

A STUDY OF HEARING IMPROVEMENT AFTER TYMPANOPLASTY BY MEANS OF PURE TONE AUDIOMETRY

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ABSTRACT: BACKGROUND: Chronic Suppurative Otitis Media (CSOM) is an important cause of preventable hearing loss, particularly in the developing world. Tympanoplasty is a procedure to eradicate the disease in middle ear and to reconstruct hearing mechanism. Pure tone audiometry is an efficient, simple and economic tool to assess the level of postoperative hearing gain.

KEYWORDS: Pure tone audiometry, is an efficient, simple and economic tool to assess the level of postoperative hearing gain.

INTRODUCTION: OBJECTIVES:

1. Selection of patients of CSOM with conductive deafness to undergo various types of Tympanoplasty surgeries by using various methods.
2. To document the hearing improvement after various types of Tympanoplasty surgeries in cases of CSOM by means of Pure tone audiometry.

METHODS: 50 cases of CSOM with conductive hearing loss were selected after adequate otoscopic and audiometric evaluation. Informed consent was taken. Complete history and examination was done according to the proforma. Medical line of treatment was given pre operatively. Post op audiological evaluation was done after three months of surgery.

RESULTS: Considering the pre OP ABG and post OP ABG, three months after surgery, AB gap improved in 30(60%) patients, remained same in 18(36%) patients and worsened in 2(4%) patients.

The highest success rate of 72% was seen in the cases operated with tubotympanic disease with tympanoplasty alone. Hearing improvement seen with the use of autologous incus was 61.5% as an ossiculoplasty material as compared to conchal cartilage 42.8%. The mean preop AB gap calculated was 37.2 ± 6.875 dB and the mean postop AB gap calculated was 27.08 ± 9.9 dB.

CONCLUSION: Postop hearing gain obtained was found to be better in patients operated upon with tubotympanic disease than those operated with atticoantral disease, in whom autologous sculpted incus was used as compared to autologous conchal cartilage and where mastoidectomies were performed in combination to tympanoplasty, better hearing gain was obtained in the cortical mastoidectomy group as compared to modified radical mastoidectomy group.

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MATERIALS AND METHODS:

1. This study of hearing improvement gained after Tympanoplasty by means of pure tone audiometry was done in the Department of Otorhinolaryngology, Kempegowda institute of medical sciences, Bangalore from December 2010 to May 2012.
2. 50 cases were compiled after selecting 65 patients fulfilling the inclusion and exclusion criteria, 15 of which did not report after 3 months for follow up.

INCLUSION CRITERIA

1. CSOM patients of the ages from 15 to 50 years with documented hearing impairment.

EXCLUSION CRITERIA

1. CSOM with mixed/sensorineural hearing loss.
2. CSOM with complications.
3. Patient's general condition not permitting surgery.

METHOD OF COLLECTION OF DATA

1. All the patients in the study were clinically evaluated by taking detailed history and clinical examination including TFT, as per the proforma.
2. Broad spectrum antibiotics were given to dry up the ear discharge
3. Dry aural toilet was done to remove debris from the ear canal
4. Otomicroscopy was performed
5. Septic foci in the nose or in the throat were treated at the out patients if present
6. PTA was done as per ASHA
7. For cases with suspicion of Unsafe CSOM, HRCT was done to know the extent of disease and status of hearing apparatus.
8. Cases then were diagnosed and surgical plan of management was formulated
9. The patients routine HB, BT, CT, urine analysis were done.
10. Then the patients were subjected to middle ear cleft surgery under GA
11. The patient's subjective hearing enquired and recorded as improved, same (no change) or worse.

PREOP PREPARATION

1. Preparation of the patients, shaving of hair of post auricular region 2 inches inside the hair line done.
2. Xylocaine test dose given – 0.1ml of 2% xylocaine intradermally given.
3. Vital parameters were recorded.
4. Informed consent of patients was taken.
5. Preop dose of antibiotic was given the night before surgery.
6. LA 2% - xylocaine with adrenaline (one in two lakhs) was infiltrated.

POST OP MANAGEMENT

1. Mastoid dressing done for all patients and kept for two days
2. IV antibiotic was given for two days followed by oral antibiotics for five days
3. Aural pack was removed on fifth day.
4. Sutures were removed on the seventh day.
5. Patients were followed up to three months. The hearing evaluation was made three months after surgery. All patients had post operative PTA. Patients were asked whether the operation had resulted in any significant hearing benefit in their daily life.

