

The histology of ‘stored’ autologous ossicles

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Abstract

Controversy still exists concerning the ultimate fate of transposed or transplanted ossicles in tympanoplasty. Histological studies on autologous and homologous ossicles removed at revision operations, or from animal studies, vary in their conclusions. The viability, of such materials used in the long-term is still uncertain. Whether this has any functional significance is also uncertain.

This report contains a histological review of 10 ossicle remnants stored in the ‘closed’ mastoid cavity for 12 months, following closed cavity mastoidectomy (combined approach tympanoplasty).

Introduction

Autologous and homologous ossicles have been widely used in tympanoplasty for many years, the latter having been proposed by House *et al.*, 25 years ago (House *et al.*, 1966).

It is generally accepted that autologous material is better tolerated immunologically and gives superior long-term functional results than homologous ossicles, in humans. In both cases early improvements in hearing thresholds are often followed by disappointing deterioration with time. The histological evidence obtained from transposed or transplanted ossicles removed at revision operations is conflicting.

Various studies have reported short, medium and long-term histological findings.

Hall and Rytznér, (1960), reviewed the history of four autologous includes up to two years after tympanoplasty and concluded that the ossicles remained viable. Although fibrous tissue replaced some marrow spaces, living osteocytes were found together with evidence of new bone formation. Linthicum, (1966), removed nine autologous includes repositioned for stapedectomy up to two years previously and concluded that the repositioned ossicles were largely dead. Only one case in this series revealed new bone formation. Larger short-term series exist that report both on autologous and homologous ossicle survival with revascularization and new bone formation after tympanoplasty. (Kerr and Smyth, 1971).

Medium term reports, up to 10 years after original surgery, are just as conflicting. On the one hand some quite large series suggest homologous ossicle viability, although admit that new bone formation is now directly proportional to time elapsed. (Smyth *et al.*, 1977; Schuknecht and Shi, 1985; Lang *et al.*, 1986). On the other hand autologous transposed ossicles and bone graft columellae have been reported as showing little evidence

of viability over similar periods. (Robin *et al.*, 1976). In the last report, one ossicle was stored in a mastoid cavity, as in this present series, but is not reported histologically.

Few long-term histological reviews exist, but Lang *et al.* (1989) recently reviewed two ossicles, one autologous one homologous, some 20 years after tympanoplasty. In their report long-term ossicle survival is suggested.

The purpose of this current study is to report the histology of ossicle remnants stored in the mastoid cavity for 12 months, following closed cavity mastoidectomy performed for cholesteatoma.

Material and method

It is the current practice of one of the authors (JMR) to manage cholesteatoma by closed cavity mastoidectomy (combined approach tympanoplasty). In addition routine re-exploration to check for residual or recurrent disease is performed approximately 12 months later. Recently, ossicles removed at first stage procedures are thoroughly cleaned under the microscope and stored in the mastoid cavity of the host. At some re-exploration operations these ossicles, or ossicle remnants, are used in an attempt to improve the hearing by various tympanoplasty procedures. The reported cases comprises those in which surplus ossicle exists, after reconstruction or in which reconstruction of the ossicular chain is felt to be inappropriate.

The ossicle remnant is removed from the mastoid cavity and placed in formaldehyde for fixation. Later the specimen is decalcified and embedded in paraffin wax. The specimen is cut into thin serial sections, stained with haematoxylin and eosin and examined under the microscope. Ten ossicle remnants have been examined in this way. An average of 25 slides were obtained from each specimen, of which approximately half were examined.

