

Hearing Improvement after Myringoplasty in Sudanese Patients

Rasha Ali ¹, Sharfi Ahmed ^{*2}, Abusefian A³ Mohamed B⁴

¹ENT Consultant in Omdurman Friendship Hospital, Sudan

^{*2}Associate Prof. Omdurman Islamic University, Sudan

³Associate Prof. ElNielin University, Sudan

⁴Consultant Audiologist Sudan

Abstract:-

Myringoplasty is a reconstructive operation of the tympanic membrane to prevent recurrent ear infection and improve the hearing.

Objective: *to assess the hearing improvement after myringoplasty and factors that might affect the outcome.*

Patients and methods: *Fifty one patients who had undergone myringoplasty were taken on this prospective study. They were subjected to clinical and audiological examination by a questionnaire, and the results of pure tone audiogram were analyzed.*

Results: *Most of the patients (51 %) were in the age group 0-20 years. Male to female ratio was 1:1.12. The common cause of perforation was chronic ear infection and its commonest size was subtotal (34 patients=66.7%). Most of the patients had conductive hearing loss (47 patients=92.2 %), while mixed hearing loss was found in 4 patients (7.8%). Postauricular approach was used in 18 patients (35.3%) and had higher hearing threshold improvement (94.4%). Underlay technique and temporalis fascia graft both had a higher hearing threshold improvement.*

The overall hearing threshold improvement was 80.4% and air-bone gap had decreased in 80.4%.

Conclusion and recommendations: *in this study myringoplasty was mainly performed in young age, had best hearing threshold improvement and better outcome in female, temporalis fascia, underlay technique and postauricular approach. We recommend for further studies conducted with more number of patients and long-time follow up after myringoplasty for assessment of hearing improvement.*

Keywords: - Myringoplasty, hearing improvement.

1. Introduction and Literature Review

Tympanoplasty refers to any operation involving reconstruction of the tympanic membrane and/or the ossicular chain. Myringoplasty is a tympanoplasty without ossicular reconstruction (1).

Myringoplasty is performed to prevent infection and to improve hearing loss caused by tympanic membrane perforation, and was established for the first time by Berthold in 1879 (2, 3).

In 1956, Zöllner successfully used autologous fascia lata (4). Temporal muscle fascia in myringoplasty was suggested for the first time by Wullstein in 1957 (5).

In myringoplasty, a graft taken commonly from temporalis fascia and sometimes from Tragal perichondrium, or cartilage (6), it can be placed either underlay or onlay (7). Since the underlay technique introduced by Shea in 1960 (8, 9), has most widely used and over 92% success

rate (10). The excision of the perforation edge is an integral part of any myringoplasty procedure, whatever the approach, incision, or technique used (11).

Chronic otitis media is one of the commonest otological problems among Sudanese, in both adult and children (43%) and they presented with perforation of ear drum and different degrees of hearing loss (12).

A study included 250 patients the subjective improvement of hearing post operatively 64%, and audiological results in the three groups of patients using the three graft materials showed insignificant statistical differences in hearing improvement (13). The subjective audition improvement coupled with objective pure tone threshold audiometric improvement in Wang C study (14). Other study showed that the mean hearing gain in cartilage grafting; group I was 12.4±6.4 dB, and 14.8±9.9 dB in temporalis fascia grafting; group II with no significant statistical difference between the 2 groups (15). In the K Snidovngs study all patients had

impaired hearing initially; the rate of hearing improvement was 74.3%, patients' mean hearing improvement was 22.9 dB, while the mean hearing improvement reached 13.49 dB in Pie/drola study (16, 17). The air-bone gap was closed to less than 10 dB in 83.3 per cent in endoscopic Transcanal myringoplasty study done by Ahmed El-Guindy (18).

In a comparative study of the underlay and onlay techniques of myringoplasty done by Mangal Singh, showed that the underlay technique was judged to be better assessment of ossicular chain integrity and mobility, hearing gain in more patients (92.8 per cent vs. 57.1 per cent) (19).

In other series the underlay also had a better hearing gain (20, 21). However, there is debate in the literature over whether the size of tympanic membrane perforations is predictive of surgical success and many studies inversely correlate perforation size with successful operative closure, whereas others demonstrate that perforation size is not a determinant for surgical success (22). Anterior perforations have less impairment of hearing and better result in successful closure of tympanic membrane than posterior perforation. Also larger the size of perforation greater is the hearing impairment preoperatively and postoperative hearing gain is also less compared to small perforation (23, 24). In another studies, hearing improvement was seen in patients with shorter duration of disease and smaller size of perforation, this was due to lesser pathological changes in the middle ear (14, 25, 26, 27 and 28).

