

# Results of inlay cartilage myringoplasty in terms of closure of central tympanic membrane perforations

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## Abstract

There is a current effort to perform myringoplasty for tympanic membrane perforations as a day-stay procedure. In 1998, an inlay myringoplasty using tragal cartilage/perichondrium was described. A retrospective study was performed by the author to analyse the results of inlay cartilage myringoplasty, in terms of closure of simple perforations of the tympanic membrane. The results of a control group of previous cases of underlay temporalis fascia myringoplasty were retrieved from the hospital records. All the operations in both groups were performed by the same author at the same institution. The operation of inlay cartilage butterfly myringoplasty has been performed in 28 ears with simple central tympanic membrane perforations. Inconsistent results have been obtained, in that only 43 per cent showed closure of the perforation at the most recent follow-up. A control group of standard underlay temporalis fascia myringoplasty has been performed by the same author in 23 ears. Eighty-three per cent of the perforations were closed at the last follow-up. The difference is statistically highly significant ( $p < 0.01$ ).

**Keywords:** Otologic surgical procedures; Myringoplasty; Fascia; Cartilage

## Introduction

Chronic tympanic membrane perforations are quite common in all races. The indications for surgical closure of a safe perforation include the prevention of recurrent discharge, improving hearing, and social reasons.<sup>1</sup> Recently efforts have been made to perform myringoplasty as a day-stay procedure.<sup>2</sup> There is marked controversy in the literature concerning the results of myringoplasty, even when the size and position of the perforation are taken into account.<sup>3</sup>

In 1998, Eavey<sup>4</sup> reported an ingenious technique for closure of simple central tympanic membrane perforations, which promised to be a breakthrough in the management of chronic otitis media. This operation relies on the principle that a tragal cartilage/perichondrium graft can be fashioned so that, after freshening of the perforation margins, it is applied transcanal and fitted in the defect. The author has reported very good early results, and these have been substantiated by other workers.<sup>5</sup>

The present author has performed this procedure, as previously described,<sup>4</sup> on 28 ears with simple central perforations. However, at a mean follow-up of 23 months (range 8–38 months), he has been disappointed with the long-term results. The aim of this report was to review the cases performed and compare the results with those of underlay fascia

myringoplasty previously performed by the same author at the same institution. The potential causes of failure of inlay cartilage myringoplasty are discussed.

## Materials and methods

The operation of inlay cartilage butterfly myringoplasty was performed on 21 patients, 13 male and eight female. The age range was 8–58 years, with a mean age of 24.5 years. No septic focus was found pre-operatively in either the pharynx or the nose. The procedure was performed on both ears under the same general anaesthetic in seven patients. Thus there was a total of 28 procedures. The indications, techniques and post-operative care have been previously described.<sup>4,5</sup> The operations were performed successively in the period between October 2001 and March 2004. Follow-up was performed by otoscopy and otomicroscopy at one-month intervals. Pure-tone audiometry was performed in the follow-up period, but audiometric data are not included in this study. The details and dates of the operations are shown in Table I.

The control group comprised 23 patients who had a standard underlay temporalis fascia myringoplasty through an endaural incision. There were 11 males and 12 females. Their age range was 22–49 years, with a mean age of 27 years. The procedures were

TABLE I  
DATA CONCERNING INLAY CARTILAGE MYRINGOPLASTY

Patient no.	Age (yrs)	Sex	Ear(s)	Date of operation	Result at last follow-up
1	51	M	R	10/2001	Intact but not epithelialized
2	22	M	L	11/2001	Intact
3	13	M	R + L	12/2001	Perforation R & L
4	23	M	L	2/2002	Perforation
5	15	F	L	4/2002	Perforation
6	18	M	L	6/2002	Intact
7	34	M	R + L	8/2002	Perforation R & L
8	32	F	R	11/2002	Intact but not epithelialized
9	8	M	R	1/2003	Intact but not epithelialized
10	42	M	R	3/2003	Perforation
11	17	F	R	6/2003	Intact
12	9	M	L	7/2003	Perforation
13	27	M	R + L	7/2003	Intact R & L
14	19	M	L	8/2003	Perforation
15	24	F	R	10/2003	Intact but not epithelialized
16	17	F	R + L	11/2003	Perforation R & L
17	32	F	R	11/2003	Intact
18	58	F	L	12/2003	Perforation
19	14	F	R + L	1/2004	Perforation R & L
20	28	M	R + L	2/2004	Intact R, perforation L
21	32	M	R + L	3/2004	Perforation R, intact L

performed by the same author at the same institution in the period between April 1996 and March 2001. All the patients had a unilateral simple central tympanic membrane perforation before the operation.

