

## Main Articles

# Paediatric tympanoplasty

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### Abstract

Much debate exists over the management of mucosal chronic suppurative otitis media in children, with the majority of it centred around the correct timing to perform either a myringoplasty (an operative repair of the tympanic membrane) or type I tympanoplasty (reconstruction of the tympanic membrane when there is an intact and mobile ossicular chain). Further discussion will use the term tympanoplasty to mean both of the above definitions. We present the findings of a recent survey of UK ENT consultants questioning their opinions on various management aspects of mucosal CSOM in the paediatric population. We also present an extensive review of the literature to provide us with published evidence in order to analyse the results of the questionnaire.

**Key words:** Infant; Child; Tympanoplasty

### Method

A questionnaire was issued to all consultant members of the British Association of Otolaryngology Head and Neck Surgeons (BAOHNS) within the UK and Ireland, with a reply rate of 308/520 (see Appendix). We asked their opinion on various aspects of the management of mucosal chronic suppurative otitis media in the paediatric population. Four questions restricted the reader to yes-no answers, whilst the remaining three provided space for discussion.

### Results

We questioned consultant members about their preferred age of a child on whom to perform a tympanoplasty. We found that 70 per cent had a set age below which they would not consider operating, and these set ages and their reasons for not operating earlier are shown in Figure 1 and Table I respectively. A case scenario of a child with a two-year history of recurrent left-sided otorrhoea, occurring three to four times a year with no history of snoring, nasal obstruction or rhinorrhoea was then presented. Examination and investigation findings included a 40 per cent sized dry anterior central perforation in the left ear, a 20 dB air bone gap in the left ear with normal bone conduction thresholds, and a normal right ear, both clinically and audiological. We asked members what factors other than

age would make them delay performing a definitive otological procedure in this case scenario, the answers being documented in Table II. In the scenario 68 per cent would have delayed surgery in the presence of a co-existing muco-purulent otorrhoea, whilst 75 per cent felt that its presence would diminish operative success rate. The various lengths of time that members leave an aural pack in-situ for post-paediatric tympanoplasty are shown in Table III. Finally members were asked about their current auditing practice, and we found that 58 per cent regularly audit their tympanoplasty results.

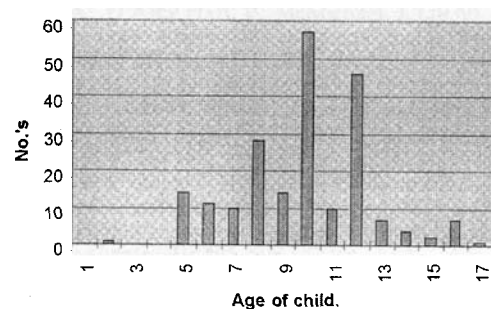


FIG. 1

Set ages below which 70 per cent of members would not perform a tympanoplasty in a child.

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TABLE I  
REASONS GIVEN FOR NOT OPERATING EARLIER THAN THE MINIMUM  
PREFERRED AGE

	No.s
Reduced success rate	108
Increased risk of recurrent ASOM	58
Increased risk of recurrent OME or eustachian tube dysfunction	90
Increased risk of recurrent URTI's	43
Inability of child to co-operate post-operatively	25
Technical difficulty due to small anatomy	15
Greater chance of spontaneous healing	9
Greater anaesthetic risks	3
Increased risk of psychological trauma	7
Child unable to give informed consent	6
Lowered immunological maturity	2
Inability to accurately test auditory function	2
Others	14

### Discussion

Much debate exists over the subject of tympanoplasty in the paediatric population, as is highlighted by the broad variety of answers in our questionnaire. It has long been stated that tympanoplasty in children is less successful than in adults because of poorer eustachian tube function and an increased risk of upper respiratory tract infections, thus leading to recurrent otitis media with effusion (OME) or acute suppurative otitis media (ASOM). Hence many use the age 12, as suggested by Raine and Singh (1983), or 10, as suggested by Dawes (1972), as the age to observe a child to before proceeding to an operative closure of their perforation. In the following discussion we wish to look at the current thinking regarding age and its influence on operative outcome, and also to review if there are any other reliable predictors for operative success or failure.