DISCUSSION: In the present study, it was observed that the majority of the patients 14 (28%) were in the age group of 31-35 yrs followed by 8 patients in the age group of 36-40 years. The minimum age was 17 years and the maximum age was 49 years. The mean age was 31.68 ± 9.19 years.

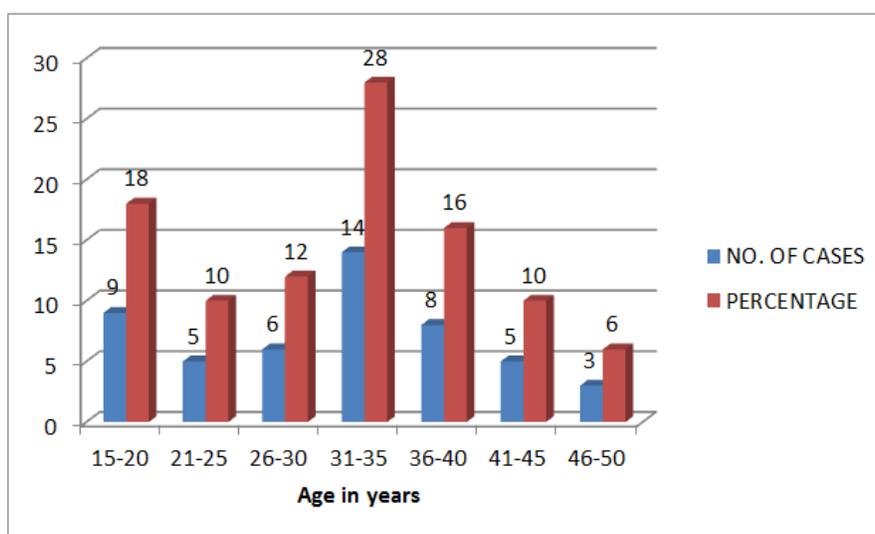


Figure 1: Age distribution

According to a study by Vrabec and Deskin, children in general and those who have undergone repair of the tympanic membrane, in particular, present a greater risk for retractions, serous otitis media, and re-perforation with episodes of acute otitis media.¹

According to available literature, unless there is cholesteatoma or a bilateral tympanic membrane perforations with conductive hearing loss, tympanoplasty in children can be delayed until the age of 10 years, when Eustachian tube function is usually better and a satisfactory outcome is more likely.²

For the elderly and adults with serious medical problems, one has to determine whether a benefit of surgery outweighs the risks of anaesthesia.

Hence in the present study, the age range was kept between 15 to 50 years.

In the present study, in the group below 30 years of total 20 patients, 11(55%) patients showed improvement, 9(45%) patients remained same and none worsened. In the group above

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30 years of total 30 patients, 19(63.3%) patients improved, 9(30%) patients remained same and 2(6.7%) patients worsened after surgery.

In the present study number of male patients operated was 27(54%) and numbers of female patients operated were 23(46%).

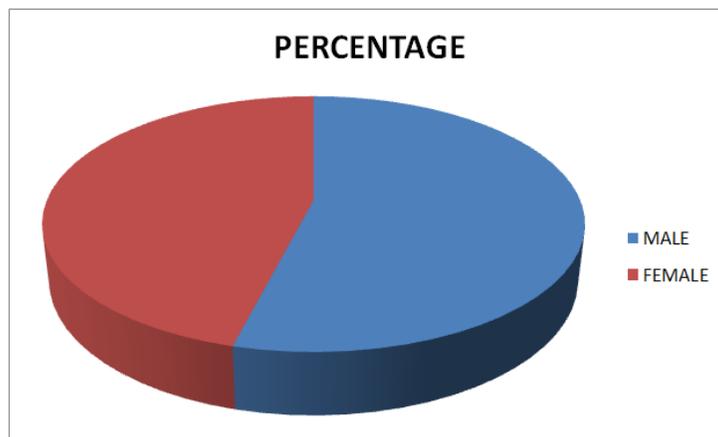


Figure 2: Sex distribution

In the Male group with 27 patients, hearing improvement was seen in 16(59.2%) patients, no improvement in 9(33.3%) patients and worsening in 2(7.4%) patients. In the Female group with 23 patients, hearing improvement was seen in 14(61%) patients, no improvement in 9(39%) and worsening in none after surgery.

