ORIGINAL ARTICLE

Improvement of Hearing After Myringoplasty: A Study on 50 Cases at HFCMCH

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Abstract:

The aim of this study was to assess hearing improvement after myringoplasty within ten weeks following surgery. The study population consisted of 50 patients who were suffering from CSOM-TT. Pre-operative and post-operative examinations of the patients were conducted clinically as well as audiotologically. Pre-and post-operative air-bone (A-B) gap were calculated by taking the averages of bone conduction and air conduction at the frequencies of 500, 1000 and 2000 Hz. Myringoplasty was done with underlay technique under general anaesthesia by postaural approach. Temporal muscle fascia was used as grafting material for reconstruction of the tympanic membrane. Pre-operatively, air-bone gap of 30 db or more was observed in 39 (78%) patients whereas post-operatively A-B gap of 30 db or more was observed in only one patient. Using hearing gain exceeding 15 dB as the criterion, 39 (78%) patients had their hearing gain exceeding 15 dB. Using post-operative A-B gap within 20 dB as the criterion, 42 (84%) patients had their A-B gap within 20 dB. Myringoplasty is a beneficial procedure for hearing improvement. Using the proportion of patients with a post-operative A-B gap of 30 dB as the criterion, in this study, 98% of patients achieved their A-B gap closer within 30 dB. Using hearing gain exceeding 15 dB as the criterion, 78% patient had their hearing gain exceeding 15 dB.

Introduction:

Chronic suppurative otitis media (CSOM) is one of the most common ear diseases in developing countries¹. CSOM is defined as a persistent disease, insidious in onset, often

capable of causing severe destruction of middle ear structure and irreversible sequelae, which is clinically manifested by deafness and discharge for more than three months. The disease affects the area of the tympanic membrane².

Myringoplasty is one of the various surgical techniques for the management of CSOM-TT disease. It is defined as simple surgical repair of a tympanic membrane perforation without ossicular reconstruction. The presence of a perforation in tympanic membrane with intermittent discharge and hearing loss of conductive nature are the indications of myringoplasty. It is a beneficial procedure

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done for closing tympanic membrane and improving hearing. The degree of hearing improvement depends on several factors such as site and size of perforation, ossicular status, surgical technique, type of graft and function of eustachian tube^{3,4}. However, hearing recovery in the immediate post-operative period may decrease because of presence of gel foam in the middle ear and external auditory canal⁵.

There has not been any published data regarding hearing improvement trend within 10 weeks following myringoplasty with emphasis on time of maximal hearing improvement. No studies have been done so far to find out the trend in hearing improvement within the short period of 10 weeks following surgery in Holy Family Red Crescent Medical College Hospital (HFRMCH).

Therefore, this study was done to assess hearing improvement after myringoplasty within 10 weeks following surgery. Majority of the myringoplasty done in this setup used the underlay technique, temporalis fascia graft and gel foam. This study gives an idea about the trend in hearing improvement following myringoplasty within the period of 10 weeks following surgery.

Materials and method:

The study population consisted of 50 patients who were suffering from CSOM-TT type. The study period was one and half years from February 2008 to July 2009. Pre-operative and post-operative examinations of the patients were conducted clinically as well as audiotically. The pre-operative examinations included ear, nose and throat examination, and otoscopic examinations of both ears.

The external auditory meatus and the tympanic membrane were examined and the site of the perforation was noted. The tuning fork test was done with a frequency of 512 Hz. Audiometric examinations were performed using a clinical audiometer calibrated according to ISO standard. A pure tone air and bone conduction audiogram within one week prior to surgery were recorded at the frequencies of 250, 500, 1000, 2000, 4000 and 8000 Hz. Air and bone conduction threshold were determined with appropriate masking technique whenever indicated. Hearing level was defined as the mean air conduction threshold at 500, 1000 and 2000 Hz and average of these frequencies was calculated to assess the hearing level. Pre-operative A-B gap were calculated by taking the averages of bone conduction and air conduction at the frequencies of 500, 1000 and 2000 Hz. The detail general physical and systemic examinations of all patients were recorded.

All the patients of the study group were examined under microscope within one week prior to surgery. Examination under microscope was done of the ear to be operated. This was carried out with a speculum under the operating microscope to reliably assess the tympanic membrane, site of the perforation, to rule out any other pathology and to assess the ossicular status as far as possible. Those who were found to have cholesteatoma, granulation polyps, discharge and ossicular discontinuity were excluded from the study.

