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Radical mastoid cavity reconstruction—the pedicled musculo-fascial flap

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Abstract

This paper reports a new procedure used successfully in the reconstruction of 12 radical mastoid cavities in King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. A composite pedicled flap composed of temporalis muscle and its fascia attached along one border, based posteriorly, is rotated in to the radical cavity. The muscle is used to obliterate the cavity and the fascia is hinged forward as a tympanic membrane graft.

Introduction

Open mastoid surgery remains the safest and most reliable form of eradicating cholesteatomatous ear disease. Younger patients resent the idea of regular hospital visits for the rest of their lives. The radical cavity also precludes them from many careers. In some patients, especially females, aesthetic considerations are often raised.

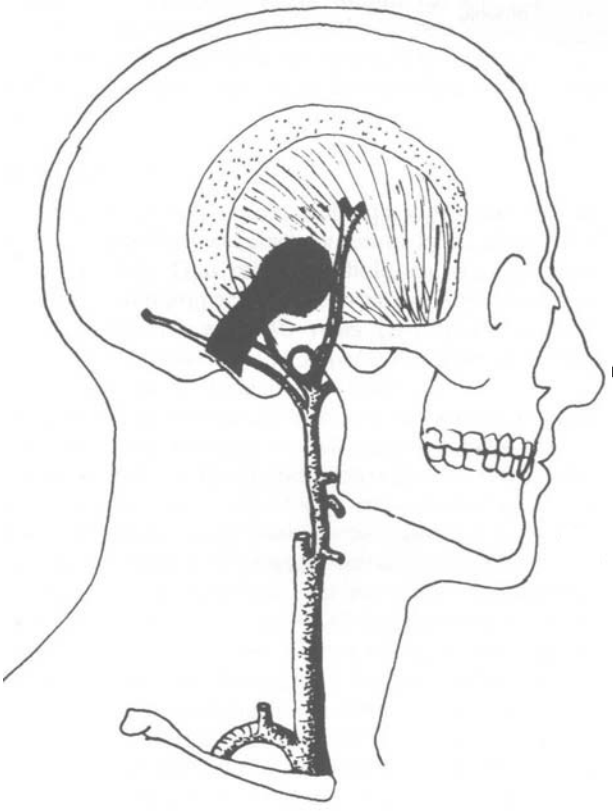

FIG. 1

An outline of the musculo-fascial flap showing its blood supply from the occipital and posterior auricular branches of the external carotid artery.

The new flap used in radical cavity obliteration and middle ear reconstruction utilizes the principle of the Pedicled Skin Autograft which has revolutionized plastic and reconstructive surgery all over the body. Hence it is named the Pedicled Musculo-fascial flap. It introduces the use of a vascularized tympanic membrane graft composed of temporalis fascia.

Patients and methods

Between October 1988 and January 1991, 11 patients (seven males and four females) ranging in age from 15 years to 30 years (average age 21 years) have undergone 12 radical cavity reconstructions (in one patient bilaterally), at the King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. Reconstruction was only undertaken on patients whose radical cavities remained dry for a minimum of 12 months. Patients with intact stapes had a

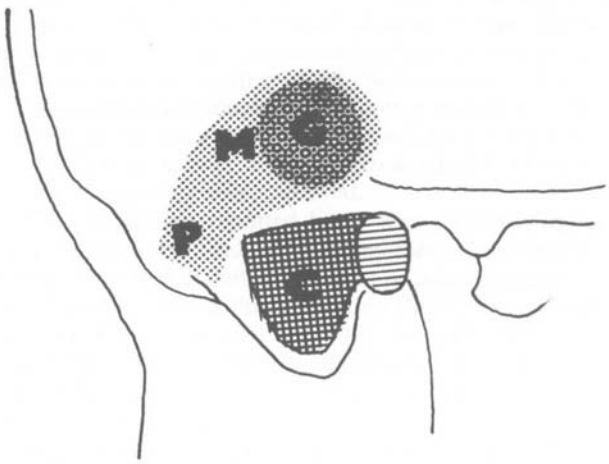

FIG. 2

The musculo-fascial flap *in situ* with the temporalis fascia graft still attached to the muscle.
C = radical cavity, G = temporalis fascia graft, M = temporalis muscle, P = flap pedicle.

