

The antrum exclusion technique in cholesteatoma surgery

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Abstract

A new surgical technique for the treatment of cholesteatoma is reported. The technique involves auto-exclusion for exteriorization of the attic and tympanic box only. The resulting cavity is rather small.

The technique allows visual post-operative control of the attic and tympanic membrane. There is no visual access to the mastoid cavity which, however, is the most unlikely site for occurrence of a residual cholesteatoma.

The proposed technique was applied to 102 patients and both the anatomic and functional results obtained are reported.

Introduction

Cholesteatoma is usually tackled surgically by two methods, namely open and closed. Open techniques involve destruction of the post-superior wall of the bony external ear canal and include the radical, modified radical, Wullstein, post-superior wall reconstruction, mastoid cavity obliteration and a few other, more recent techniques. On the other hand, closed techniques do not require the post-superior wall of the external ear canal to be destroyed, and therefore it remains intact. These techniques are known as canal wall up, combined approach tympanoplasty (CAT) or intact canal wall (ICW) techniques. The long-term problems posed by these techniques are causing it to decline gradually in favour of open techniques for the removal of cholesteatoma, which are

being promoted by such authors as Palva (1963), Kohut (1980), Cole and Reamus (1983), Hough (1983), Fisch (1986), Sade *et al.* (1986) and Smyth (1986).

While the most widely used open techniques (radical, modified radical and open tympanoplasty of the Wullstein variety) have major advantages, they also pose some problems that occasionally make them unsatisfactory. One such problem lies in the fact that the mastoid cavity is exteriorized. Provided the cavity is small, the problem faced is normally insubstantial; however, if the cavity is large enough, the problem faced can be quite troublesome. For this reason, an open surgical technique allowing complete removal of the cholesteatoma while avoiding too small cavities would be quite desirable. This has for long been the target of a number of authors who use open tech-

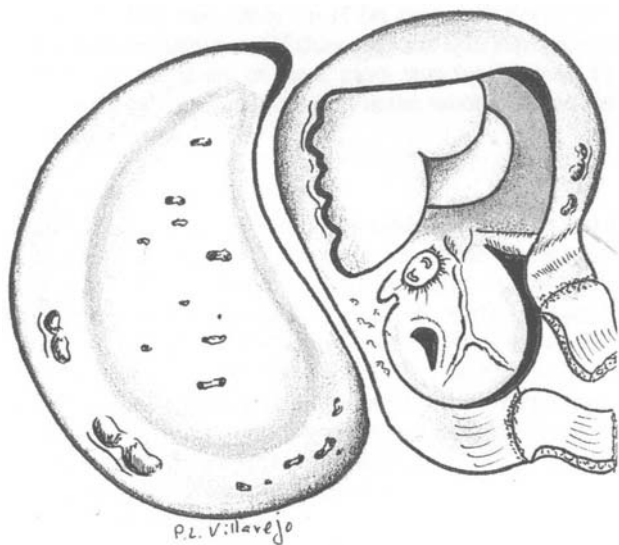


FIG. 1
Atticotomy.

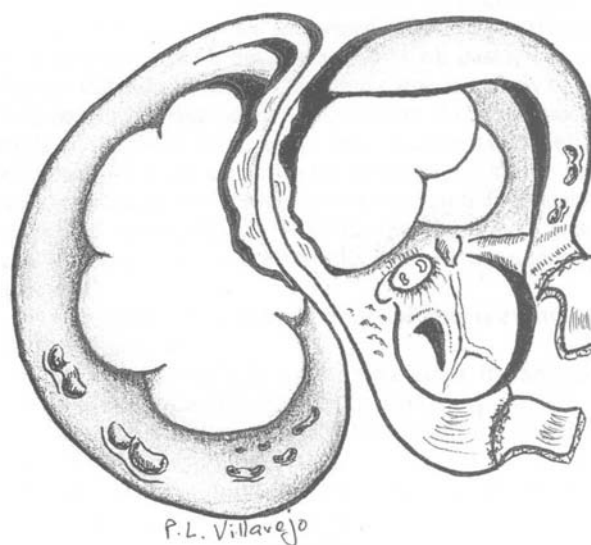


FIG. 2
Mastoidectomy.