Myringoplasty was done with underlay technique under local anaesthesia either permeal or endaural approach. Temporal muscle fascia was used as grafting material for reconstruction of the tympanic membrane. Bismuth Iodoform Paraffin Paste (BIPP) pack

was removed on the 10th post-operative day. Then the patients were instructed to instil three drops of antibiotic (ciprofloxacin) ear drop three times a day to the operated ear for 15 days. The patients were then called for follow up at the interval of four, six, eight and 10 weeks following surgery. During follow up, both clinical and audiological examinations were done. Post-operative audiograms were obtained at the consecutive interval of 4th, 6th, 8th and 10th week following surgery. Post-operative hearing level were calculated as the mean air conduction threshold at 500, 1000 and 2000 Hz. Post-operative A-B gap was calculated comparing an average of pre-operative bone conduction threshold and post-operative air conduction threshold at frequencies of 500 Hz, 1000 Hz and 2000 Hz.

Results:

Age and sex distribution:

Majority of the male patients (n=25) belonged to the age group 15 to 25 whereas 12 out of 18 female fall in age group 15 to 25 (Table-I).

Site of perforation:

Total 50 patients were divided into different groups, according to the site of perforation, namely, anterior central, posterior central, central malleolar, and big central (Table-II).

Preoperative audiometric evaluation:

An impairment of pre-operative bone conduction threshold of 20 dB or more was observed in none of 50 patients. Pre-operatively, an impairment of air conduction with 40 dB or more was observed in 62% of

the patients and A-B gap of 30 dB or more was observed in 76% of patients (Table-III). The normal threshold of audiometer is 120 dB in this set up.

The impaired air conduction threshold and the A-B gap also varied with the type of perforation, being greatest in the big central, and least in those with anterior central perforation.

Post-operative hearing improvement:

The number of patients gaining an improvement after operation resulting closure of the A-B gap (Table-IV). It shows progressive improvement in air-bone gap.

Hearing results:

The hearing statistics were based on the average of the three frequencies 500, 1000 and 2000 Hz and compared the 4th, 6th, 8th and 10th week post-operative air conduction to pre-operative bone conduction (Table-V).

Patients were reviewed at 6th week following surgery; it was found that number of cases in A and B column were increased to eight (16%) and 22 (44%) respectively. Therefore, more patients achieved A-B gap between zeros to 20 dB at 6th week compared to 4th week follow up. The last follow up at 10th week following surgery had shown that "A" category had same number of patients as in 8th week having achieved maximal closure of A-B gap. "B" category had slight increase in number of patients compared to 8th week with improved A-B gap within 11-20 dB. Only one patient had more than 31 dB A-B gap that had big central perforation

Table-I: Age and sex distribution.

Age in years	Male	Female	Total
15 - 20	13	05	18
21 - 25	12	07	19
26 - 30	05	02	07
31 - 35	00	03	03
36 - 40	02	01	03
Total	32	18	50

Table-II: Age wise distribution of perforation sites of the patients who underwent myringoplasties

Site of perforation	Number of patients	Age (years)
Anterior central	07	17-40 Average: 27
Posterior central	04	24-40 Average: 29
Central malleolar	17	15-37 Average: 22
Big central	22	15-35 Average: 22
Total	50	15-40

Table-III: Severity of hearing loss according to the site of perforations, pre-operative air conduction thresholds and A-B gaps in different groups

Position of perforation	A-B gap	
	Number of patients with 30 dB or more	Mean (dB)
Anterior central	4/7 (57%)	35
Posterior central	3/4 (75%)	34
Central malleolar	14/17 (41%)	43
Big central	18/22 (82%)	43
Total	39/50 (76%)	

Table-IV: Number of patients with post-operative improvement

Position of perforations	Number of patients with 20 dB or more improvement in A-B gap			
	4 th week	6 th week	8 th week	10 th week
Anterior central	0/7	1/7 (14%)	0/7 (0%)	1/7 (14%)
Posterior central	0/4	2/4 (50%)	1/4 (25%)	2/4 (50%)
Central malleolar	7/17 (41%)	7/17 (41%)	10/17 (59%)	13/17 (76%)
Big central	8/22 (36%)	12/22 (55%)	14/22 (64%)	15/22 (68%)
Total	15/50 (30%)	22/50 (44%)	25/50 (50%)	31/50 (62%)

Table-V: Air-bone gap at different weeks following surgery (n=50)

