The Journal of Laryngology & Otology
April 2001, Vol. **115,** pp. 270–273

Main Articles

Canalplasty: review of 100 cases

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Abstract
Canalplasty is the surgical procedure whereby the external auditory meatus is widened. The indications include exostoses, stenosing external otitis and widening for surgical access. One hundred consecutive ears operated on by one surgeon are reported. The surgical technique is described in detail, paying particular attention to bone removal from the anterior canal wall. In this paper the majority of cases were occasioned by soft tissue rather than bony stenosis. The re-stenosis rate was four per cent and in each case this was associated with the use of a middle temporal artery flap. Partial, transient, delayed facial palsy occurred in two per cent, probably relating to thermal injury transmitted from the burr. A full, spontaneous recovery of facial function occurred in each case. This is a safe and effective technique for canal widening.

Key words: Ear Canal; Surgery, Plastic

Introduction

Canalplasty is a surgical procedure designed to restore patency to, or widen, the external auditory canal. Its indications vary and include chronic stenosing external otitis, exostoses and anatomically narrow canals. The operation can be an end in itself (to widen a stenosed canal) or to gain access for another procedure (myringoplasty, tympanoplasty). One hundred consecutive cases of canalplasty performed by one surgeon (PAF) between 1995 and 1999 are presented.

Method and Patients

Patients

Eighty-six patients (74 male, 12 female) underwent 100 canalplasties. Indications are detailed in Table I. Fourteen patients had bilateral surgery with the same indication for each ear.

A number of other procedures were carried out at the same operation (Table II):

TABLE I
INDICATIONS FOR CANALPLASTIES

Chronic otitis media	11
Tympanic membrane perforation	32
Exostoses	34
Chronic stenosing external otitis	7

TABLE II
OTHER PROCEDURES CARRIED OUT AT THE SAME TIME AS CANALPLASTIES

Atticotomy	2
Intact canal wall mastoidectomy	11
Tympanoplasty	42
Middle temporal flap	7

Surgical technique

The canal is transected approximately 10 mm from the anulus through a post-auricular incision. The exact siting of the transection depends on the pre-existing pathology. The lateral skin-tube is carefully elevated from the bony canal and retracted forward with the pinna exposing the lateral surface of the tympanic bone. The medial skin tube (attached medially to the anulus) is elevated and carefully folded medially to lie against the drum. A small disc of Silastic® is then placed over the skin to protect it from the burr. Individual exostoses are removed by working from within the bony outgrowth, hollowing out the centre, leaving an intact rim of bone on the luminal surface. This also facilitates skin preservation.

The main focus for bone removal is the anterior wall. Removing bone anteriorly opens up the anterior tympanomeatal angle giving excellent

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Accepted for publication: 24 October 2000.

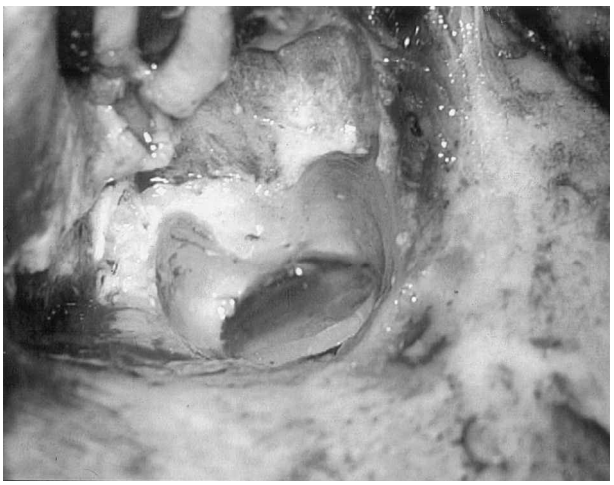

FIG. 1

Left ear (surgeon's view). Superior and inferior gutters are created in the anterior canal wall. The buttress of bone overlying the TMJ (between the two gutters) can be taken down on a broad front to avoid damaging the joint.

access to the whole of the tympanic membrane. In order to avoid inadvertently breaching the temporomandibular joint (TMJ), anterior bone removal is carried out in a systematic way. First superior and inferior gutters are created in the anterior canal wall (Figure 1). The intervening buttress of bone, under which the TMJ lies, is then taken down working on a broad front under direct vision (Figure 2).[1] Eventually, when the bone has been thinned to its maximum extent, the area of the joint assumes a bluish hue. The rationale for this technique is illustrated by the parasagittal computed tomography (CT) scan of a temporal bone shown in Figure 3. The thickest parts of the bony anterior wall are superiorly heading towards the root of the zygoma and inferiorly into the thick part of the tympanic ring. Working from lateral to medial, all bony overhangs

FIG. 2

(Same ear and position as figure 1) The buttress has been taken down and a further small bony overhang is being removed.

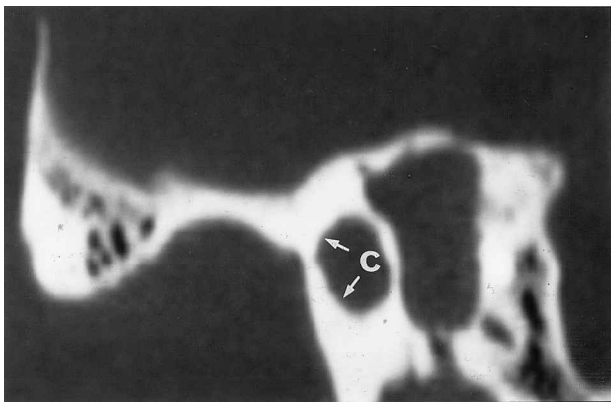

FIG. 3

Parasagittal CT scan of temporal bone (Bone window setting). The thickest bone of the anterior canal (C) wall can be seen superiorly (arrow) into root of zygoma and inferiorly (arrow) into thick part of tympanic ring.

should be removed until the dictum of Fisch has been satisfied, namely that the whole of the fibrous anulus is visible in one position of the microscope.[2] If a canalplasty is all that is being performed the skin tubes can now be replaced. Releasing incisions will be required to drape the skin over the new, widened canal. Finally a cartilagenous meatoplasty is fashioned and the skin carefully packed out against the bone using a BIPP soaked ribbon gauze. In 62 cases, canalplasty was part of a further procedure (Table II).