When comparing paediatric tympanoplasty results to those in adults we must first decide what is the accepted success rate in the adult population. Many of us quote in the region of an 80 to 90 per cent success for an intact graft, but do we know our results from prolonged follow-up? Only 58 per cent

TABLE II  
REASONS OTHER THAN AGE FOR NOT PERFORMING A MYRINGO-  
PLASTY (SEE CASE SCENARIO)

	No.s
Infrequent infections	31
Recurrent tonsillitis	13
Symptoms & signs or adenoidal hypertrophy	17
Sinonasal symptoms	38
Contralateral OME	57
Contralateral ASOM	13
Recurrent URTI's	15
Persistent otorrhoea	17
Congenital abnormalities – Cleft palate	11
– Other	6
Wet ear at time of operation	29
Size of perforation	5
Normal contralateral hearing ear	11
Inadequate trial of conservative Mx	5
Poor social background/poor hygiene	15
Diseased ear is the best/only hearing ear	11
Parental wishes	26
Child who is obviously psychologically immature	23
Doing well socially and at school	2
Coexisting medical problems	41

of those questioned regularly audited their tympanoplasty result. In one such audit, 605 patients of all ages were followed for up to 10 years in 44 per cent and 15 years in five per cent of cases, and survival life table analysis of long-term results revealed a normal healed intact tympanic membrane in only 74 per cent at an 11 year follow-up, and it was found that late failures occurred more commonly than had been previously reported (Halik and Smyth, 1988).

Certainly a period of observation is required in paediatric tympanic membrane perforations because of the high rate of spontaneous closure; as high as 94 per cent within one month (Berger, 1989). Low success rates are well-documented with graft take rates between 30–67 per cent (Table IV), however there is a substantial volume of literature supporting tympanoplasty in the paediatric population (Table V).

Delaying a definitive otological procedure is not without its own inherent risks, yet one questions if these are seemingly easier to accept than those of operative failure. Ossicular chain erosions are seen less frequently in paediatric tympanoplasties than adult tympanoplasties, (Lau and Tos, 1986; Tos and Lau, 1989), and an early operation may prevent the progression of ossicular chain erosion. There is also evidence that even unilateral hearing loss can have a detrimental effect upon the education of the child (Bess, 1985). We must not overlook the effects that a foul smelling otorrhoea may have on a child's interaction and acceptance by their peer group.

We asked BAOHNS members what factors, other than age, would make them delay performing a definitive otological procedure in a child with a 40 per cent sized dry, central pars tensa perforation, which had been active three or four times a year over a two-year period (see Appendix). A delay was thought necessary by six per cent if the child demonstrated symptoms and signs of adenoidal hypertrophy. Others felt that contra-lateral OME, (19 per cent), or a history of recurrent contra-lateral ASOM (four per cent) were indications to delay surgery. Although there is evidence that adenoidectomy reduces the incidence of otitis media with effusion, (Gates, 1989), there is evidence that a previous adenoidectomy (Bluestone *et al.*, 1979; Buchwach and Birck, 1980) fails to influence the

TABLE III  
LENGTH OF TIME AN AURAL PACK IS LEFT IN SITU POST-  
MYRINGOPLASTY

Length of time	No. of BAORL members
1 day	4
2 days	5
3 days	2
5 days	7
1 week	82
10 days	22
2 weeks	89
3 weeks	47
4 weeks	9
5 weeks	1
6 weeks	1
No pack	17