Total	A (0 to 10 dB)	B (11 to 20 dB)	C (21 to 30 dB)	D (>31 dB)	E (0 to 20 dB)
Fourth week	03 (6%)	15 (30%)	19 (38%)	13 (26%)	18 (36%)
Result	Excellent	Good	Fair	Failure	Satisfactory
Sixth week	08 (16%)	22 (44%)	16 (32%)	04 (8%)	30 (60%)
Result	Excellent	Good	Fair	Failure	Satisfactory
Eighth week	11 (22%)	30 (60%)	07 (14%)	02 (4%)	41 (82%)
Result	Excellent	Good	Fair	Failure	Satisfactory
Tenth week	11 (22%)	31 (62%)	07 (14%)	01 (2%)	42 (84%)
Result	Excellent	Good	Fair	Failure	Satisfactory

Discussion:

Out of 50 patients, seven had anterior central perforation, four posterior central perforation, 17 central malleolar perforation and 22 had big central perforation. The result has shown that the age and sex did not seem to have any bearing on the site of perforation, pre-operative hearing level or post-operative hearing improvement. Yung had the similar findings⁶. There was no relationship between duration of ear discharge and size of the perforation.

The impaired air conduction threshold and air-bone gap also varied with the site of perforation, being greatest in the big central perforation and least in anterior central perforation. Several ears had marked hearing loss associated with different site of perforation. This was particularly noticeable when the round window had been exposed. Big central and central malleolar perforation had greatest hearing loss^{7,8}. In present study, the pre-operative air conduction threshold was poorer than 40 dB for big central perforation in 17 (77%) out of 22 patients. The pre-operative A-B gap poorer than 30 dB for big central perforation was found in 18 of 22 (82%) patients. Similarly, the pre-operative air conduction threshold poorer than 40 dB for central malleolar perforation in 12 (71%) and pre-operative A-B gap poorer than 30 dB was observed in 14 (82%) cases.

In the present study, an increased incidence of pre-operative hearing loss was found in big central perforation and central malleolar perforation compared to anterior central and posterior central perforation. Similar results were found by Young that big central, central malleolar and posterior central perforation had greater hearing loss compared to other sites of perforation⁶. He found that out of 18 patients six had big central perforation with pre-operative air conduction loss of average 43 dB whereas in central malleolar type of perforation there was an average of 48 dB pre-operative air conduction loss. Similarly, A-B gap was also wider in these patients. The greater hearing loss in big central perforation and central malleolar perforation were due to exposure of the round window. Temporal muscle fascia graft was placed by underlay technique in 49 cases and in one case modified underlay technique was used where graft was placed lateral to the handle of malleus. This patient was found to have central malleolar perforation with the tip of the malleus handle touching the promontory. Post-operative hearing improvement was 18 dB in this patient at 10th week. The study done by Stage showed good hearing improvement with underlay technique graft lateral to the malleus handle and concluded as good alternative

method to conventional underlay myringoplasty in ears with perforation involving the area anterior to the malleus handle⁹.

There are different criteria for assessing hearing after chronic ear surgery such as social hearing method, hearing gain method and mean A-B gap for each frequency but none is a universally accepted method¹⁰. The standard method of comparing the post-operative air conduction with pre-operative bone conduction appears most frequently in literature¹⁰. Thus, this method was used for calculating hearing result in this study.

Japan Clinical Otology Committee has used following three criteria for calculation of the hearing¹¹. Using the proportion of patients with a post-operative hearing within 40 dB as the criterion, in this study, 100% of patients achieved their hearing level within 40 dB. Using hearing gain exceeding 15 dB as the criterion, 78% patients had their hearing gain exceeding 15 dB. Using post-operative air-bone gap within 20 dB as the criterion, 84% patients had their air-bone gap within 20 dB. There were 27 patients (54%) who had maximal closure of A-B gap at 10th week followed by 15 patients (30%) at 8th week and eight patients (16%) at 6th week. Graft could be seen in all cases except six at 4th week. These six patients had gel foam still in the external auditory canal at the 4th week. In the audiological evaluation, these six patients were found to have greater hearing loss at 4th week compared to other groups. Only one patient did not have any improvement in hearing level after surgery in all the subsequent follow-ups. On otoscopic examination, there was medialization of the graft with retraction at the posterior superior quadrant, which probably resulted due to eustachian tube dysfunction.

Site of perforation affects the degree of hearing loss. Regarding the site of perforation, big central and central malleolar perforation had greater hearing loss than other perforation

sites. Myringoplasty is a beneficial procedure for hearing improvement.

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