The Journal of International Advanced Otology

J Int Adv Otol 2019; 15(2): 189–92 • DOI: 10.5152/iao.2019.5731

Original Article

Effect of the Fascia Graft Size on Healing Rate of Cavities in Patients Undergoing CWD Tympanomastoidectomy: A Clinical Prospective Study

Hasan Deniz Tansuker, Şahin Öğreden, Cemal Özyılmaz, A. Buğra Cengiz, Şebnem E. Beder, Mehmet Faruk Oktay, Nazım Korkut

Department of Otolaryngology, University of Health Sciences Bağcılar Training and Research Hospital, İstanbul, Turkey (HDT, ŞÖ, CÖ, ABC, MFO)
Clinic of Otolaryngology, Beylikdüzü State Hospital, İstanbul, Turkey (ŞEB)
Department of Otolaryngology, Acıbadem Ahmet Ali Aydınlar University School of Medicine, İstanbul, Turkey (NK)

ORCID IDs of the authors: H.D.T. 0000-0001-6599-856X; Ş.Ö. 0000-0001-5513-8224; C.Ö. 0000-0001-5580-1014; A.B.C. 0000-0003-3942-6765; Ş.E.B. 0000-0002-0808-630X; M.F.O. 0000-0001-5708-4813; N.K. 0000-0001-9819-7486.

Cite this article as: Tansuker HD, Öğreden Ş, Özyılmaz C, Cengiz AB, Beder ŞE, Oktay MF, et al. Effect of the Fascia Graft Size on Healing Rate of Cavities in Patients Undergoing CWD Tympanomastoidectomy: A Clinical Prospective Study. J Int Adv Otol 2019; 15(2): 189-92.

OBJECTIVES: To evaluate the effects of size of temporal fascia graft on healing of the mastoid cavity in patients undergoing canal wall down (CWD) procedures.

MATERIALS AND METHODS: The study included 32 patients (ages from 10 to 69 years) who were performed CWD tympanomastoidectomy from 2016 to 2018. Patients were divided into 2 different groups randomly based on size of fascia used in the operations. Group 1 consisted of 19 patients with temporal muscle fascia large enough to extend up to antrum by passing through over the facial ridge. Group 2 consisted of 13 patients with fascia of a size hardly enough to create a middle ear space, which were quite smaller than those the first group. It was also observed that whether or not the type of pathology (cholesteatoma, granulation tissue or both) had an effect to the epithelialization time of the cavity.

RESULTS: Thirty-two patients met inclusion criteria. Nineteen patients were randomized to study (large fascia) group and 13 patients were to control (small fascia) group. The mean duration for epithelialization of cavities with study group-large grafts was 34.10 days and that was 39.76 days in control group-small grafts. According to type of pathology; in cases with cholesteatoma, with granulation, and cases of coexisting granulation with cholestatoma; the mean epithelialization times were 38.73, 31.33 and 34.42 days, with respectively.

CONCLUSION: Placement of larger fascia graft to line the mastoidectomy cavity facilitate rapid epithelialization and healing in patients undergoing CWD tympanomastoidectomy. Further studies with larger groups would be beneficial to confirm this result in the aspect of statistical significance.

KEYWORDS: Fascia graft size, mastoidectomy cavity, epithelialization

INTRODUCTION

The goal of surgery for chronic otitis media is to eradicate infection with restoring functional anatomy as much as possible. Tympanomastoidectomy is usually the procedure for surgical treatment; it can be divided basically into techniques for preserving the posterior wall of the external ear canal (EAC) or not [1, 2]. Although efforts are made to preserve the posterior canal wall, the canal wall down (CWD) technique is sometimes inevitable, in which the resultant surface area of the exposed mastoid cavity is usually substantially greater than the original surface area of the EAC [3]. In addition to major advantages, such as better exposure for disease eradication and postoperative monitoring, CWD technique also has many disadvantages, such as cosmetic defects of enlarged meatus, problems with water exposure, and the need for aural toilet [1, 2, 4]. In this well-established technique of CWD, the time needed for complete epithelialization of the cavity is usually between 6 and 12 weeks, depending on some factors [3]. Fascia grafts are usually too small both to repair the perforated tympanic membrane and to clothe the mastoid bowl throughout, the presence of uncovered cavity handicaps healing that ends up with prolonged otorrhea [1]. Many techniques have been described to improve the healing of the mastoidectomy cavity, which usually focused on facilitating epithelialization [3]. Postauricular skin flap to cover the mastoid cavity, pinch grafting described by Takeda [5], cultured autologous keratinocytes reported by Premachandra [6],and split-thickness

