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Comparative study of Crescentic Cartilage and Anterior Tucking Tympanoplasty

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Abstract

Introduction: This study was undertaken to know the better technique of two methods i.e. cresentric cartilage tympanoplasty (CCT) and anterior tucking tympanoplasty (ATT) operated by single handed endoscopically.

Material and Methods: This study was conducted on hundred patients at Shyam Shah Medical College, Rewa, MP. Hundred patients were selected using certain criteria and fifty patients each were operated by cresentric cartilage supported tympanoplasty(CCT) and anterior tucking technique(ATT). Audiometrically results were analysed preoperatively and postoperatively.

Results: Maximum patients affected were teens and males. Maximum patients had large central perforation followed by subtotal and then total perforations in both the groups of cresentric cartilage tympanoplasty (CCT) and anterior tucking tympanoplasty (ATT). We operated under local anaesthesia and some under general anaesthesia in both the groups.

Discussion: Hearing being special sense organ needs restoration for normal development and personality grooming. Newer method with evolution of medical sciences have devised techniques of reconstruction of hearing mechanism to give better results. Comparative study using cresentric cartilage tympanoplasty (CCT) and anterior tucking tympanoplasty (ATT) was done to know the better outcome and method.

Conclusion: Cresentric cartilage tympanoplasty (CCT) is better of the two methods as it doesn't shrink or change the shape.

Keywords: Hearing; Cresentric Cartilage Tympanoplasty; Anterior Tucking

Abbreviations: CCT: Crescentic Cartilage Tympanoplasty; GA: General Anaesthesia; LA: Local Anaesthesia; ATT: Anterior Tucking Tympanoplasty.

Introduction

Ear is an important special organ of hearing. Hearing loss and discharging ear is the commonest otological disease. Hippocrates was the first to observe that painful ear with fever was ominous [1]. Primitive days when no microscope or endoscope was invented, different scientist devised ways and means to treat ear disease. In 1640 Banzer was first to attempt to repair tympanic membrane perforation. Blake in 1877 used paper patch to close the tympanic membrane perforation with improved hearing. Storr's results of tympanoplasty were inspiring but skin grafts gave poor results which were replaced by Glasscock and Sheehy by temporalis fascia. Then various methods of onlay

underlay and inlay techniques were employed to repair tympanic membrane perforations with gratifying results. In the anterior tucking method, the tympanomeatal flap was elevated with the posterior tympanic annulus, an incision was made on anterior canal wall about 5mm lateral to the anterior mesotympanum tunnel was made connecting to anterior mesotympanum. The graft was placed medical to the handle of malleus and tucked medial to the fibrous annulus anteriorly by pulling it through the tunnel. Similarly in Cresentric Cartilage Tympanoplasty, a semilunar / Cresentric cartilage is placed below the grafted material and graft was cleverly spread. This Cresentric cartilage fixed the grafted material between itself and the annulus. Cartilage harvested from patient and also used in ossicular reconstruction both helpful in anterior perforation where perforation remains if done by conventional technique.

But to achieve best results innovative techniques are devised. Hence, anterior tucking, ring cartilage tympanoplasty, boomerang cartilage tympanoplasty, cresentric cartilage tympanoplasty etc. Were used to achieve best outcome. Our study focused at the comparative outcome between cresentric cartilage tympanoplasty and anterior tucking.

Material and Methods

Patients Selection

Hundred patients were selected randomized for the study, with crescentic cartilage tympanoplasty (CCT) or anterior tucking for comparison of the method. Informed written consent was obtained from all donors to participate in this study prior to any study-related procedures during the period of one year (1/1/2019 to 1/1/2020) at SS Medical College, Rewa, and Madhya Pradesh. Children below ten years and adults above eighty years were excluded. All the surgeries were done endoscopically by single handed technique. Frontline three chip camera with with cold light source and HD monitor was used. Preoperative audiometry was done in all cases and postoperative audiometry was done once ear healed and was dry. Patients were cleared of all local disease and chronic illness if any, were controlled before surgery. Preferably temporalis fascia was used, but sometimes tragal perichondrium was also used. Conchal cartilage and tragal cartilage were used. All the operations were done either under general anaesthesia (GA) or local anaesthesia (LA).