TABLE IV  
LIST OF PREVIOUS PUBLICATIONS FINDING A POOR GRAFT TAKE RATE, FOLLOWING TYMPANOPLASTY

Publication	Patient age	Operative No.s	Operative outcome (graft take rates)
Shih <i>et al.</i> (1991)	10 and under	n = 24	54%
	11 to 16	n = 35	94%
Raine and Singh (1980)	8 and under	n = 6	67%
	All ages to 16	n = 114	81%
Bluestone <i>et al.</i> (1979)	11 and under	n = 32	Overall success was 35%
	12 to 16	n = 19	
Halik and Smyth (1988)	under 10	n = 38	Patients less than 10 have a higher graft failure ( $p = 0.057$ )
	over 10 to adult	n = 567	
Koch <i>et al.</i> (1990)	under 8	n = 10	30%
	8 to 17	n = 54	81%
Glasscock (1976)	No data available		

operative outcome in tympanoplasty. Other factors found not to influence operative outcome were evidence of contralateral tubal dysfunction (Bluestone *et al.*, 1979), a documented history of previous otitis media with effusion (Buchwach and Birck, 1980), demonstrable ipsilateral tubal function, as opposed to patency, (Sharp, 1970; Koch *et al.*, 1990), and evidence of current or prior contralateral middle-ear disease (Shih *et al.*, 1991). Some also feel that eustachian tube function can often recover after successful myringoplasty (Sharp, 1970; Tos and Lau, 1989). Hence there is good evidence not to base the timing of operative intervention on the state of the contra-lateral ear.

In our study, 32 per cent would have performed a tympanoplasty on a child, despite the presence of a mucopurulent discharge on the operative day, whilst 74 per cent felt that its presence did reduce the operative success rate. Although it has been documented that the presence of mucopurulent otorrhoea at the time of surgery reduces the success rates for tympanoplasty (Armstrong, 1965; Gibb and Chang, 1982), more recent literature contradicts this, claiming success rates to be comparable whether the ear is wet or not (Lau and Tos, 1986; Ophir *et al.*, 1987; Halik and Smyth, 1988; Koch *et al.*, 1990). This information does not distinguish between mucoid discharge, which maybe considered as a reflection of the normal middle ear's physiological secretory function, and mucopurulent discharge, which in our opinion is more indicative of pathology. Another important factor, when operating on those patients with active on-going infections, which is not men-

tioned by these authors, is the increased difficulty and hence duration of the procedure, resulting from increased bleeding and tissue oedema.

Several members felt that in cases of mucosal chronic suppurative otitis media associated with marked otorrhoea, that a tympanoplasty should be performed in conjunction with a cortical mastoidectomy, and hence removing a source of persistent mucosal infection. Given the increased morbidity of a cortical mastoidectomy, one would think that its addition would be based on firm evidence of an improved operative success rate. There is, however, no study indicating that tympanoplasty with mastoidectomy yields better surgical and functional results than tympanoplasty without mastoidectomy in cases of non-cholesteatomatous CSOM (Baylan *et al.*, 1997). In a recent retrospective analysis of 323 patients treated for non-cholesteatomatous CSOM, 53 patients were treated by tympanoplasty alone, 28 patients treated by tympanoplasty and cortical mastoidectomy (ears actively discharging at the time of surgery), and 242 patients treated by tympanoplasty alone (ears dry at the time of surgery but with a history of recurrent suppuration). The outcome revealed no statistical difference between the three groups for either graft take or post-operative functional hearing (Baylan *et al.*, 1997).

The authors felt that within the region they worked they had witnessed a great variation in the lengths of time that different otologists left in an aural pack post-tympanoplasty. The questionnaire demonstrated this to be a nationwide variation (Table III) and certainly there is no great weight of scientific evidence as yet to change what amounts to a range of personal preference.