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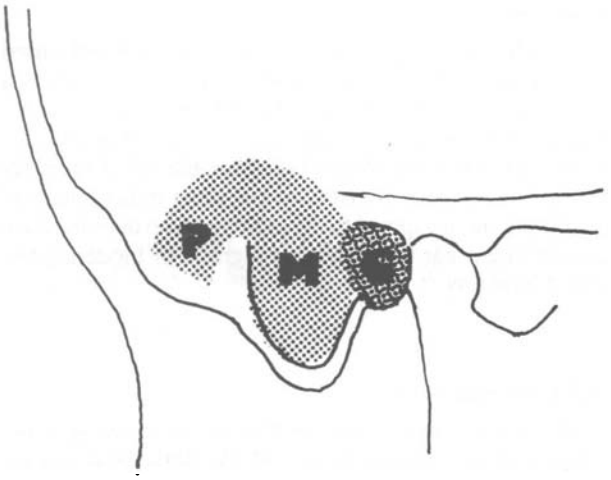

FIG. 3

The musculo-fascial flap rotated to obliterate the cavity and graft the tympanic membrane.
G = temporalis fascia graft, M = temporalis muscle, P = flap pedicle.

one stage cavity obliteration and myringostapediopexy. In patients with no stapes superstructure, a staged procedure was performed. Sculpted cortical bone was used to reconstruct the posterior bony meatal wall in very large cavities.

Technique

The postaural incision is extended upwards and backwards into an S-shape. Where temporalis fascia has been used in previous procedures, a right-angled incision is taken postero-superiorly from the middle of the postaural incision to gain access to healthy muscle and fascia. The musculo-fascial flap based posteriorly is outlined. It derives its blood supply from the posterior auricular and occipital branches of the external carotid artery (Fig. 1). Cutting diathermy is used to develop the flap (Fig. 2). The fascia is dissected clean and is left attached to the muscle border. In very large cavities the musculo-fascial attachment is positioned 4–5 mm from the margin of the fascia to allow its application to the bone graft. The lining of the cavity is carefully elevated, the cavity is saucerized and its margins are bevelled into a smooth slope. The mobility of the stapes and the eustachian tube patency are checked. Sialastic is applied to the middle ear. The muscle is used to obliterate the cavity and the fascia is used to graft the tympanic membrane (Fig. 3). A V-shaped segment of redundant cavity lining is removed to allow for smooth lining of the rebuilt posterior meatal wall. The elevated cavity lining is used to secure the fascial graft in position. The end result (Fig. 4) is the conversion of the cavity into an enlarged external auditory canal as described by Smith (1975).

In patients with very large cavities sculpted mastoid cortical bone is railed along prepared grooves to rebuild the bony canal. The bone graft is then removed while the cavity obliteration and tympanic membrane grafting is carried out. It is re-inserted and the free margin of the fascial graft is lifted onto its deep part (Fig. 5). Reconstruction of the bony meatal wall with sculpted cortical bone was performed in four of the 12 reconstructions.

Results

In four patients who have undergone a one-stage myringostapediopexy, hearing improvements of 15–20 dB in the speech frequencies have been observed during a follow up of 12–20 months. Five patients are waiting for second stage ossiculoplasty. One patient has been lost to follow-up. One patient referred with a painful stenozed dead ear following five previous ear operations has had wound breakdown and is waiting for a pedicled skin graft to the postauricular region. One patient has undergone a second stage reconstruction and is awaiting audiological assessment. The 11 operations followed up have resulted in aerated middle ears and all the patients are satisfied with the cosmetic result.

The fate of the muscle flap has been observed in two patients at three and 12 months. After three months the muscle had lost its characteristic fasciculations and resembled 'proud flesh'. It had maintained contact with the temporalis fascia graft. There was fresh bleeding when this was severed to gain access to the middle ear. The ear was explored when the patient developed bizarre symptoms and the bone graft was found bare of its skin lining. This was later discovered to be the result of self-inflicted trauma. At second stage ossiculoplasty after one year, the cavity was empty and clean except for a few fibrous bands that made no contact with the fascial graft.

