation and 94.1% in small perforations, Maqbool Ahmad Baloch et. al (2012)[27] in which study was conducted in 53 patients, Vartiainen E et al (1993)[28], J.C. Riberio et. al (2011)[29], Migirov L. et. al (2013)[30], Lassaletta Atienza L et al (1999)[31] & Gersdoff et. al (1995).[32]

However the result of the study conducted by Lee et. al (2002)[11] on 423 patients showed success rate of 74.1 % for small perforations and 56% for large perforations. This difference in success rate was statistically significant and was contradictory to the result of our study

The study conducted Md Zakaria Sarkar et. al (2011)[12] on 60 patients showed success rate of 100% in small perforation, 80% in medium perforation and 72.73% in larger perforation. The difference in success rate was statistically significant & which was also contradictory to the result of our study.

The study conducted by Nemer Al-Khtoum et. al(2009)[21] in 35 children showed success rate of 94.7% in small perforations and 66.9% in large perforations. This difference was statistically significant.

The results of the study conducted by Warren Y et. al (1984)[10] on 71 patients & Ophir D. et. al (1987)[33] on 153 patients were also contradictory to the results of our study.

In our study conducted, 12 patients had anterior perforation, 72 patients had central perforation and 16 had posterior perforation. The success rate of tympanic membrane perforation closure was 75% in anterior perforations, 90.27% in central perforations and 100% in posterior perforations. The difference in success rates however was found insignificant. (p = 0.091)

The study conducted by J.C. Riberio et. al (2011)[29] in 91 children showed success rate of 88.9% in anterior perforation, 90.4% in central perforation and 100% in posterior perforation. The difference in success rate was not statistically significant as was the case in our study.

José Carlos Bolini, de Lima et. al (2011)[6,7] in their study showed 96% success rate in anterior perforations and 92.8% success rate in posterior perforations. The success rates were similar and statistically there was no significant difference.

The results of the study conducted by Baloch et. al (2012)[27] in 53 patients, Vertiainen E et. al(1993)[28] in 404 cases, Ramón Balaguer García et. al(2011)[35] in 126 cases, Olalla Castro et. al (2013)[36] in 81 patients, Sade J et. al (1981)[37], Meranda D et. al (2007)[38] & Lassaletta Atienza L et al (1999)[39] were also similar to the results of our study.

However the study conducted by Md Zakaria Sarker et. al(2011)[12] showed success rate of 83.79% in central perforation, 82.35% in posterior perforation and 66.67% in anterior

perforation. The difference in success rate was statistically significant and was contradictory to the result of our study.

The study conducted by Eije WJ. Wielinga et. al(1995)[14], Lee et al (2002)[11] also showed lower success rate for closure of anterior perforations which was contradictory to the result of our study.

The advantage of permeatal this approach was that it was easy to perform. There were no scar marks on the pre auricular or postauricular areas. Only a small separate incision was required for harvesting the temporalis fascia graft. This approach was excellent for small perforations with wide meatal canal

1. This approach was suitable only for those cases who had external auditory canal wide enough to allow complete visualization of perforation.
2. When using permeatal approach, site of the perforation was also an important factor. It was found that it was more suitable for posterior segment perforations.
3. This approach was found to be unsuitable for anterior perforations which were obscured by the overhanging canal wall. Similarly difficulty was encountered while dealing with large perforations using this approach due to small operating field.

Postaural approach was used in 82 cases. With this approach the pinna and the attached retroauricular tissues were retracted anteriorly. The temporalis fascia graft was harvested by extending the incision superiorly.

The success rate in patients where post aural approach was used was 91.46% (75 out of 82) whereas it was 83.33% in patients where permeatal approach was used (15 out of 18). The difference in success rate of two approaches was not statistically significant.

The observation of our study was similar to the study conducted by Saeed A. Al-Ghamdi (1994).[40] The overall success rate was 73.2%. Comparison between two approaches failed to show any significant difference.