The results were recorded in terms of closure of the tympanic membrane perforation at the most recent follow-up. The minimum follow-up was 8 months. The results were analysed statistically by means of the chi-squared test.

## Results

The details of the patients in the inlay cartilage myringoplasty group and the post-operative results are shown in Table I. An intact tympanic membrane was encountered in only 12 ears (43 per cent). An intact tympanic membrane was encountered in 19 ears from the underlay fascia myringoplasty group (83 per cent). The difference in terms of closure of the tympanic membrane perforation is highly significant ( $p < 0.01$ ).

## Discussion

Acute or recurrent infection of the middle ear may result in a permanent perforation of the tympanic membrane. Ears with chronic perforation but without cholesteatoma may be chronically or intermittently infected.<sup>6</sup> In their histological study of perforated tympanic membranes, Somers *et al.*<sup>7</sup> concluded that a tympanic perforation should not be considered merely as a simple defect in an otherwise normal tympanic membrane. All tympanic membranes in that study showed one or more signs of a persistent abnormality, such as inflammation, fibrosis, tympanosclerosis or epithelial hyperplasia. For reconstruction of the perforated tympanic membrane, numerous graft materials and methods of placement have been described in the literature. Cartilage was first introduced in middle ear surgery in 1959, and has recently been used by several

otologists for reconstruction of the tympanic membrane, as an underlay graft with perichondrium adjacent to the tympanic membrane remnant.<sup>8</sup> In 1998, Eavey<sup>4</sup> described a type of transcanal inlay myringoplasty, which he termed cartilage butterfly technique. He used this technique for small and medium-sized central perforations and reported a 100 per cent take-rate after early follow-up.

The present author has found inconsistent results after this procedure. Inlay cartilage myringoplasty possibly has different pathophysiological effects from the other types of myringoplasty reported in the literature. The weight of the graft can result in tearing of the tympanic membrane fibres.<sup>9</sup> In addition, the abnormal pressure of the graft may interfere with the blood supply of the tympanic membrane, resulting in avascular necrosis.<sup>10</sup>

Cartilage contains type II collagen, whereas the predominant collagen in the tympanic membrane is type I.<sup>11</sup> The tympanic membrane is capable of mounting inflammatory and immune responses.<sup>12</sup> Autoimmunity to type II collagen has been described in various ear diseases, such as auricular chondritis, Ménière's disease, otosclerosis, Cogan's syndrome and autoimmune sensorineural hearing loss.<sup>13</sup> It is possible that collagen autoimmunity may play a role in the extrusion of the cartilage graft.

A feature frequently noted in the operated ears was lack of epithelialization of the cartilage graft. In an experimental study by Hicks *et al.*<sup>14</sup> it was found that tracheal cartilage down-regulates growth factor expression and impairs epithelialization. The presence of unepithelialized cartilage/perichondrium may be an ideal site for the development of a bacterial biofilm on the surface.<sup>15</sup> Bacterial biofilms have been seen on the middle ear mucosa of experimental models of otitis media and on extruded ventilation tubes.<sup>16</sup> Bacterial biofilms are a real source of infection and may play a role in the extrusion of the graft.

## Conclusion

The theoretical advantages of the cartilage butterfly technique of inlay myringoplasty do not appear to tally with the poor long-term results found in the present study. The operation is certainly a swift procedure that is easy to learn and causes minimal morbidity to the patient. However, the biomechanics of the delicate tympanic membrane, as well as putative biochemical, immunological and bacteriological factors, probably play a role in the extrusion of the graft.

- **This retrospective study compares the results of two techniques of myringoplasty undertaken by a single surgeon**
- **The inlay cartilage technique produced poor results (43 per cent tympanii membrane closure) compared with an underlay temporalis fascia technique (83 per cent closure)**
- **The theoretical advantages of inlay cartilage myringoplasty do not seem to be borne out in practice**

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