

# SOFT POSTERIOR CANAL WALL RECONSTRUCTION WITH AND WITHOUT ANTERIORLY BASED MUSCULOPERIOSTEAL FLAP

M. Sadooghi<sup>\*1</sup>, M. H. Baradaranfar<sup>2</sup> and F. Dodangeh<sup>2</sup>

1) Department of Otolaryngology, Head and Neck Surgery, Amir Alam Hospital, School of Medicine, Medical Sciences/University of Tehran, Tehran, Iran

2) Department of Otolaryngology and Head and Neck Surgery, Yazd University of Medical Sciences, Yazd, Iran

**Abstract-** This study was designed reevaluate the outcome of soft wall reconstruction technique for CWD mastoidectomy and to test the validity of anteriorly-based musculoperiosteal flap attachment without obliterating the mastoid cavity for increasing graft viability. Two methods of reconstruction were used. Soft wall reconstruction method as described previously by Smith et al, were performed on 35 patients (A) , and anteriorly – based musculoperiosteal flap was attached to it in 25 patients (B). Post operative condition of meatal wall, graft failure and canal volume in two groups were documented. In 3 years follow up period no retraction pockets were documented and there was slight increase in canal volume measured by the volume of povidone iodine pouring in the canal. 17% of group A and 8% of group B had graft failure. No significant differences was seen ( $P > 0.05$ ). There was no recurrent cholesteatoma in the patients on clinical examination. Soft-wall reconstruction method is a safe method for eliminating the problem of radicalized mastoid cavity, and the musculoperiosteal flap attachment had no advantage compared with soft-wall reconstruction.

*Acta Medica Iranica*, 44 (6): 387-390; 2006

© 2006 Tehran University of Medical Sciences. All rights reserved.

**Key words:** Radical mastoidectomy, soft posterior wall, mastoid reconstruction

## INTRODUCTION

The surgical treatment of cholesteatoma often requires canal wall down mastoidectomy to ensure complete removal of disease. Mastoid cavity after the surgery may develop complications, including cosmetic problems due to enlarged meatus, poor hearing aid fit, recurrent infection, impaction with debris and chronic otorrhea (1-9). Reconstruction and obliteration methods are performed to resolve these problems (6, 8, 10).

Canal wall reconstruction is more practical for anatomic and physiologic reason (11), and can be performed by various techniques. In this article, we performed posterior canal wall reconstruction by using posterior canal skin and temporales graft, described previously by Smith *et al.* (12-14) and report our results in this regard.

## MATERIALS AND METHODS

Sixty patients included 31 male and 29 female with their age ranging from 8 to 63 years with unilateral primary cholesteatoma underwent soft wall reconstruction. We obtained informed consent from all patients.

In the first step a canal wall down mastoidectomy was performed and all cholesteatoma and

Received: 13 Feb. 2005, Revised: 8 Aug. 2005, Accepted: 31 Aug. 2005

**\* Corresponding Author:**

M. H. Baradaranfar, Department of Otolaryngology and Head and Neck Surgery, School of Medicine, Yazd University of Medical Sciences, Yazd, Iran

Tel: +98 351 8224000

Fax: +98 351 8224100

E-mail: baradaranf@hotmail.com

## Soft posterior canal wall reconstruction

granulation tissue were removed. In the second step for reconstruction of posterior canal wall we divided our patients in two groups. In group A, including 35 patients, a piece of temporalis fascia was used for covering the defect on the ear drum and posterior canal wall skin and supported in its place with few small pieces of Gelfoam. In group B, include 25 patients, an anteriorly based musculo-periosteal flap, which was derived from muscle and periosteum behind the ear, was matched with the defect size and was turned down to attach behind the soft wall without obliterating the mastoid cavity and then supported by Gelfoam.

In 26 patients who had good stapes, ossiculoplasty was performed but in the 34 patients (42%) without suprastructure of stapes ossiculoplasty was not performed and they were referred for second stage operation.