Karela performed a 211 post aural approach using temporalis fascia and underlay technique myringoplasties; hearing improvement was achieved in 91.5% of cases, independently of age, gender, size and site of the perforation (22). Vartianen found that a result of 404 primary myringoplasty operations; the air-bone gap within 10 dB was achieved in 61% and 11 of them had persistent conductive hearing loss was found to be fixation or erosion of the ossicles (29). Pfammatter had prospective study for 154 patients with temporalis fascia myringoplasty; in which complete ABG closure achieved in only approximately 20% of the cases, and 80% presented with a mean residual ABG of 8 dB (30). Sudhangshu study found that a mean audiological improvement of 10 dB and 11 dB mean air bone gap improvement (31). In the study done by Shrestha were found that Preoperative air-bone gap of 30 dB or more was observed in 39 (76%) patients where in post-operative AB gap of 30 dB or more was observed in only one patient. 98% of patients achieved their A-B gap closer within 30 dB and 78% patient their hearing improvement exceeding 15 dB (32).

2. Patients and methods

This is a prospective study, conducted at Khartoum state hospitals (Three ENT hospitals and four ENT units in

general hospitals.) during the period from March 2012 to August 2013. 51 patients who underwent myringoplasty with intact graft were included in the study. Following detailed history, general and E.N.T examination, pure tone Audiometry was used to assess the hearing level of patients preoperative and 3 months or more postoperative.

The data was collected through a well-designed questionnaire filled in by patients and E.N.T surgeons, then analyzed through Statistical program {SPSS}, a computer program for social science.

3. Results

Fifty-one patients were included in this study. Their ages ranged from 9-75 years, 26(51%) of them were in 0-20 years age group, their hearing thresholds improvement were 84.7.

Males were 24(47.1%); females were 27 (52.9%), with male: female ratio 1:1.12, the hearing threshold improvement was 81.5% in females and 79.2% in males.

The cause perforation was infection in 44 patients (86.3%), while the trauma in 7 patients (13.7%), hearing threshold improvement was 100% in the trauma, and 77.2% in the infection.

All patients had central perforation, 34 of them (66.7%) had subtotal perforation with hearing threshold improvement 76.5%. Regarding the middle ear status at surgery; 43 patients (84.3%) had normal mucosa with 86% hearing threshold improvement. 47 of the patients (92.2%) had conductive hearing loss and 4 patients (7.8%) had mixed hearing loss, 40-60 dB preoperative hearing threshold was found in 28 patients (54.9%), and air bone gap 30-45 dB was found in 20 patients (39.2%). Transcanal approach was used in 33 patients (64.7%), with 72.7% hearing threshold improvement, in the remaining 35.5% postauricular approach was used, with 94.4% hearing threshold improvement. Concerning the technique; 16 patients (31.4%) undergone under-lay technique had a better hearing threshold improvement (93.8%). 35 patients (68.6%) had on-lay technique. 32 patients (37.3%) had tragal cartilage graft, while 19 patients had temporalis fascia graft. Those who had temporalis fascia graft had a better hearing threshold improvement (89.4%). Subjective hearing improvement was reported by 84.3% of patients.

Overall hearing threshold improvement was observed in 80.4% of patients and ABG decreased in 41 patients (80.4%).

4. Discussion

The study revealed that the commonest age group ranged from 0-20 years, and constitute (51%) of patients. 84.7% of

them showed hearing improvement. Male to female ratio was 1:1.12; the hearing threshold improvement was better in female (81.5%).

The mean hearing improvement in the study was 12.5 dB. This was matching with the finding of Pie/drol and Mohsen, where the mean hearing improvement reached 13.5 dB and 13.6 dB (17, 15) respectively. Wasson et al (23) and Sudhangshu (31) found a mean threshold improvement of 6.8dB, 10dB respectively. K Snidvongs (16) reported 22.9 dB as mean hearing improvement.

All patients had central perforation, 66.7% were subtotal perforation, with better hearing threshold improvement 88.2% in the medium one, thus the smaller the size of perforation; the better the improvement in hearing post-operatively, there agreement with a study carried out by B.J.Singh et al (24). In Lee P, Kelly G study was found that the smaller size of perforation and shorter duration; the better hearing threshold improvement, this may be due to lesser pathological changes in the middle ear, this in agree to the findings of this study where patients with normal mucosa hearing threshold improvement of 86% (25, 26, 27), whereas the condition of mucosa did not affect the outcome of Pfammatter study (30). In J D Wasson study, the mean air conduction audiometric gain directly correlated with pre-operative perforation size (23), but in Karela M study the hearing improvement independent on size of the perforation (22).