Corresponding Address: Hasan Deniz Tansuker E-mail: hasandeniztansuker@gmail.com

Submitted: 17.06.2018 • **Revision Received:** 15.10.2018 • **Accepted:** 21.10.2018 • **Available Online Date:** 09.07.2019
Available online at www.advancedotology.org

skin grafting have varying degrees of success on improving mastoid cavity healing; however, most of them are not commonly preferred in today's surgical practice [2]. In addition to these, cavity obliteration techniques and reconstruction of the posterior wall of the EAC with hard or soft tissues [7] have been also introduced to overcome the disadvantages of the CWD procedure.

In the present report, a simple modification was developed for traditional technique of small fascia graft lining and was compared with the antecedent in a prospective, randomized fashion. We intended to determine whether this could reduce the necessity or frequency of use of the other much more complicated techniques mentioned above in promoting epithelialization of the cavities. In addition to this, we tried to observe whether the type of pathology had a relationship with the epithelialization time of the mastoidectomy cavity in the current study.

MATERIALS AND METHODS

This was a prospective, randomized study. The study was approved by the University Ethics Committee (approval no. 2018.03.3.01.022. r1.032). A total of 32 patients (13 (40.6%) females and 19 (59.4%) males) who were brought to the otorhinolaryngology clinic from 2016 to 2018 to be performed modified radical CWD tympanomastoidectomy for the first time for chronic otitis media strictly resistant to other treatment options and who did not have exclusion criteria were included in the study.

The pathophysiology of every case (cholesteatoma, granulation tissue, or both) was determined intraoperatively. All patients were followed up postoperatively at the outpatient clinic with otomicroscopy, two or three times a week, from discharge up to complete healing time, to observe epithelialization of the mastoidectomy cavities. No medication was used; only cavity care with aspiration was performed to the patients. Patients who did not come to outpatient visits regularly, who did not achieve complete epithelialization for any reason, who did not fulfill the postoperative care regimen, with revision cases, with persistent otorrhea, and who had residual disease were excluded from the study.

Patients were grouped randomly according to fascia size used in the operations. Group 1 consisted of 19 patients in whom temporal muscle fascia was used large enough to extend up to the antrum by passing through over the facial ridge. The age of the patients in Group 1 ranged from 10 to 69 years. Group 2 consisted of 13 patients in whom temporal muscle fascia was used in a size hardly enough to create a middle ear space, which was rather smaller than those of the first group. The age of the patients in Group 2 ranged from 13 to 51 years. Both superficial and deep layers of temporal fascia were used together as a single graft in every operation. Since tympanoplasty was performed in every case, the rate of the tympanoplasty in both groups was equal.

All patients had the same postoperative cavity care regimen. Days of complete epithelialization time, according to almost completely full dry cavity, were recorded for every patient, and the values were compared between the groups. In addition to this, it was also observed whether or not the type of pathology had an effect to the epithelialization time of the cavity.

Statistical Analysis

All statistical calculations were performed using the Statistical Package for the Social Sciences (SPSS) v15.0 for Microsoft Windows (SPSS Inc., Chicago, IL, USA). The patient and control groups were similar with regard to age and gender. Data are expressed as mean±standard deviation. Student's *t*-test and Mann–Whitney *U* test were used to compare continuous variables. A $p<0.05$ was considered as significant.

RESULTS

The present study included 32 patients (13 (40.6%) females and 19 (59.4%) males), provided that they fulfilled the inclusion criteria. The patients were grouped randomly as described above. Group 1 consisted of 19 patients with larger temporal muscle fascia, with ages ranging from 10 to 69 years. Group 2 consisted of 13 patients with smaller temporal muscle fascia, with ages ranging from 13 to 51 years. Difference between mean ages ($p=0.465$) and gender ($p=0.720$) of the groups were not significant (Table 1).