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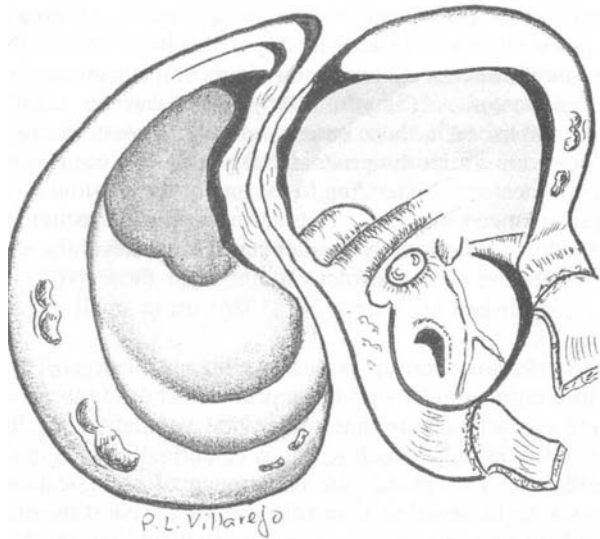


FIG. 3
Cholesteatoma exeresis.

niques and, to some extent, it is accomplished successfully in many cases. In fact, according to Hough (1983), roughly 80 per cent of ears with cholesteatomas have only small sclerotic mastoids. Also, as pointed out by Portmann (1985), poorly pneumatized mastoids can be treated by using an open technique, and Sade (1982) has reportedly obtained small radical cavities.

The aim is therefore to obtain the smallest possible cavities in using open surgical techniques for removal of cholesteatoma. In this respect, we have used the open technique reported by Olaizola *et al.* since 1982 (1982, 1983), López-Villarejo and Jurado-Ramos, 1986. This technique is quite suitable for those cases in which the antrum and mastoid is affected by the cholesteatoma as it provides an extremely precise overview of the situation and allows very small, self-cleaning cavities to be obtained, thereby avoiding all potential problems posed by exteriorized cavities.

Material and methods

We studied 102 cases of ears with attico-antral or attico-antral-mastoid cholesteatomas that were operated on by using the antrum-exclusion technique between 1982 and 1985.

Under general anaesthesia, a retro-auricular approach was adopted to extract fascia from the temporal muscle in order to obtain the graft. Then, the mastoid cortex was exposed and tympanomeatal flaps were created.

The next step involved a broad atticotomy as far as the aditus with exposure of the stapes region and the second part of the facial nerve (Fig. 1). Once the cholesteatoma was exposed, it was fully uncovered by mastoidectomy, which left a bony bridge between the two cavities (Fig. 2). After complete removal of the cholesteatoma (Fig. 3), a bone fragment extracted from the mastoid cortex was placed on the bony bridge. Such a fragment is intended to shut off the gap between the attic and the mastoidectomy cavity at the aditus level. This isolates the mastoid cavity (antrum-exclusion, Fig. 4). Finally, the graft is inserted in order to reconstruct the tympanic membrane—the graft must carpet the attic cavity. Next, the tympano-meatal flaps are restored (Fig. 5), the box packed with Gelfoam; finally, the small resulting cavity is packed with gauze soaked in antibiotic ointment.

In as much as only the attic and tympanic box are exteriorized, the resulting cavity is very small.

The patients ranged from 11 to 64 years of age and were monitored post-operatively for over five years. The anatomical results were assessed on the basis of the state of epithelization condition of the cavities, whether or not they remained dry, their volume (as measured with physiological serum), the condition of the neotympanum, and whether or not there was post-operative retraction or residual cholesteatomas appeared.

The functional results were evaluated on the basis of the air-bone gap at three different frequencies (500, 1,000 and 2,000 Hz).

No patients operated on by other techniques were included in this study.