The postauricular approach had a better hearing threshold improvement (94.4%) than transcanal.

The temporalis fascia was less used as a graft material (37.3%) with 89.4% hearing threshold improvement; this figure was close to that found by Karela M the hearing improvement was achieved in 91.5% of cases (22). Zhi also found that early hearing improvements in the temporalis fascia and perichondrium groups were better than that of cartilage-perichondrium composite grafts, but there was no significant difference at one year after surgery (33, 25), and the study of Al lackany, although the best results were observed when they used perichondrial and cartilage composite grafts for cases with subtotal and total perforation and advanced middle ear pathology (13, 15). In this study there was also no significant difference statistically between temporalis fascia and cartilage grafts, but the temporalis fascia had better results as M. Mohsen et al finding (15). The under-lay technique had higher hearing threshold improvement (93.8%), this was close to that found by Mangal. (92.8 % vs. 57.1%) (19,20). Subjective hearing improvement was reported by 84.3% of patients, this was high percentage compared to the study of Mohamed Al lackany et al in which 64% of patients had reported improvement (13). The Subjective hearing improvement coupled with hearing threshold improvement, which was

statistically significant ($p = 0.04$), same to that of Wang C et al study (14).

In this study there was 31.6% complete closure of air-bone when temporalis fascia was used as a graft and 6.3% when cartilage was used, while in study of Pfammatter, Complete ABG closure achieved in only approximately 20% of the cases (30).

Regarding the surgical technique the mean air-bone closure in this study was 12.5db with better results in under-lay, this was also observed in the Sergi study (21). And was 11 dB In Sudhangshu Shekhar study (31). In study done by Shrestha was found that preoperatively, air-bone gap of 30 db or more was observed in 39 (76%) patients whereas post operatively A-B gap of 30 db or more was observed in only one patient. Ninety-eight percent of patients had achieved their A-B gap closer within 30 dB and 78% patient had their hearing gain exceeding 15 dB (32). In this study 5 patient patients had persistent conductive hearing loss, and Vartianen et al found that 11 patients had persistent conductive hearing loss due to fixation or erosion of the ossicles (29), similar to Muhammad Ashfaq study (28).

5. Conclusions

In this study we conclude that, most of patients are in age group 0-20 years (51%). Females have a better hearing threshold improvement (81.5%). The commonest size of perforation is subtotal perforation (66.7%) with the medium one having a better hearing threshold improvement (88.2%). Most of approaches are transcanal (64.7%), but postauricular one has a better hearing threshold improvement (94.4%). Tragal cartilage graft is used in 62.7% of patient while hearing threshold improvement of temporalis fascia graft is achieved in 89.4%. Subjective hearing improvement is reported by 84.3% of patients. Hearing threshold has improved in 80.4% of patients, and ABG decrease in (80.4%).

References

- [1] George G Browning. Chronic otitis media. Scott brown's Otorhinolaryngology, head and neck surgery 7th edition. 2008; 237: 3421-22.
- [2] Frootko NJ. Applying the language of transplant to tympanoplasty. Acta otolaryngology. 1985 ; (39): 377.
- [3] Zollner F. The principles of plastic surgery of the sound-conducting apparatus. J Laryngol Otol. 1955; 69: 637.
- [4] Zollner F. Panel of myringoplasty. Second workshop on reconstructive middle ear surgery. Arch Otol. 1963; 78:301.
- [5] Wullestin H. Theory and practice of tympanoplasty. Laryngoscope. 1956; 66: 1076-95.