As per the available literature there is no difference in outcome of surgery solely on the basis of gender.³

In the present study, left ear was operated in 26(52%) patients and right ear was operated in 24(48%) patients.

In the present study, number of patients with no discharge at the time of initial presentation was 10(20%). Amongst the patients presented with discharge at the time of initial presentation, mucopurulent discharge was seen in 25(50%) cases and purulent discharge was seen in 15(30%) cases. Amongst the 25 patients presented with mucopurulent discharge initially, hearing improvement was seen in 15(60%) patients, no improvement in 10(40%) patients and worsening in none. Amongst the 15 patients presented as purulent discharge initially, hearing improvement was seen in 8(53.3%) patients, no improvement in 5(33.3%) patients and worsening in 2(13.3%) patients. Amongst the 10 patients presented with no discharge initially, hearing improvement was seen in 7(70%) patients, no improvement in 3(30%) patients and worsening in none after surgery.

In the present study, number of patients operated with central perforation was maximum, 36(72%) followed by attic perforation, 8(16%) and least with marginal perforation, 6(12%).

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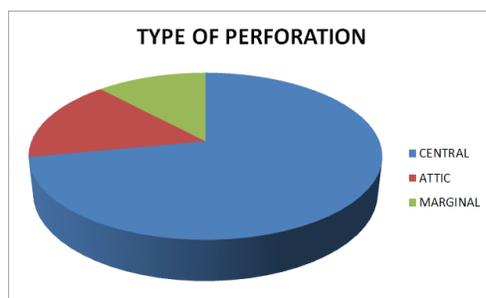


Figure 3: Types of perforation

Amongst the 36 patients presented with central perforation, hearing improvement was seen in 24(66.6%) patients, no improvement in 12(33.3%) patients and worsening in none. In the present study, amongst the 8 patients presented with attic perforation, hearing improvement was seen in 3(37.5%) patients, no improvement in 4(50%) patients and worsening in 1(12.5%). Amongst the 6 patients presented with marginal perforation, hearing improvement was seen in 3(50%) patients, no improvement in 2(33.3%) patients and worsening in 1(16.6%) patients after surgery.

The study by Felien et al. of the 160 cases operated with central perforation, shows graft uptake of 99%. Social hearing improved from 49 % before operation to 86 % and the ABG closed within 10 dB, in 67% to 20dB, for 88%, and 30 dB, in 96% of cases.⁴

Of the 50 cases, 9(18%) patients underwent type I tympanoplasty, 8(16%) patients underwent type II tympanoplasty, 6(12%) patients underwent type IIIa tympanoplasty, 2(4%) patients underwent type IIIb tympanoplasty, 7(14%) patients underwent cortical mastoidectomy with type I tympanoplasty, 4(8%) patients underwent cortical mastoidectomy with type II tympanoplasty, 3(6%) patients underwent cortical mastoidectomy with type IIIa tympanoplasty, 2(4%) patients underwent cortical mastoidectomy with type IIIb tympanoplasty, 5(10%) patients underwent modified radical mastoidectomy with type IIIa tympanoplasty, 2(4%) patients underwent modified radical mastoidectomy with type IIIb tympanoplasty, 2(4%) patients underwent modified radical mastoidectomy with type IIIc tympanoplasty.

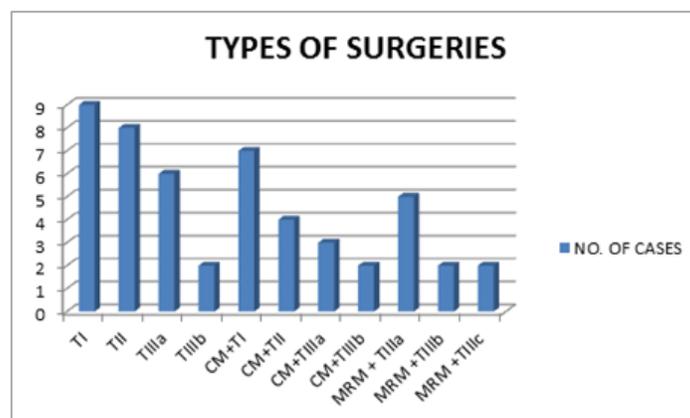


Figure 4: Types of surgeries

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In the present study, amongst the 9 patients who underwent Type I tympanoplasty, 6(66.6%) showed hearing improvement and 3(33.3%) remained the same.