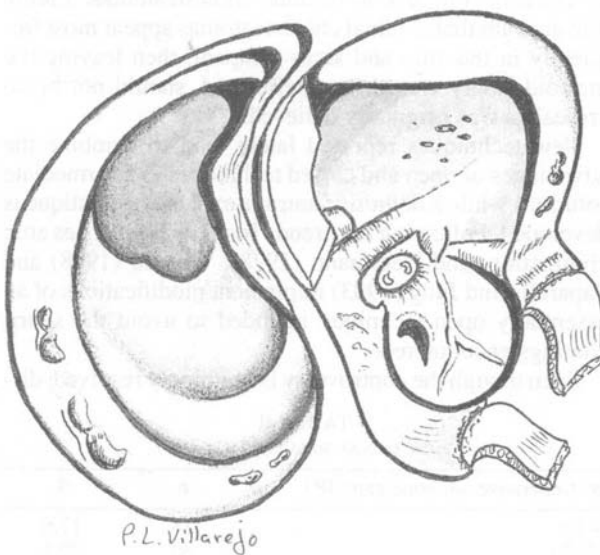


FIG. 4
Antrum-exclusion. Placement of a bone septum at the aditus levels.

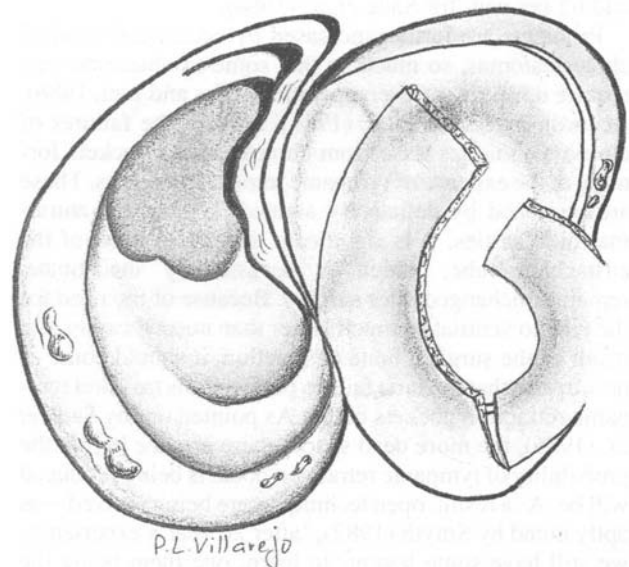


FIG. 5
Grafting and flap replacement.

TABLE I
ANATOMICAL RESULTS

| | | n | % |
|------------------------|------------|----|------|
| Cavity | Dry | 99 | 97.1 |
| | Wet | 3 | 2.9 |
| Neotympanum | Intact | 96 | 94.1 |
| | Perforated | 6 | 5.9 |
| Residual cholesteatoma | Attic | 6 | 5.8 |
| | Middle ear | 3 | 2.9 |
| | Mastoid | 0 | 0 |
| Tympanic retraction | | 6 | 5.8 |
| Cavity volume (ml) | 1.5–2 | 54 | 52.9 |
| | 2–2.5 | 30 | 29.4 |
| | 2.5–3 | 12 | 11.7 |

Results

The most outstanding conclusion in relation to the anatomical results (Table I) is the small volumes of the cavities obtained (over half of them had a volume of only between 1.5 and 2 cm³, thus appearing to be external ear canals enlarged on the vertical axis). Neotympanic reperforation prevented measurement of the cavity volume in six cases. In 99 per cent of all cases, the small volumes obtained facilitated achievement of dry, epithelized cavities. No residual cholesteatoma has so far been detected in the mastoids. Those observed in attics occurred as small beads.

The functional results (Table II) were not as good as the anatomical results. Failures such as reperforations, residual cholesteatomas in the middle ear and adhesive otitis were occasionally worsened by others derived from ossiculoplasty. In addition, we encountered three cases of fixed stapes and another six of lateral semicircular canal fistulae.

Discussion

Neither open nor closed techniques provide—to our minds—completely satisfactory results in the removal of cholesteatomas. Thus, recurring cholesteatomas (pockets) are rather a common occurrence in patients operated on by closed techniques even 10 years post-operatively, the number of relapses reaching 32 per cent for Smyth (1986) and 62 per cent for Sade *et al.* (1986).