Patients were followed up to three years, one visit a month in the first year and one visit every other month for the next two years. During the follow-up period we carefully examined the ears with operating microscope and examined the canal volume by using povidone iodine in operated canal and compared this volume with the other intact canal of each patient. The data were collected and statistically analyzed with Fisher's exact test.

## RESULTS

During follow up period these two groups were compared with each other. There were 6 cases (17%) of graft failures in group A and 2 cases (8%) in group B, but there was no significant difference ( $P > 0.05$ ) (Table 1).

No narrow neck retraction pocket was found by clinical examination but increase in canal volume, a balloon like retraction, was seen and measured by the volume of povidone iodine poured in the canal.

The increase in canal volume was only seen in the first year during serial measurements and reached a plateau afterward. Recurrent cholesteatoma was not seen in any patients on clinical examination and in 42% of the patients who underwent second operation two years later for ossiculoplasty no cholesteatoma was seen during operation.

## DISCUSSION

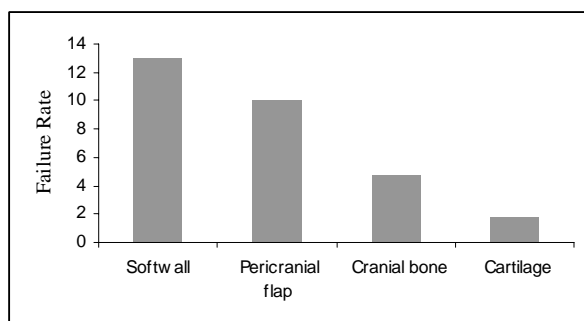
Our method is based on smith *et al.* description of using posterior canal wall skin and temporalis fascia for reconstruction of posterior canal wall (12-14).

For reevaluation of this method our sixty patients were divided in to two groups. In 35 patients (A) soft wall reconstruction was performed and in 25 patients (B) an anteriorly based musculoperiosteal flap was turned down and attached behind it. This form of flap is easily accessible and can provide physical and physiological support to the soft wall. The blood supply of this flap is from occipital and posterior auricular artery. Our hypothesis of using this flap was based on this fact that using pedicle flaps for mastoid reconstruction may enhance vascularity and therefore increase graft viability (15, 16).

During 3 years follow up period, there were 17% (6 cases) graft failures in group A and 8% (2 cases) in group B. Therefore there were total 13% (8 cases) graft failures. These amounts of graft failures in each group were comparable with other studies. In a study of sixty cases using postauricular periosteal pericranial flap for mastoid elimination, 10% graft failure was seen (9). In the other study the rate of graft failure in 62 patients using autogenous cranial bone for mastoid obliteration was 4.6% (17), and in Milewski report ,the failure rate in drum closure was 1.5% using cartilage for mastoid reconstruction (18) (Fig. 1).

**Table 1.** Evaluation of graft status in the study groups

Study Groups	Total		Success		Failure	
	N	%	N	%	N	%
Group A	35	100	29	83	6	17
Group B	25	100	23	92	2	8
Total	60	100	52	87	8	13



**Fig. 1.** Comparison of failure rates in various methods reported in different studies.

Our graft failure rate was not significantly more than these studies; moreover our follow up period was longer. The difference between the graft failure rate in our two groups was presumably because of vascular support of musculoperiosteal flap but this difference was not statistically important ( $P > 0.05$ ).

In our study dry ears were obtained in all patients except in the cases of graft failure. Different results in obtaining a dry ear in various methods of mastoid elimination were repeated. For example 100% success was reported by Smith using reconstruction technique (19), 94% for Tos who used obliterating and reconstructing methods (20), 93% success for Sanders who used palva flap for obliteration (21) and 83% for Blak using autograft cartilage for reconstruction (22) and recently Minatogawa reported 45% success in long term with obliterating surgery (23). Takahashi also reported a comparative study on open cavity method and soft wall reconstruction method for cholesteatoma. He concluded, the period to obtain early ear was significantly shorter in soft wall group ( $P < 0.01$ ) (12). We found no narrow neck retraction pocket on microscopic examination; however, a balloon like retraction, previously described by other authors occurred (12, 24). We also demonstrated the increase in canal volume with pouring povidone iodine in the operated canal and compared it with opposite ear of each patient except for the cases of graft failure. In the first year, the volume of canal increased in all patients and then became stable. Takahashi found that retraction involved the entire soft wall. He concluded that soft wall reconstruction allow the graft to retract or not according to eustachian tube function, this reconstructed canal may be slightly

wider than primary size up to large space and there is no severe problem such as narrow neck retraction in this method (12).