In 34 cases there was a perforation of the drum, and canalplasty provided improved access for underlay repair. In patients undergoing intact canal wall mastoidectomy, canalplasty improves intra-operative access and ensures a good view of the tympanic ring in the follow-up period. In chronic stenosing external otitis there is inevitable skin loss when the stenotic plug is excised. These cases may require a split skin graft. Seven cases underwent repair using a middle temporal flap.[3]

Results (Table III)

Each patient was reviewed at two weeks and thereafter every two weeks until complete healing had occurred. Healing time varied from six weeks to six months. Ninety per cent of cases had healed by eight weeks. One case that was complicated by infection took a full six months but complete healing did occur. Discomfort on eating was very common in the first few weeks, but in every case it resolved spontaneously. A mild transient facial weakness was noted in two cases. In each instance resolution was spontaneous and complete.

TABLE III
RESULTS

Healing	90% healed by 2 months
Restenosis	4% (all occurred where middle temporal flap was used)
Facial weakness	2% (Transient, partial, delayed with full recovery in each case)
Infection	2% (Delayed healing to 6 months in one case)

https://doi.org/10.1258/0022215011907424 Published online by Cambridge University Press

The cause for this was postulated to be thermal transmission from the burr to the facial nerve in the postero-inferior quadrant where it can lie lateral to the anulus. There were four cases of re-stenosis of the canal.

This complication only occurred in those cases where a middle temporal flap was used to provide soft tissue cover of exposed bone. This technique has been abandoned by the authors in intact canal wall surgery and in canalplasty.

Discussion

Definition

Parisier *et al.*[4] describe canalplasty as a surgical procedure designed to restore patency to the ear canal. This review goes a step further and includes those cases where the canal is patent but narrow. The incidence of canal exostoses is significantly higher in Australia than in Europe[5] and thus in Australia canalplasty is a routine surgical procedure.

Technique

Soft tissue. Permeatal and endaural approaches for canalplasty have their advocates,[4,6,7] however, the post-auricular approach with canal transection, as described here, not only gives the best appreciation of the bony landmarks, but also allows for good canal skin preservation.

Although deficient skin can be grafted, donor skin lacks the natural migratory characteristic of canal skin which should be preserved if at all possible.[4] By transecting the canal, the need for complex skin flap design is circumvented with the lateral skin tube being retracted anteriorly out of the way and the medial skin tube kept intact and protected from the burr by a silastic disc. The middle temporal artery flap[3] was used in a handful of cases to provide a vascular bed to encourage epithelialization. Its use was accompanied by an unacceptable rate of re-stenosis and so its incorporation, in this procedure, has been abandoned. Others describe the use of anterior and posterior skin flaps[8,9] and full thickness skin grafts[11] but neither of these techniques have been necessary in this series.

Bone. Since most of the bone removal is carried out anteriorly the technique works well in intact canal wall mastoidectomy where the posterior canal wall can be left relatively untouched. This technique gives excellent access to the middle ear through the ear canal. In those cases operated on for tympanic membrane perforation, 10 were revisions for previous graft failures. The reason for failure in each case was deemed to be inadequate surgical access.

The rate of perforation closure of these revision cases following canalplasty was 90 per cent. Other authors emphasize bone removal from the posterior canal wall. Whilst this has limitations, particularly if the procedure is part of an intact canal wall mastoidectomy, there is also risk of entering the mastoid air cells.

Post-operative care. There are numerous descriptions of different splints for maintaining patency,[11–13] however, simple packing with BIPP ribbon gauze was all that was required in this series. The packing is removed at the first post-operative visit and the ear is repacked with increasingly smaller packs until complete healing has occurred.

Complications

Perforation of the drum is one of the commonest complications described by other authors,[4] however, with this technique the drum is always protected from the burr by a Silastic® disc and by the infolded medial canal skin tube. Re-stenosis is usually due to a technical fault, either insufficient bone removal or, as in this series, the use of a bulky, middle temporal flap. The use of this flap in canalplasty has been discontinued.

Some form of temporomandibular joint discomfort is almost universal following this procedure and should not therefore be regarded as a complication. In every case presented it was short-lived and self limiting. Transient facial palsy is a more worrying complication and, indeed, there have been cases of nerve transection during canalplasty. The facial nerve can lie lateral to the tympanic anulus in the postero-inferior quadrant[14] and the heating effect of a rotating burr is sufficient for thermal damage to occur by transmission through the bone surrounding the nerve.[15] For this reason it should be stressed that copious irrigation be used when drilling in the region of the facial nerve.

Conclusion

Canalplasty is a safe, effective operation. The post-auricular, canal transection approach provides unrivalled access to the tympanic bone and enables safe bone removal and good skin flap preservation, that are the keys to successful surgery.

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Mr J Lavy takes responsibility for the integrity of the content of the paper.
Competing interests: None declared