Amongst the 8 patients who underwent Type II tympanoplasty, 6(75%) showed hearing improvement and 2(25%) remained the same.

Amongst the 6 patients who underwent Type IIIa tympanoplasty, 4(66.6%) showed hearing improvement and 2(33.3%) remained the same.

Amongst the 2 patients who underwent Type IIIb tympanoplasty, 2(100%) showed hearing improvement.

Amongst the 7 patients who underwent Cortical mastoidectomy with Type I tympanoplasty, 4(57%) showed hearing improvement and 3(43%) remained the same.

Amongst the 4 patients who underwent Cortical mastoidectomy with Type II tympanoplasty, 3(75%) showed hearing improvement and 1(25%) remained the same.

Amongst the 3 patients who underwent Cortical mastoidectomy with Type IIIa tympanoplasty, 2(66.6%) showed hearing improvement and 1(33.3%) remained the same.

Amongst the 2 patients who underwent Cortical mastoidectomy with Type IIIb tympanoplasty, 1(50%) remained the same and 1(50%) worsened after the surgery.

Amongst the 5 patients who underwent Modified radical mastoidectomy with Type IIIa tympanoplasty, 3(60%) showed hearing improvement and 2(40%) remained the same.

Amongst the 2 patients who underwent Modified radical mastoidectomy with Type IIIb tympanoplasty, 1(50%) remained the same and 1(50%) worsened after the surgery

Amongst the 2 patients who underwent Modified radical mastoidectomy with Type IIIc tympanoplasty, 2(100%) remained the same.

In the study of Kaźmierczak W of 489 tympanoplasties using wullstein’s classification, Good effect was seen in 116 cases (86.9%) of type I tympanoplasty, good or satisfactory in 150 cases (78.6%) of type II tympanoplasty and satisfactory in 63 cases (67.7%) of type III tympanoplasty. There were no hearing improvement and its deterioration results in 61 cases (14.48%), including all treated by type IV tympanoplasty.⁵

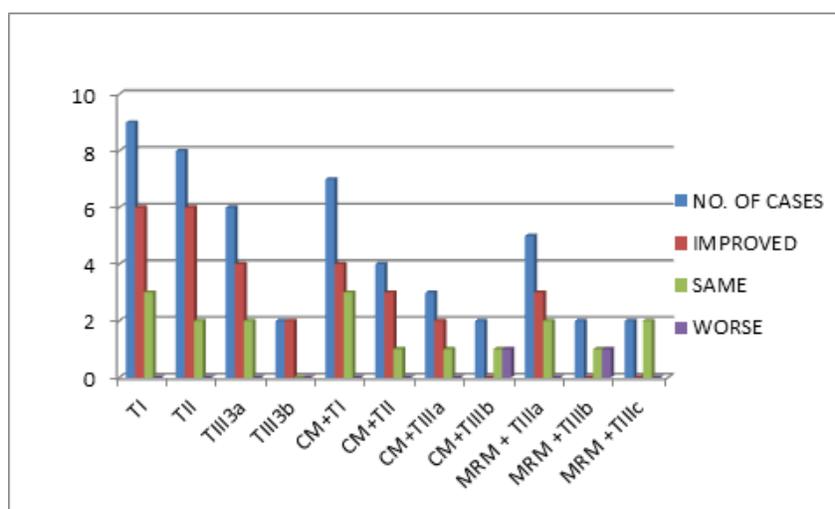


Figure 5: Post operative hearing in various surgeries

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Only tympanic membrane as graft was used in 30(60%) cases, tympanic membrane with autologous sculpted incus was used in 13(26%) cases and tympanic membrane with autologous conchal cartilage was used in 7(14%) cases.