The cause of similarity of retraction in our two groups in spite of using musculoperiosteal flap for group B was muscular atrophy during follow up period. This observation is previously described by Mitchell (9) and Linthicum (25). They demonstrated the replacement of muscle of pedicle flaps by fibrofatty tissue and loss of its supportive effect. In our series, we did not have recurrent cholesteatoma on clinical microscopic examination in all the patients, and in 42% of the patients who underwent second operation for ossicular reconstruction no cholesteatoma was seen during operation. In Takahashi soft wall series, the incidence of recurrent cholesteatoma was 1.9% (12) which had no difference with open group. Many authors believed that the low incidence of recurrent cholesteatoma in soft wall reconstruction technique was at least similar to open method and less than intact canal wall mastoidectomy (22, 26, 27).

In this article, we did not compare various method of reconstruction or obliteration with soft wall method. But in comparison of reconstruction of canal with hard material or soft wall Black and Kelly found that the hard material withstand the effect of negative pressure caused by eustachian tube dysfunction, leading to formation of narrow retraction pocket between the canal and pars tensa (11). Geyer found this phenomenon as a major problem and reported a 31% failure rate (28). With the use of synthetic hard material other problems including extrusion and infection also occurred (7, 11, 29).

The follow up period in this study was limited so longer follow up may increase the complication rate. Moreover, the hearing results of this method were not evaluated. In conclusion soft-wall reconstruction method is a safe method for eliminating the problem of radicalized mastoid cavity, and the musculoperiosteal flap attachment had no advantage compared with soft-wall reconstruction method.

### Conflict of interests

We have no conflict of interests.