Problems are further increased by occasional residual cholesteatomas, so much so that some troublesome ears require up to six or seven operations (Tos and Lau, 1986). According to Sade *et al.* (1986), most of the failures of closed techniques arise from cholesteatoma pockets forming at the expense of tympanic retraction pockets. These are produced by deficiently aerated, large attico-antral-mastoid cavities. It is significant that the volume of the eustachian tube, which is occasionally inadequate, remains unchanged after surgery. Because of the need for the tube to ventilate a much larger than normal cavity as a result of the surgical bone destruction, it should come as no surprise that the tube fails to perform this task and tympanic retraction pockets occur. As pointed out by Sade *et al.* (1986), the more dead spaces there are, the higher the probability of tympanic retraction pockets being produced will be. As a result, open techniques are being revived—as aptly noted by Smyth (1982), ‘after 20 year’s experience, we still have some lessons to learn, one them being the value of traditional techniques’.

However, the inherent problem in open techniques

remains that they result in large exteriorized mastoid cavities which some avoid as far as possible by destroying the minimal amount of bone required for complete removal of cholesteatomas (Smyth, 1986). This can be readily accomplished in those cases where the cholesteatoma is located in a sclerotic mastoid, but not in those of invasive cholesteatomas extending to the end of the mastoid or in pneumatized mastoids. The antrum-exclusion technique results in substantially smaller cavities, whatever the size or location of the cholesteatoma, than those typically accomplished by Sade *et al.* (1986) using small radical cavities.

Performing antrum-exclusion with partitioning off and attic-elimination avoids the appearance of dead spaces, so the eustachian tube has to provide ventilation for the middle ear only, which will thus be normally much more efficient. This avoids the occurrence of cholesteatoma pockets, but not that of an adhesive middle ear if the tube fails to ventilate the small volume anyway. Any residual cholesteatoma will almost certainly appear in small exteriorized cavities as they normally occur in the attic and sinus tympani. Those appearing in the attic normally occur as small beads that can be removed at consultation under microscopic control. On the other hand, only very rarely are cholesteatomas found exclusively in the mastoid cavity, so they are normally not readily visible. So far we have never faced this problem; yet, its occurrence cannot be ruled out until a long enough post-operative time has elapsed. Any cholesteatomas occurring in the sinus tympani are also concealed from sight by the neotympanum, but only for a fairly short time. This problem is also encountered in using other open techniques as it is the antrum-mastoid area where residual cholesteatomas may pose problems since early diagnosis is impossible. On the other hand, it is at this location that cholesteatomas can be removed most safely and where, according to statistics, they are the least likely to appear. Therefore, this potential weakness of this technique will rarely be experienced. In addition, according to Sade *et al.* (1986) failures in closed techniques arise basically from recurring (retraction pockets) rather than residual cholesteatomas. These authors encountered 62 per cent of failures, of which only 18 per cent were due to residual cholesteatomas. Taking into account that residual cholesteatomas appear most frequently in the attic and sinus tympani, then leaving the mastoid cavity closed, unexteriorized, should not be so critical as was originally believed.

New techniques reported lately tend to combine the advantages of open and closed techniques as intermediate solutions while a definitive antrum-exclusion technique is developed. Following this trend, Tos (1982) practises attic elimination, and Heermann (1978), Wigand (1978) and Paparella and Jung (1983) implement modifications of an essentially open technique intended to avoid the shortcomings encountered.

Even though the controversy is seemingly resolved, dis-

TABLE II
FUNCTIONAL RESULTS (N = 102)

| Post-operative air–bone gap (dB) | n | % |
|----------------------------------|----|------|
| 0–10 | 18 | 17.6 |
| 11–20 | 30 | 29.4 |
| 21–30 | 21 | 20.5 |
| >30 | 33 | 32.3 |

ussion does not end here. Thus, according to Jansen (1983), the problems posed by closed techniques arise from the simple fact that they are carried out in the wrong manner. In implementing the antrum-exclusion technique with attic-elimination, our group avoids the traditional drawbacks associated with this surgical alternative.

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