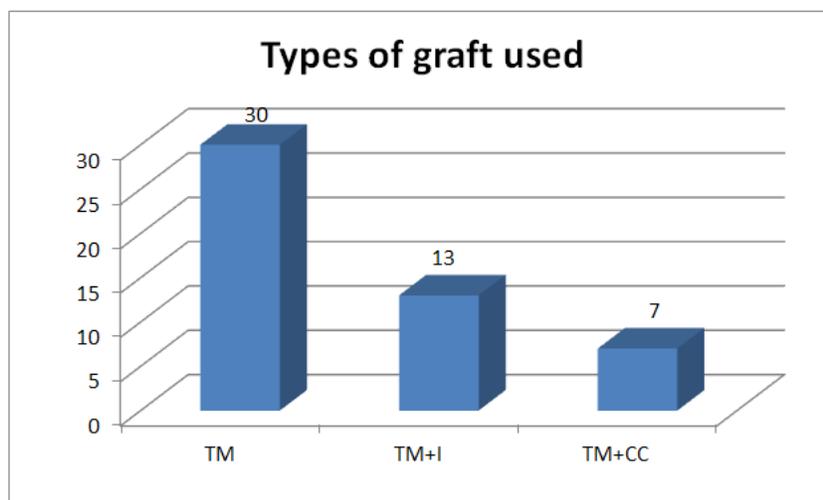


Figure 6: Types of graft used

Amongst the 30 patients in whom only tympanic membrane was used as graft 19(63.3%) showed hearing improvement, 11(36.6%) remained same and none worsened. Amongst 13 patients in whom ossiculoplasty was done using autologous sculpted incus in addition to tympanic membrane graft, 8(61.5%) showed hearing improvement, 4(30.7%) remained same and 1(7.7%) worsened after surgery. Amongst 7 patients in whom ossiculoplasty was done using autologous conchal cartilage in addition to tympanic membrane graft, 3(42.8%) showed improvement, 3(42.8%) remained same and 1(14.2%) worsened after surgery.

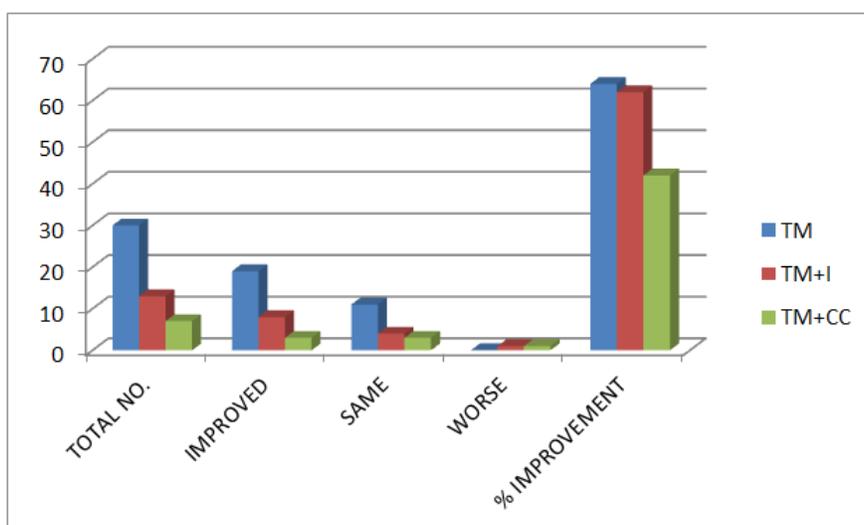


Figure 7: Post op hearing in relation to type of graft

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The study of Christopher et al shows that in the ossicular reconstruction group of 14 patients, the results revealed a significant improvement in the postoperative BC thresholds at 250, 1000 and 2000 Hz with the largest mean improvement observed at 2000 Hz. No significant improvement was observed at any frequency for the group of 10 patients without ossicular reconstruction.⁵

As per the available literature, autologous ossicle grafts maintain their morphological contour, size, shape and physical integrity for longer periods of time, over 25 years. They do not incite formation of new bone, nor do they undergo resorption. They undergo slow replacement of nonviable bone through a process of creeping substitution. Ossicle grafts made of cartilage often develop chondromalacia with loss of stiffness and a tendency to become resorbed over time.⁶

Hence, in the present study, conchal cartilage graft was only used in instances where extensive erosion of incus was seen and sufficient incus could not be obtained for grafting purpose. Spur cartilage is considered to be better option over conchal cartilage but involves additional incision over nasal septum, where conchal cartilage can be harvested through already made postauricular incision.

In the present study of 50 patients who underwent surgery for CSOM, out of 1 cases in the pre op range 11-20 dB, there was no improvement seen.

Out of 12 cases in the pre op range 21-30 dB, 2 had a post op AB gap of less than 10 dB, 7 cases were in the range of 11-20 dB, 3 cases did not change;

Out of 17 cases in the pre OP range 31-40 dB, 4 cases were in the range of 11-20 dB, 6 cases were in the range of 21-30dB, 7 cases did not change;

Out of 20 cases in the pre op range 41-50 dB, 2 cases were in the range of 21-30 dB, 9 cases in the range 31-40 dB, 7 cases did not change another 2 had AB gap of >50 dB.