## REFERENCES

1. Arriaga MA. Mastoidectomy. In: Brackmann DE, Shelton C, Arriaga MA. Otolologic surgery. 2th edition. Philadelphia: W.B. Saunders; 2001. p. 178-189.
2. Chole RA, Brodie HA. Surgery of the mastoid and petrosa. In: Bailey BJ. Head and neck surgery otolaryngology. 2nd edition. Philadelphia: Lippincott-Raven publishers; 1998. p. 2053-2072.
3. Paparella MM, Meyerhoff WL, Morris MS, Da Costa SS. Mastoidectomy and tympanoplasty. In: Paparella MM, Shumrick DA. 3th edition. Philadelphia: WB. Saunders company; 1991. p. 1405-1439.
4. Brown JS. A ten year statistical follow-up of 1142 consecutive cases of cholesteatoma: the closed vs. the open technique. *Laryngoscope*. 1982 Apr; 92(4):390-396.
5. Karmarkar S, Bhatia S, Saleh E, DeDonato G, Taibah A, Russo A, Sanna M. Cholesteatoma surgery: the individualized technique. *Ann Otol Rhinol Laryngol*. 1995 Aug; 104(8):591-595.
6. Leatherman BD, Dornhoffer JL. Bioactive glass ceramic particles as an alternative for mastoid obliteration: results in an animal model. *Otol Neurotol*. 2002 Sep; 23(5):657-660.
7. Mahendran S, Yung MW. Mastoid obliteration with hydroxyapatite cement: the Ipswich experience. *Otol Neurotol*. 2004 Jan; 25(1):19-21.
8. Ishimoto S, Ito K, Shinogami M, Yamasoba T, Kaga K. Use of cartilage plate as tympanic membrane in total middle ear reconstructive surgery for infected radicalized ear. *Otol Neurotol*. 2003 Jan; 24(1):2-5.
9. Ramsey MJ, Merchant SN, McKenna MJ. Postauricular periosteal-pericranial flap for mastoid obliteration and canal wall down tympanomastoidectomy. *Otol Neurotol*. 2004 Nov; 25(6):873-878.
10. Ishimoto S, Ito K, Sasaki T, Shinogami M, Kaga K. Total middle ear reconstructive surgery for the radicalized ear. *Otol Neurotol*. 2002 May; 23(3):262-266.
11. Duckert LG, Makielski KH, Helms J. Refined mastoid reconstruction with the pedicled postauricular perichondrial flap. *Am J Otol*. 1997 Jan; 18(1):10-14.
12. Takahashi H, Hasebe S, Sudo M, Tanabe M, Funabiki K. Soft-wall reconstruction for cholesteatoma surgery: reappraisal. *Am J Otol*. 2000 Jan; 21(1):28-31.
13. Takahashi H, Honjo I, Hasebe S, Sudo M, Tanabe M. Soft-wall reconstruction of posterior canal wall for surgery of noninflamed ears: a preliminary report. *Am J Otol*. 1999 Jan; 20(1):31-35.
14. Smith PG, Stroud MH, Goebel JA. Soft-wall reconstruction of the posterior external ear canal wall. *Otolaryngol Head Neck Surg*. 1986 Mar; 94(3):355-359.
15. Black B, Kelly S. Mastoidectomy reconstruction: revascularizing the canal wall repair. *Am J Otol*. 1994 Jan; 15(1):91-95.
16. Black B, Kelly S. Mastoidectomy reconstruction: management of the high facial ridge using hydroxylapatite implants. *Am J Otol*. 1994 Nov; 15(6):785-792.
17. Roberson JB Jr, Mason TP, Stidham KR. Mastoid obliteration: autogenous cranial bone pate reconstruction. *Otol Neurotol*. 2003 Mar; 24(2):132-140.
18. Milewski C. Composite graft tympanoplasty in the treatment of ears with advanced middle ear pathology. *Laryngoscope*. 1993 Dec; 103(12):1352-1356.
19. Smith MF. Reconstruction of the open mastoidectomy ear: a six year progress report. *Ann Otol Rhinol Laryngol*. 1975 Jul-Aug; 84(4 Pt 1):552-557.
20. Tos M. Reconstruction of old radical cavities. *Clin Otolaryngol Allied Sci*. 1978 Aug; 3(3):255-261.
21. Saunders JE, Shoemaker, DL. Reconstruction of mastoid obliteration surgery. *Am J Otol* 1995; 16: 99-103.
22. Black B. Mastoidectomy elimination. *Laryngoscope*. 1995 Dec; 105(12 Pt 2 Suppl 76):1-30.
23. Minatogawa T, Machizuka H, Kumoi T. Evaluation of mastoid obliteration surgery. *Am J Otol*. 1995 Jan; 16(1):99-103.
24. Hosoi H, Murata K, Kimura H, Tsuta Y. Long-term observation after soft posterior meatal wall reconstruction in ears with cholesteatoma. *J Laryngol Otol*. 1998 Jan; 112(1):31-35.
25. Linthicum FH Jr. The fate of mastoid obliteration tissue: a histopathological study. *Laryngoscope*. 2002 Oct; 112(10):1777-1781.
26. Smyth GD. Cholesteatoma surgery: the influence of the canal wall. *Laryngoscope*. 1985 Jan; 95(1):92-96.
27. Charachon R. Cholesteatoma, epidermization: choice between closed and obliteration technique. *Clin Otolaryngol Allied Sci*. 1978 Nov; 3(4):363-367.
28. Geyer G, Dazert S, Helms J. Performance of ionomeric cement (Ionocem) in the reconstruction of the posterior meatal wall after curative middle-ear surgery. *J Laryngol Otol*. 1997 Dec; 111(12):1130-1136.
29. Leatherman BD, Dornhoffer JL. The use of demineralized bone matrix for mastoid cavity obliteration. *Otol Neurotol*. 2004 Jan; 25(1):22-25