When the epithelialization periods were evaluated according to the size of the grafts, the mean durations of epithelialization of cavities were 34.10 days and 39.76 days in cases with large grafts (Group 1) and small grafts (Group 2), respectively. Epithelialization was observed earlier in cases with large grafts, but no statistically significant difference ($p=0.143$) was observed (Figure 1).

When we observed the relationship between type of pathology and epithelialization time of the cavities, the mean epithelialization times were 38.73, 31.33, and 34.42 days in cases with cholesteatoma, cases with granulation, and cases of coexisting granulation with cholesteatoma, respectively. These differences were not statistically significant ($p=0.182$).

When cases with cholesteatoma had large grafts, the mean duration of epithelialization was 36.46 days; however, it was 43.67 days when small graft was placed. This might show that in patients with choles-

Table 1. Mean age and gender differences between the groups

Variables	Group 1	Group 2	p
Gender			
Male	12	7	
Female	7	6	0.465
	19	13	
Age (median)	38.63 (±14.52)	34.30 (±11.38)	0.720

Table 2. Mean epithelialization time of the groups and relationship between type of pathology and the epithelialization time of mastoidectomy cavities

Variables	Group 1	Group 2	p
Epithelialization duration (day)	34.10±2.22	39.76±3.18	0.143
Epithelialization duration related to pathology (day)			
Cholesteatoma	36.46	43.67	0.218
Granulation	31.50	31.00	0.978
Mixed	24	38.60	0.083

The independent samples t-test.
*$p<0.05$.

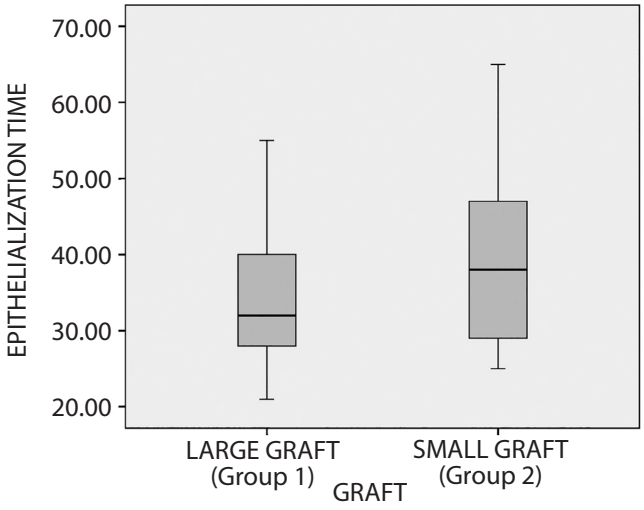

Figure 1. Mean duration for epithelialization of mastoidectomy cavities according to graft size.

teatoma, there was a positive effect of large graft on healing. However, this was not statistically significant (p=0.218) (Table 2).

Similarly, in cases with mixed pathology (coexisting granulation with cholesteatoma), the mean duration of epithelialization with large grafts was faster than that with small grafts, with 24 days and 38.6 days, respectively. However, this was not statistically significant (p=0.083). Moreover, in cases without cholesteatoma, there was no statistically significant difference in cavity epithelialization time whether with large or with small grafts, with 31.50 days and 31 days, respectively (p=0.978).

DISCUSSION

The primary purpose of CWD mastoidectomy is to eradicate infection, to have a safe and dry ear. To achieve that, some crucial surgical principles, including complete removal of air cells, sufficiently low level of facial ridge, and adequate size meatus, as well as careful postoperative bowl care, should be fulfilled. All of these surgical steps are necessary to help complete rapid epithelialization and to avoid complications from the operation cavity. Epithelial migration of great importance is a physiological self-cleaning mechanism that prevents keratin debris accumulation in the ear canal, but very few studies have investigated this issue in CWD mastoidectomy cavities [4]. In a previous study, the migration rate in the tympanic membrane was reported as 0.10 (0.02-0.45) mm/day in the lateral direction [8]. It was reported as 0.68 mm/week with mostly inferior lateral direction (64.7%) in another study [9]. Complete re-epithelialization time for CWD mastoidectomy cavity is generally considered as 2-3 months [1]. It is believed that the faster a mastoidectomy cavity heals, the less likely it is to come across with persistent ear draining. Therefore, multiple techniques have been tested to promote epithelialization of the bowl in open mastoidectomy procedures [3].