The study conducted by J D Wasson et. al (2009)[5] on 130 patients showed 75% success rate for post aural approach, 81.8% for permeatal approach and 82.2% for endaural approach. The difference in success rate was not statistically significant.

Md Zakaria Sarker et. al (2011)[12] in their study found success rate of 82% for post aural route and 80% in permeatal route.

Our results were also confirmatory to the findings of Sharma et al. (2009)[41], there was no significant difference in graft uptake and improvement in hearing in all the three approaches. The overall success rate was 81.1%, and significant improvement in post-operative patients.

However, the results of studies of Sheehy & Anderson (1980)[42] and Shelton (1985)[43] were found to be contradictory to our findings which suggested that postaural approach was superior to a permeatal approach. Likewise, Fadl-A Fadl (2003)[44] concluded that permeatal approach was better than postaural approach.

Revision tympanoplasty was being performed in 5 of our patients while in 95 patients tympanoplasty was being performed for the 1st time. 4 out of 5 patients had successful tympanic membrane perforation closure (80%) while 86 of the 95 patients had successful operative closure (90.52%). The difference in success rate was not statistically significant.

J D Wasson et. al (2009)[5] showed 78.9% success rate, Raghavan et. al (2000)[45] with success rate of 97.23% was not statistically significant and similar to result in our study.

Smoking status was assessed and 21% patients were associated with history of smoking. The success rate of tympanic membrane perforation closure in smoker's was 66.67% while in nonsmokers it was 96.2%. This difference in success rate was statistically found significant (p=0.00) and it was concluded that smoking had an unfavourable effect on graft uptake.

This unfavourable effect of smoking on graft uptake could be due to oxidizing particles content in the smoke which are likely to interfere with the healing process; the results were similar with the

study conducted by Becvarovski Z et. al (2001), Onal et al.(2005), Belluci (1973) and Kartush et al. (2002)[7,46,47,48].

However the results of our study were contradictory to the results of J D Wasson et. al (2009)[5], Migirov L et. al (2013)[30] and José Carlos Bolini de Lima et. al (2011).[6]

In our study of 100 patients 59 patients had chronic otitis media – tubotympanic type in one ear while the other ear was normal and 41 patients had the disease involving both the ears. The operative closure rate in patients who had single ear disease was 89.83% (53 out of 59) and in patients who had both ears involved it was 90.24% (37 out of 41). The difference in success rate was not statistically significant (p = 0.946) which was similar to our study by Nemer Al-Khtoum et al (2009)[21], José Carlos Bolini de (2011)[6] and contradictory results with the study conducted by J.C. Ribeiro et al (2011)[29].

90 patients who had successful operative closure were evaluated for audiometric improvement at 6 and 12 weeks. The mean pre-operative AB gap of 90 patients was 31.5 db (range 18db to 40 db). After tympanoplasty the mean post-operative AB gap of these patients was 20.4 db at 6 weeks and 20 db at 12 weeks. The overall improvement of 11.1 db at 6 weeks and 11.5 db at 12 weeks was statistically significant and such achievement of an audiometric gain in hearing thresholds following successful myringoplasty has been widely demonstrated, both in paediatric and adult populations in various studies and the results were statistically significant with Jose Carlos Bolini di Lima et. al (2011)[6] and Nemer Al-Khtoum et. al (2009).[21]

CONCLUSION

Type 1 tympanoplasty is an operative procedure done for repairing perforated tympanic membrane and thereby improving hearing. Various studies have been done in the past to assess the impact of various factors on successful outcome of the procedure. On the basis of our study size & site of the perforation had no impact on the success rate of the procedure along with the type of approach used, status of contralateral ear & revision surgery. However smoking had a negative impact on the success rate of tympanoplasty. The audiological improvement was found to be dependent on the size & site of the perforation with more audiological improvement for larger perforation than medium and small sized perforation &for central and posterior perforation than anterior perforation respectively.

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