Anterior Tucking Tympanoplasty

In the anterior tucking method, the tympanomeatal flap was elevated with the posterior tympanic annulus, an incision was made on anterior canal wall about 5mm lateral to the anterior mesotympanum tunnel was made connecting to anterior mesotympanum . The graft was placed medical to the handle of malleus and tucked medial to the fibrous annulus anteriorly by pulling it through the tunnel.

Cresentric Cartilage Tympanoplasty

A semilunar / Cresentric cartilage is placed below the grafted material and graft was cleverly spread. This Cresentric cartilage fixed the grafted material between itself and the annulus. Cartilage harvested from patient and also used in ossicular reconstruction both helpful in anterior perforation where perforation remains if done by conventional technique.

Apprehensive females and young patients were operated under general anesthesia. Patients were prepared preoperatively by shaving the hair, cleaning and packing (mastoid bandage).Preoperative medication was given to reduce anxiety. Operation done under local anesthesia are given preoperative injection diazepam intramuscularly, injection fortwin and Phenergan was given intravenously through drip slowly. Periauricular block is given using mixture of injection lignocaine and bupivacaine. All the patients were operated by underlay technique and ossicular reconstruction was done by cartilage and remnant ossicles. Incision within hairline was given to take temporalis fascia graft of adequate size, similarly tragal perichondrium was retrieved wherever it was needed. Conchal cartilage or tragal cartilage was harvested as per requirement. Endomeatal incisions from six o'clock to twelve o'clock with outward extension at nine o'clock are given. All the patients were operated by single handed technique with zero degree endoscope. After placing the graft the crescentic cartilage was pushed below the graft anteriorly. It was further pushed anteriorly by the abgel and stabilized. Ossicular reconstruction using cartilage was done and graft in middle ear was supported by abgel soaked in antibiotic ear drops. In anterior tucking technique, a small incision just above annulus at three o'clock position is made and elevated. With the help of suction elevator or any pointed sharp instrument, the graft is pulled up. This tucking technique is also helpful in temporalis fascia graft stabilization. In few cases the excessive anterior bony overhang derailed our procedure and we had to resort to crescentic cartilage tympanoplasty.

Patients were kept for seven days on injectable antibiotics and other medicines. Stitches were removed on eight day. Patients were asked to take precaution and keep ear dry. Patients were followed up to three months and once neotympanic membrane was formed postoperative audiometry was done to asses hearing.

Results

This study was conducted on hundred patients at Shyam Shah Medical College, Rewa, MP. The age group affected maximally was between ten to twenty years of age. The maximum number of patients were males in both the groups ie thirty five (70%) in crescentic cartilage (CCT) and thirty nine (78%) anterior tucking tympanoplasty (ATT). In CCT group the large central perforation was present in twenty six (56%)patients, subtotal in eighteen (36%) and total perforation in six(12%) patients. Similarly, in ATT group thirty four(68%) patients were having large central perforation, fourteen(28%) had subtotal perforations and two (4%) had total perforation. Forty patients(80%) were operated under local anesthesia and ten(20%) under general anesthesia in CCT group. In ATT group thirty nine (78%) were operated under local anesthesia and eleven (22%) in general anesthesia. Average air bone gap in CCT group was 38.28dB and postoperatively the A-B gap was 19.14dB with the net gain of 19.14dB.Similiarly, average A-B gap in ATT was 36.57dB and postoperatively A-B gap was 25.43dB with the net gain of 11.14dB. Infection was seen in five (10%) patients in CCT and ten (20%) patients in ATT group. Failure was seen in one (2%) patient in CCT group and five (10%) in ATT group and required surgery again. The average time of surgery in both the groups varied from forty five minutes to ninety minutes.