An alternative way to help get dry, self-cleaning, functional ear canal is to obliterate the CWD mastoidectomy cavity by the use of free grafts, such as bone chips, fat, cartilage, and fascia, use of hydroxyapatite or silicone materials, or use of local muscle flaps. All of these have the same goal of both reducing the size and promoting the epithelialization of the mastoidectomy cavity [10]. Soft tissue flaps are challenging techniques; however, they can sometimes be inadequate to cover the entire mastoidectomy bowl [2]. However, because epithelialization over flaps is faster than that over exposed bone, many flap techniques have been used to promote re-epithelialization of the mastoid cavity to shorten the time needed for the healing process. Lee et al. [1] used a deep temporalis fascial–periosteal flap that was a modification of the periosteal–pericranial flap introduced by Ramsey [11]. Lee et al. [1] stated that their technique avoids undesirable complications, such as unnecessary bleeding, injury to the muscle, and postoperative temporal headache, which were almost unavoidable in the previous one. They also stated that if the superficial temporalis fascia cannot be separated from the deep layer, it is not possible to use this deep temporalis fascial–periosteal flap, causing limitation in some cases. Kim et al. [2] described a novel technique to avoid postoperative mastoidectomy cavity problems of CWD procedure, in which the musculoperiosteal flap based anteriorly was prepared, and horizontal skin incision was made on the concha that extended up to the ear canal by crossing the antecedent incision. They reported the mean time of complete epithelialization to be 11.1±4.6 weeks, and 90% of these did get a dry and self-cleaning CWD mastoidectomy bowl within 16 weeks. They stated that the mega-mastoid cavity limits this technique since postoperative temporal headache and unpleasant-looking auricula are inevitable in those patients [2].

Harvey [12] introduced delayed placement of a split-thickness skin grafting (STSG), allowing a granulation tissue bed to be developed in the mastoidectomy cavity in 9 patients in 1997. Wetmore [3] conducted a prospective, randomized study comparing STSG in 13 patients with a control group of 11 patients. In that study, the use of STSG resulted in the reduction of duration needed for complete epithelialization. Pedicled temporoparietal fascial flap (TPFF) is also a technique for mastoid obliteration. Ninety percent of success was declared in achieving dry cavity 2 years after mastoid obliteration using pedicled TPFF, in a study conducted in patients suffering from mastoidectomy bowl problems with persistent otorrhea [13]. In another study with the same flap, a 100% success rate in this time was announced with regard to achieving volume reduction, dry, completely epithelialized CWD mastoidectomy cavity [14]. However, the disadvantages of the additional surgical time, the large incision for exposing the temporoparietal fascia, and the risk of postoperative alopecia, facial nerve injury, and visible scar formation must be considered in the use of TPFF [14].

All of the techniques described above have targeted the same purpose of shortening the time needed for complete epithelialization of the mastoid cavity. Faster healing time results in reduced number of doctor visits in the postoperative period and not only enhances the quality of life but also decreases the cost to the patient. However, all of these procedures burden extra surgical effort to the surgeon in the aspects of time consuming and risk of additional surgical complications. Therefore, we aimed in this prospectively conducted study to increase the size of the traditional temporal fascia used ordinarily for promoting epithelialization of cavities to provide the desired effect as successful as the above-mentioned very complicated techniques intended to do. For this purpose, the patients were divided into two different groups randomly based on the size of the fascia used in the operations. In one group of patients, the temporal muscle fascia large enough to extend up to the antrum by passing through over the facial ridge was used; in the other group of patients, the fascia in a size

hardly enough to create a middle ear space, which was quite smaller than that of the first group, was used. To the best of our knowledge, this is the first study to make this comparison in the literature. The results of the present study pointed a reduction in time for epithelialization of the mastoid cavity in case using larger fascia graft to line the mastoidectomy cavity despite statistical insignificance. Moreover, we observed that the type of pathology had no significant relationship with the epithelialization time of the mastoidectomy cavity. This type of observation was also evaluated for the first time.

The strengths of the present study are its simplicity, originality, easy repeatability, and investigating a missed or underestimated part of a known and traditional technique. Moreover, the otologist who observed the status of the mastoidectomy cavities postoperatively in the follow-up period of the patients did not participated directly in the surgical procedure. This fact must have enhanced the reliability of our study.