Discussion

In the post-antibiotic era nearly all radical mastoid surgery is performed for cholesteatomatous ear disease, where the observed pathology is usually superiorly and posteriorly. The posterior meatal skin is also split during conchomeatoplasty. Surgical trauma and recurrent cavity infections add injury to the insult of the chronic preoperative discharge making the posterior meatal skin the 'Achilles' heel' of the radical cavity when reconstruction

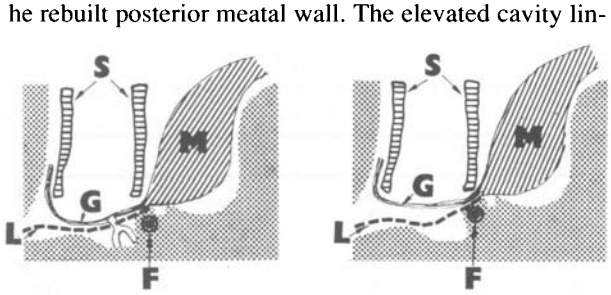

FIG. 4

Radical cavity reconstruction. One stage myringostapediopexy (left) and first stage (right).
F = facial nerve, G = temporalis fascia graft, L = sialastic, M = temporalis muscle, S = meatal skin.

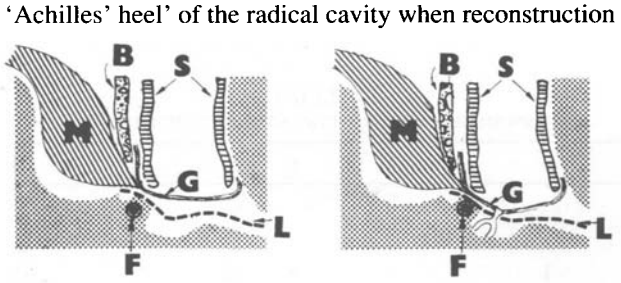

FIG. 5

Reconstruction of very large cavities with bone graft. First stage (left) and one stage myringostapediopexy (right).
B = bone graft, F = facial nerve, G = temporalis fascia graft, L = sialastic, M = temporalis muscle, S = meatal skin.

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is undertaken. The probable explanation of a lot of late graft failures following initial success is the precarious vascularity of this part of the graft bed. A sensible approach to such a problem is to bring the tympanic membrane graft with its blood supply to the recipient site.

In the English literature, five different pedicled flaps have been reported in radical cavity reconstruction. Mosher (1911) first reported the use of a soft tissue flap taken from the back of the auricle with its pedicle based superiorly. Its use shortened the healing time, prevented deformity caused by sinking of the scar and lessened the frequency of secondary operations in cases of acute mastoiditis. Meurman and Ojala (1949) use the attachment of the sternomastoid and its periosteal extension upwards to develop a flap based inferiorly. The flap is rotated into the lower part of the cavity and is sutured to the cartilaginous meatus. Rambo's (1958) musculoplasty flap consists of full thickness temporalis muscle, with its fascia and pericranium, based anteriorly. It is used to reconstruct an air-containing middle ear cavity and to re-establish a sound conducting mechanism by fenestration of the lateral semicircular canal. Palva's (1963) musculo-periosteal flap consists of mastoid periosteum and the posterior auricular muscle. It is based anteriorly, and is attached to the auricle. It is hinged backwards to obliterate the cavity and to support a large temporalis fascia graft. Palva's flap has gained general acceptance and is the most widely used in radical cavity reconstruction. East *et al.* (1991) use Byrd's axial temporoparietal fascia flap to obliterate chronically discharging cavities.

With the exception of Rambo's flap, all reported pedicled flaps are used to obliterate the radical cavity and to support free tympanic membrane grafts when this is performed. This improves the chances of success by providing a vascular bed for the graft (Palva, 1963). The musculo-fascial flap combines the two main aims of radical cavity reconstruction. The muscle obliterates the cavity and provides blood supply to the fascial graft. The maintained vascularity of the tympanic membrane graft greatly increases its chances of success. Though the muscle flap ultimately atrophies, it seems to survive long enough for the tympanic membrane graft to establish new vascular connections.

Key words: Mastoid surgery

Conclusion

A pedicled musculo-fascial flap, based posteriorly, used in radical cavity reconstruction is reported. It utilizes a vascularized temporalis fascia to graft the tympanic membrane. It has the built-in safety factor of all autografts. It is easy to perform and should be within the technical capabilities of every otologist who performs radical mastoid surgery. It has its appeal to the otologist who does not have access to an 'ear bank' for homografts or modern prosthetic implants.

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