Regression Data Analysis

The results were better achieved with the cartilage supported grafting rather than simple grafting. However, the regression data shown that, there is a no significance positive relationship between the %age difference of A-B gap between Preop and Postop between the ATT cases and CTT cases, r =0.44, p<0.3 (Tables 1-4).

S.No	Age (yrs/No)	Sex M/F	Size of Perforation USTIT	Anesthesia LA/GA	A-B gap preop (Avg.dB)	A-B gap postop (Avg.dB)	Failure
1	10-20= 12	8/4	5/4/3	8/4	38	22	1
2	20-30= 11	6/5	6/5/0	8/3	42	20	0
3	30-40=9	7/2	5/3/1	7/2	44	26	0
4	40-50=8	6/2	4/3/1	8/0	40	18	0
5	50-60=5	4/1	3/2/0	4/1	38	16	0
6	60-70=4	4/0	2/1/1	4/0	36	14	0
7	70-80=1	0/1	1/0/0	1/0	30	18	0
Total	50	35/15	26/18/6	40/10	38.28	19.14	1

Table 1: Crescentic Cartilage Tympanoplasty (CCT).

S.No	Age Yrs/ no	Sex M/F	Size of Perforation UST/T	Anesthesia LA/GA	A-B gap Preop (Avo dB)	A-B gap postop (Avo dB)	Failure
1	10-20=12	8/4	8/3/1	7/5	42	34	1
2	20-30=10	9/ 1	7/3/0	8/2	38	28	0
3	30-40=9	7/2	5/4/0	7/2	36	24	2
4	40-50=7	5/2	5/2/0	6/1	38	22	1
5	50-60=6	6/0	4/1/1	6/0	32	20	0
6	60-70=4	2/2	3/1/0	3/1	36	26	1
7	70-80=2	2/0	2/0/0	2/0	34	24	0
Total	50	39/11	34/14/2	39/11	36.57	25.43	5

L= Large, ST= Subtotal, T= Total.
LA=Local Anaesthesia, GA=General Anaesthesia.
AB Gap=Air Bone Gap.
Table 2: Anterior Tucking Tympanoplasty (ATT).

Age Group	% age difference of A-B gap between Preop and Postop; CTT	% age difference of A-B gap between Preop and Postop; ATT
01 to 20	17.78	8.88
20 to 30	24.43	11.1
30 to 40	19.99	13.33
40 to 50	24.44	17.77
50 to 60	24.44	13.32
60 to 70	24.45	11.11
70 to 80	13.33	11.1

Table 3: %age difference of A-B gap between Preop and Postop of CTT and ATT.

Regression Statistics								
Multiple R	0.442277							
R Square	0.195609							
Adjusted R Square	0.034731							
Standard Error	2.778226							
Observations	7							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	9.384855	9.384855	1.21589	0.320394			
Residual	5	38.59269	7.718538					
Total	6	47.97754						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	6.351511	5.560734	1.142207	0.3051	-7.94281	20.6458	-7.94281	20.64583
%age difference of A-B gap between Preop and Postop CTT	0.283148	0.256784	1.102672	0.32039	-0.37694	0.94323	-0.37694	0.943232

Table 4: *Regression Statistics* of %age difference of A-B gap between Preop and Postop of CTT and ATT.