Overall there were 2 patients in post OP ABG of ≤ 10 db (4%) and 12 patients (24%) in the range 11-20 dB; 11 patients (22%) in the range of 21-30 dB; 16 patients (32%) in the range of 31-40 dB; 7 patients (14%) in the range of 41-50 dB; and 2 patients (4%) in the range of more than 50 dB.

In the present study, the mean pre-op AB gap calculated was 37.2 ± 6.875 dB and the mean postop AB gap calculated was 27.08 ± 9.9 dB.

In the study by Srestha BI, mean pre and post-operative air bone gap in classical type III tympanoplasty were 37.8 dB and 29.8 dB respectively and these differences were statistically significant. The postoperative PTA-ABG ranged from 15-61.2 dB. Hearing results after type III tympanoplasty varied widely showing statistically significant improvement in mean post-operative PTA-ABG but there was a great variation.⁷

The study of Berenholz et al of 387 tympano-mastoidectomies showed almost 64% of ABG closed to within 20 dB, postoperatively. The mean PTA improvement was 12.3 dB.⁸

In the study of Habib MA et al of 60 patients, mean closure of air bone gap in Group I (Tympanoplasty alone) was 9.38 dB and in Group II (Tympanoplasty with mastoidectomy) it was 20.61 dB.⁹

In the study of Sasaki T, the mean hearing gain was $13.6 (\pm 11.9)$ dB.¹⁰

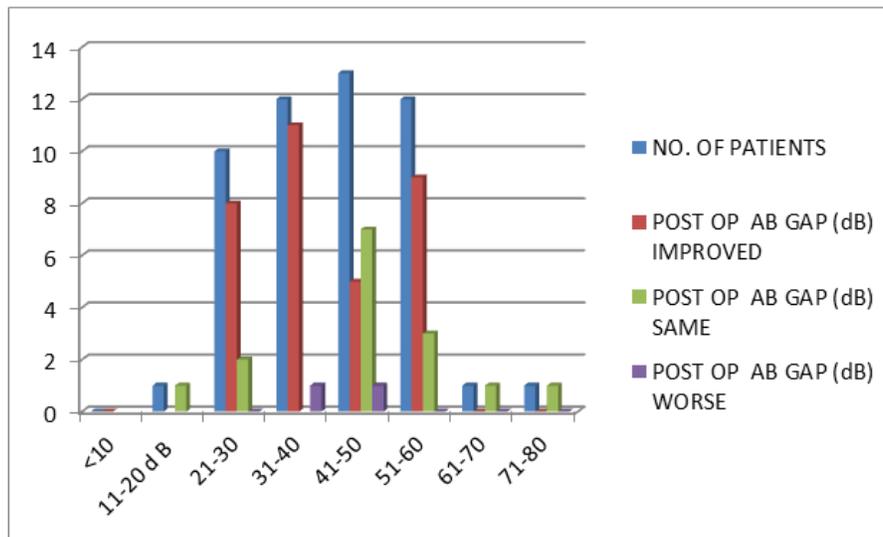


Figure 8: Result of postop Air bone gap

CONCLUSION:

1. The primary objective of surgery for CSOM is to eradicate infection and disease and make the ear safe and dry.
2. A second objective of surgery for CSOM is to restore hearing to serviceable levels by means of tympanoplasty.
3. The main objective of this study is to determine the level of gain of hearing postoperatively after tympanoplasty surgery in relation to various parameters.
4. Postop hearing gain obtained was found to be better in patients operated upon with tubotympanic disease than those operated with atticofacial disease.
5. Amongst the various methods used for reconstruction of ossicular mechanism, postop hearing gain was found to be better in patients in whom autologous sculpted incus was used as compared to autologous conchal cartilage.
6. Amongst the various types of surgeries where mastoidectomies were performed in combination to tympanoplasty, better hearing gain was obtained in the cortical mastoidectomy group as compared to modified radical mastoidectomy group. However, it may be attributed to less extensive disease in the former.
7. Success of tympanoplasty is better in restoring hearing in cases with lesser Air Bone gap at the presentation than with larger Air Bone gap provided regular postoperative care is done.
8. However, it should be noted that the 'key to success in otologic surgery is not what technique one uses but how well one uses it'.

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