In contrast to the above-mentioned strengths, there are also many weak points that limit the present study. Since canal wall up techniques are more commonly preferred than open techniques in the institution where the study was performed, optimum sample size could not be provided, which might explain statistically insignificant results. In addition to these, cavity size was not taken into consideration in comparison with the time length of epithelialization. For better interpretation, further studies with larger sample sizes would be necessary to support and to increase the generalizability of these results. Furthermore, the lack of long-term follow-up might have been another limitation of the present study.

CONCLUSION

Placement of larger fascia graft to line the mastoidectomy cavity facilitate rapid epithelialization and healing in patients undergoing CWD tympanomastoidectomy. Further studies with larger groups would be beneficial to confirm this result in the aspect of statistical significance.

Ethics Committee Approval: Ethics committee approval was received for this study from the University of Health Sciences İstanbul Bağcılar Training and Research Hospital Clinical Research Ethics Committee (approval number 2018.03.3.01.022.r1.032).

Informed Consent: Informed consent form was received from all the patients participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – H.D.T.; Design – H.D.T.; Supervision – N.K.; Resource – Ş.Ö.; Materials – M.F.O.; Data Collection and/or Processing – C.Ö., Ş.E.B.; Analysis and/or Interpretation - A.B.C.; Literature Search – H.D.T.; Writing – H.D.T.; Critical Reviews – H.D.T., N.K.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. Lee DH, Jun BC, Jung SH, Song CE. Deep temporal fascial-periosteal flap for canal wall down mastoidectomy. Laryngoscope 2006; 116: 2229-31. [CrossRef]
2. Kim CW, Oh JI, Choi KY, Park SM, Park MI. A technique for concurrent procedure of mastoid obliteration and meatoplasty after canal wall down mastoidectomy. Auris Nasus Larynx 2012; 39: 557-61. [CrossRef]
3. Wetmore SJ, Bueller HA, Cost JL. Split Thickness Skin Grafting in Canal Wall Down Tympanomastoidectomy. Otol Neurotol 2014; 35: 97-100. [CrossRef]
4. Uluyol S, Ugur O, Arslan IB, Yagiz O, Gumussoy M, Cukurova I. Effects of cavity reconstruction on morbidity and quality of life after canal wall down tympanomastoidectomy. Braz J Otorhinolaryngol 2018; 84: 608-13. [CrossRef]
5. Takeda T, Saito H, Takeuchi S, Komada I. Pinch grafting of the open mastoid cavity. Auris Nasus Larynx 1991; 18: 9-15. [CrossRef]
6. Premachandra DJ, Woodward B, Milton CM, Sergeant RJ, Fabre JW. Long-term re- sults of mastoid cavities grafted with cultured epithelium. Laryngoscope 1993; 103: 1121-5. [CrossRef]
7. Haginomori S, Nonaka R, Takenaka H, Ueda K. Ann Otol Rhinol Laryngol 2008; 117: 719-26. [CrossRef]
8. Bonding P, Charabi S. Epithelial migration in mastoid cavities. Clin Otolaryngol Allied Sci 1994; 19: 306-9. [CrossRef]
9. Ong CA, Prepageran N, Godbole S, Raman R. Epithelial migration in open mastoidectomy cavities. Asian J Surg 2007; 30: 57-9. [CrossRef]
10. Mehta RP, Harris JP. Mastoid obliteration. Otolaryngol Clin North Am 2006; 39: 1129-42. [CrossRef]
11. Ramsey MJ, Merchant SN, McKenna MJ. Postauricular periosteal-pericranial flap for mastoid obliteration and canal wall down tympanomastoidectomy. Otol Neurotol 2004; 25: 873-8. [CrossRef]
12. Harvey S. Skin grafting in otology. Laryngoscope 1997; 107: 1199-202. [CrossRef]
13. East CA, Brough MD, Grant HR. Mastoid obliteration with the temporoparietal fascia flap. J Laryngol Otol 1991; 105: 417-20. [CrossRef]
14. Cheney ML, Megerian CA, Brown MT, McKenna MJ. Mastoid obliteration and lining using the temporoparietal fascial flap. Laryngoscope 1995; 105: 1010-3. [CrossRef]