TABLE V  
LIST OF PREVIOUS PUBLICATIONS FINDING COMPARABLE GRAFT TAKE RATES, FOLLOWING TYMPANOPLASTY

Publication	Patient age	Patient No.s	Operative outcome (graft take rates)
Ophir <i>et al.</i> (1987)	Age 5 to 8	n = 63	78%
	Age 9 to 12	n = 92	80%
Lau and Tos (1986)	Age 2 to 7	n = 26	92%
	Age 8 to 14	n = 98	91%
Sade <i>et al.</i> (1981)	Age 0 to 9	n = 38	84%
	Age 10 to 19	n = 141	81%
Lee and Schuknecht (1971)	Age 1 to 10	n = 94	82%
	Age 11 to 20	n = 222	78%
Buchwach and Birck (1980)	Age 8 to 17	n = 55	67%
	Age 3 to 7	n = 25	64%

No questionnaire reply mentioned the position of the perforation as a factor in making an operative timing decision in a child. Endoscopic tympanic membrane fluorescein angiography techniques have demonstrated that the predominant blood supply to the posterior half of the tympanic membrane is from the malleolar artery, whilst the anterior half is perfused by branches from the annular ring, and that the posterior half is consistently better perfused than the anterior half (Applebaum and Deutsch, 1986). This may well explain the greater occurrence of perforations seen to occur in the anterior region in acute suppurative otitis media (Berger, 1989), and the reported less favourable prognosis of graft take during myringoplasties and tympanoplasties on anterior perforations (Sade *et al.*, 1981; Halik and Smyth, 1988). One may also postulate that anterior perforations would be less likely to close spontaneously for the same reasons. Operative repair of anterior perforations is probably less successful for technical reasons as well as physiological ones. This is due to the greater risk of inadequate graft support because of the voluminous underlying eustachian tube orifice. Due to these factors, the repair of an anterior perforation in a small child can become a technically demanding procedure, and hence we feel it is wise that this should be performed by an experienced otologist, and under optimal conditions.

## Conclusions

There is currently a very varied opinion on the management of non-cholesteatomatous CSOM in the paediatric population. Seventy per cent of consultants would not perform a tympanoplasty in a child below a set age; this age most commonly being 10. There is no weight of literature evidence suggesting that age adversely affects the outcome of tympanoplasty results. The majority (68 per cent) would delay operating on a child during an episode of muco-purulent discharge. We may be quoting too high a success rate in adult myringoplasty due to an inadequate follow-up period and hence comparisons with paediatric tympanoplasty success rates become less meaningful.

Ossicular chain erosions are less frequently seen in paediatric tympanoplasties compared with adult ones. We presume this is a direct relationship with the exposure time of the ossicles to osteolytic enzymes and the frequency of erosions. Hence delay in operative closure may increase the number of children progressing to ossicular chain erosion. Twenty-seven per cent of consultants felt that a decision to perform a tympanoplasty should depend upon the state of the contralateral ear, however, there is good evidence in the literature not to base the timing of operative intervention on this. There is no study indicating that tympanoplasty with mastoidectomy yields better surgical and functioning results than tympanoplasty without mastoidectomy in cases of non-cholesteatomatous CSOM. There are anatomi-

cal as well as technical reasons why closure of anterior perforations are documented to be less successful in all age groups.

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**Appendix**Questionnaire

- 1) Do you have a set age below which you would not perform a myringoplasty in a child?
- 2) If so what age is this?
- 3) What would be your reasons for not operating earlier?

A child presents to your clinic with a two-year history of recurrent left-sided otorrhoea, occurring three to four times a year. The mother denies any history of snoring, nasal obstruction or rhinorrhoea. Examination and investigation findings include;

- a 40 per cent sized dry anterior central perforation in the left ear.
  - a 20 dB air bone gap in the left ear with normal bone conduction thresholds.
  - a normal right ear, both clinically and audiologically.
- 4) What factors would make you delay performing a definitive otological procedure in this child other than age?
  - 5) On the day of surgery the child's left ear is wet with a mucopurulent discharge. Would you delay the procedure?
  - 6) Do you feel that performing a myringoplasty on a patient with active mucosal CSOM reduces the success rate of the procedure?
  - 7) For how long would you leave the aural pack in situ?
  - 8) Do you routinely audit your myringoplasty results in order to counsel your patients accurately on the expected success rate for the procedure, given the perforation's size, position and degree of infective activity?