Discussion

Ear is a special sense organ of hearing. Its significance can be best understood by people who are deaf mute, students who can't hear and under perform in class, girls who are to be married and hearing loss, discharging ear becomes social stigma. Job seekers in various companies especially defence are denied job if they are otologically not fit. Scientist from time to time had worked hard to devise ways and means out to close the perforation and improve hearing. The advent of microscope, endoscope and other operating instruments has helped us achieve marvellous results and reach near perfection. Microscope was first used by Cael Nylen in 1921 which was perfected by Littmann and Ziess company in 1951[2]. Han L, et al. [3] in their study found equivalent results with both endoscopic and microscopic techniques and better with endoscopes in some reference especially hidden areas. Various grafting material like temporalis fascia, tragal perichondrium, fascia lata, fat, choncal & tragal cartilage are used to reconstruct the hearing mechanism. Simple grafting, onlay, underlay and interlay etc, are various techniques used to close the tympanic membrane perforation. Fresh temporalis fascia graft shrinks after drying, rehydrating and is a major cause of failure [4], hence cartilage supplements this drawback. Similar was the findings of Ulku CH [5]. John L Dornhoffer [6] operated thousand patients and found cartilage an important grafting material especially in atelactic, chronic and in patients with large central perforations. In some cases temporalis fascia graft developed retraction in patients operated by anterior tucking technique but cartilage supported tympanoplasty prevented retraction of tympanic membrane. The use of endoscope in ear surgery has helped

a lot. Scar less ear surgery, bilateral endoscopic ear surgery in single sitting and many more innovative technologies have paved way for better outcome [7]. We too used endoscope to operate all patients single handed. Stabilization of the graft material is very important so that no defect in the tympanic membrane is left postoperatively. Various techniques are used to stabilize the graft, like interlay, anterior tucking, ring cartilage, boomerang cartilage, crescentic cartilage tympanoplasty etc.

Demirci, et al. [8] conducted study in 60 patients younger than eighteen years with cartilage (n = 25) or temporalis fascia (n = 35) while our group had a larger size of hundred (ATT= 50, CTT= 50) patients making the study more relevant. Our comparison was between crescentric cartilage and anterior tucking of temporalis fascia graft whereas others compared results between crescentric and ring cartilage tympanoplasty [9]. In our study the anterior tucking took more time than crescentric cartilage placement. The ring shaped graft was difficult to insert and so it is less preferred [9].

The mean pre and postoperative air bone gap (ABG) of 28.2dB and 15.1dB in temporalis fascia group, while mean gain postoperative was 13.1dB. The mean pre- and postoperative air bone gap (ABG) was 28.9dB and 16.8dB, and the postoperative hearing gain was 12.1dB in the cartilage group [7]. In our study average hearing gain was better in crescentic cartilage group with gain of more than nineteen decibel postoperatively.

In our study the results obtained were better with the crescentic cartilage graft when compared with the anterior tucking technique contrary to temporalis fascia graft which gave better results than cartilage graft [10,11]. Debasish, et al. [12] had more than 93.33% result with ring cartilage tympanoplasty similar to the findings of Yakup, Mustafa, et al. [13]. In Demirci's study success rates of 82.9% was achieved with the fascia and 92.0% with the cartilage similar to our results [8]. Burse Kulkarni, et al. [14] in their study of cartilage versus anterior tucking technique found no significant difference in graft uptake but asserted that hearing was better in anterior tucking technique. Mundra, et al. [15] in their study concluded that in subtotal perforation cartilage support provided almost hundred percent results. We tried to restore the middle ear physiology as normal as possible but blunting, displacement of the cartilage graft, epithelial pearls, infections did occur in spite of all the precautions being taken. Can Ozbay et al in their study used different shapes of the cartilage {boomerang-shaped (BSG) and shield-shaped grafts (SSG)} and found similar results [10]. Ahmed Hasmat et al found no difference in their study for large central perforation and had similar results with ring cartilage composite graft and temporalis fascia tympanomeatal degloving technique [16].

Conclusion

The present study carried out on a group of hundred patients was done to compare the results of two different techniques of tympanoplasty to achieve better results. We concluded that results were better achieved with the cartilage supported grafting rather than simple grafting. Anterior tucking was also another viable option but results were inferior when compared with cartilage supported grafting and was more time consuming.

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