- [6] Stenfors LE. Treatment of tympanic membrane perforation with hyaluronan in an open pilot study of unselected patients. *Acta otolaryngol.* 1987; (supp 442): 81-7.
- [7] Crovetto De La, Torro M. Myringoplasty in chronic otitis media, comparative analysis of underlay and overlay technique. *Acta Otorhinolaryngol ESP.* 2000; 51: 101-4.
- [8] Shea JJ. Vein graft closure of ear drum perforation. *Northwest Med.* 1960; 59:770-2.
- [9] Shea JJ. Vein graft closure of eardrum perforations. *J Laryngol Otol.* 1960; 74: 358.
- [10] Black JH, Warmald PJ. Myringoplasty effects on hearing and contributing factors. *AFr. Med J* 1995; 85(1): 41.
- [11] Hussam K. El-Kashlan Lee A. Harker. Tympanoplasty and ossiculoplasty. *Cummings Otolaryngology Head & Neck Surgery* 4th edition. 2005; 136: 1905-06-07.
- [12] Yagi H.I. the pattern of diseases of the ears in Sudanese patients. *Sudan medical journal, Sudan medical association.* 1989; 127(1-4):44-47.
- [13] Mohamed Al lackany, Nadia Nassif Sarkis. Functional Results after Myringoplasty and Type 1 Tympanoplasty with the Use of Different Graft Materials. *Journal of the Medical Research Institute (JMRI).* 2005; 26(4): 369-374.
- [14] Wang C et al. Hearing results and an analysis of related impact factors following myringoplasty. *Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi.* 2008 Jul; 22(13): 577-9.
- [15] M. Mohsen et al. Comparative study of the clinical and audiological outcome of myringoplasty using temporalis fascia graft versus tragal cartilage graft. *Al-Azhar- Assiut Medical Journal,* April 2010; 8: 2.
- [16] K Snidvongs et al. Outcome of mobile ear surgery units in Thailand. *Cambridge Journals, the Journal of Laryngology & Otology.* April 2010; 124: 04: 382-386.
- [17] Pie/drola Maroto D et al. Functional results in myringoplasties. *Acta Otorrinolaringol Esp.* 2010 Mar-Apr; 61(2): 94-9.
- [18] Ahmed El-Guindy et al. Endoscopic transcanal myringoplasty. *Cambridge Journals, the Journal of Laryngology & Otology.* June 1992; 106(06): 493-495.
- [19] Mangal Singh M.S. et al. Comparative study of the underlay and overlay techniques of myringoplasty in large and subtotal perforations of the tympanic membrane. *Cambridge Journals, the Journal of Laryngology & Otology.* June 2003; 117 (06): 444-448.
- [20] Bruno Sergi et al. Perforation Closure Rate and Hearing after Myringoplasty. *Journal of the American Academy, Otolaryngol Head Neck Surg.* August 2010; 143: 2.
- [21] Sergi B et al. Overlay versus underlay myringoplasty: report of outcomes considering closure of perforation and hearing function. *Acta Otorhinolaryngol Ital.* 2011 Dec; 31(6):366-71.
- [22] Karela M et al. Myringoplasty: surgical outcomes and hearing improvement: is it worth performing to improve hearing? *Eur Arch Otorhinolaryngol.* 2008 Sep; 265(9):1039-42.
- [23] J D Wasson, C E Papadimitriou et al. Myringoplasty: impact of perforation size on closure and audiological improvement. *Cambridge Journals, the Journal of Laryngology & Otology* September. 2009; 123: 09: 973-977.
- [24] B.J.Singh et al. A comparative study of different graft materials used in myringoplasty. *Indian Journal of Otolaryngology and Head & Neck Surgery.* June 2009; 61 (2): 131-134.
- [25] Lee P, Kelly G, Mills RP. Myringoplasty: does the size of the perforation matter? *Clin Otolaryngol.* 2002; 27 (5): 331-4.
- [26] Lin C. Er BY, Feng W, Hu Y Related Articles. The selection of tympanoplastic type in treating chronic suppurative otitis media <<http://www.ncbi.nlm.nih.gov>. 1999; 13(7):307-8.
- [27] Frade Gonzalez C et al. Prognostic factors influencing anatomic and functional outcome in myringoplasty. *Acta Otorrinolaringol Esp.* 2002 Dec; 53(10):729-35.
- [28] Muhammad Ashfaq et al. Myringoplasty: Anatomical and functional results. *Pakistan armed forces medical journal, a journal of army medical corps.* December 2004; 2.
- [29] Vartanen E et al, Success and pitfalls in myringoplasty: follow-up study of 404 cases. *Am J Otol.* 1993 May; 14(3):301-5.
- [30] Pfammatter A et al. Can myringoplasty close the air-bone gap? *Otol Neurotol.* 2013 Jun; 34(4):705-10.
- [31] Sudhangshu Shekhar Biswas et al. Hearing evaluation after myringoplasty. *Bangladesh J Otorhinolaryngol.* 2010; 16(1): 23-28.
- [32] Shrestha S et al. Hearing results after myringoplasty Kathmandu Univ Med J (KUMJ). 2006 Oct-Dec; 4(4):455-9.
- [33] Zhi Gang Zhang et al, Three Autologous Substitutes for Myringoplasty: A Comparative Study. *Otol Neurotol* 2011; 32:1234-1238.