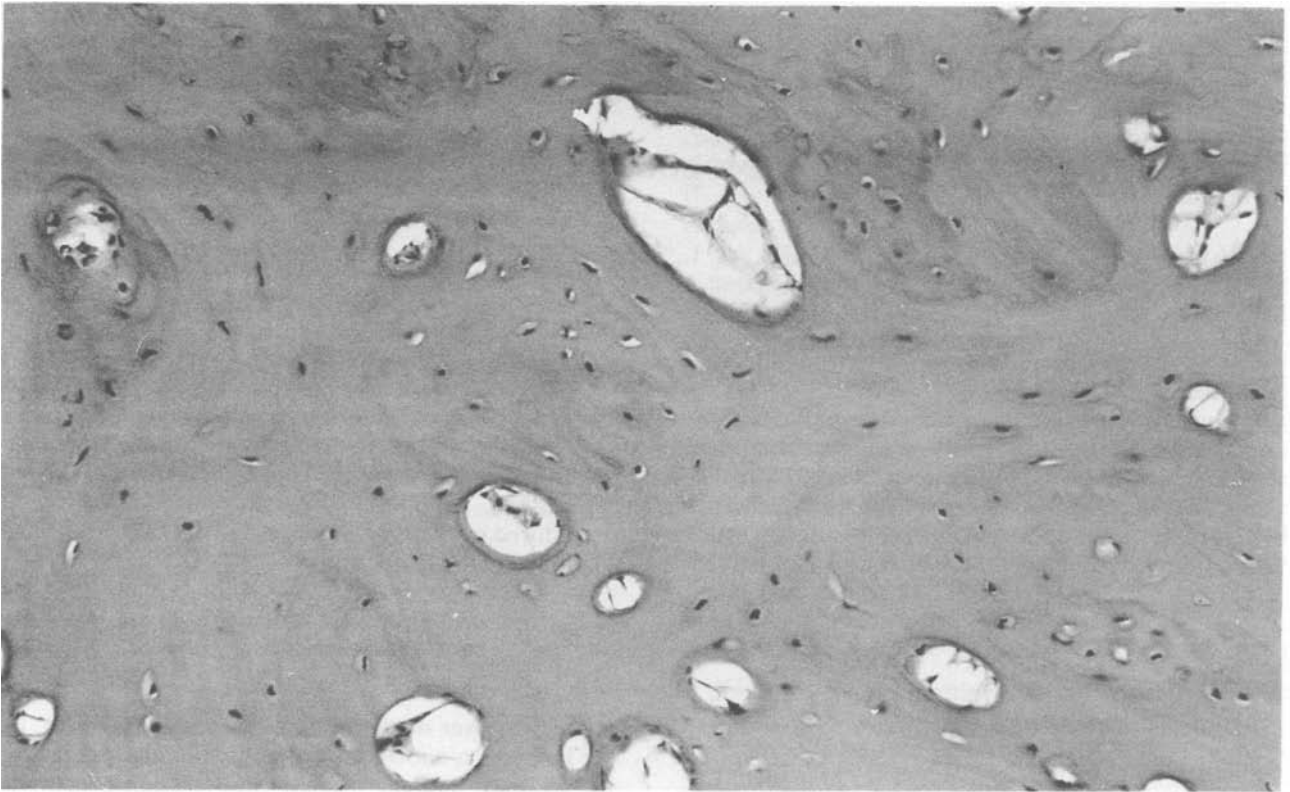


FIG. 1

Light microscopic appearances of 'stored' autologous ossicles. Viable lamellar bone with osteoblasts in all lacunae and large blood vessels within Haversian canals.



FIG. 2

Light microscopic appearances of 'stored' autologous ossicles. Viable bone in lower half of picture with rim of dead bone (arrow) containing 'ghost-like' osteoblasts. This rim of dead bone did not polarize. Traumatized respiratory epithelium is seen in the upper left hand corner of the picture.

TABLE I
DETAILED HISTOLOGICAL FEATURES OF SERIAL SECTIONS OF STORED OSSICLES, REMOVED FROM CLOSED CAVITY MASTOIDECTOMY PATIENTS AT REVISION SURGERY

Case number	% viable bone	% colonized by osteoblasts	Haversian canals Fibrous tissue+ Size of vessels	Osteoclast activity 0+ ++ +++	Inflammation 0+ ++ +++	% woven new bone	Cholesteatoma
1	100%	20%	Dense fibrous tissue + very poor vascularity small vessels	0	+ occasional lymphocytes in fibrous tissue	20%	No
2	100%	30%	Dense fibrous tissue + large vessels	0	+ occasional plasma cell	20%	No
3	60%	20%	Dense fibrous tissue + vessels in viable area	+	++ chronic inflammation	30%	No
4	90%	40%	Fine fibrous tissue + vessels in viable area	0	0	40%	No
5	100%	30%	Fine fibrous tissue + large vessels	0	++ chronic inflammation in haversian canals	40%	No
6	80%	20%	Dense fibrous tissue + small vessels	0	++ chronic inflammation	20%	No
7	100%	100%	Fine fibrous tissue + large vessels	0	0	20%	No
8	90%	10%	Dense fibrous tissue + large vessels	0	++ chronic inflammation	0%	No
9	80%	20%	Dense fibrous tissue + large + small vessels	+	0	40%	No
10	90%	80%	Dense fibrous tissue + small vessels	0	++ plasma cells	80%	No

Results

The histological findings from the 10 ossicle remnants analyzed are presented (Table 1). All specimens were prepared in the same manner and examined by the same Pathologist.

Ossicle remnants removed at mastoid exploration and subsequently stored in a 'closed cavity' remain viable, or partially viable, in all cases. (Figs. 1 & 2). There is no histological evidence that residual or recurrent cholesteatoma exists in ossicles stored in this way.

Discussion

In any histological review of this type, one should consider the pre-operative state of the ossicular chain. Robin *et al.* (1976), examined a large series of ossicles from ears with chronic suppurative otitis media and documented evidence of bone resorption, remodelling and areas of non-viability caused by the disease process.

The literature also reports a variable pattern of ossicular viability in histological studies, from ossicles removed at revision tympanoplasty procedures.

It would be premature to assume, that after 12 months a 'steady state' exists and clearly alterations in the histological picture of stored ossicles is possible beyond this period. Despite this reservation, it is clear that mastoid storage of ossicles removed at closed cavity mastoidectomy, is consistent with prolonged survival, revascularization and new bone growth. It is the minority of bones that display any adverse histological features.

Previous studies from revision tympanoplasty cases self-select a group displaying unsatisfactory functional results. This may have implications with regard to the expected histological picture and not represent the typical features of ossicular transfer. Animal studies performed on autologous ossicle survival at tympanoplasty report poor long term viability, but homologous material is likely to do rather better. (Robin & Clegg, 1980).

No cases of recurrent cholesteatoma due to this method of ossicle preservation have so far been found by one author (JMR). Obviously, it is not possible to correlate directly the relationship between functional results and histology from the small series of patients reported here.

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