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Review Article

# Should we aspirate middle-ear effusions prior to insertion of ventilation tubes?

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**Abstract**

Background: Routine aspiration of middle-ear effusions prior to ventilation tube (grommet) insertion is practised by many surgeons. It has been suggested that removing the fluid from the middle ear improves immediate post-operative hearing levels and reduces the chance of the ventilation tube becoming obstructed. The potential adverse effects of applying suction to the middle ear include acoustic trauma and an increased risk of tympanosclerosis and otorrhoea. We undertook a review of the literature in order to determine the benefits or side effects associated with middle-ear aspiration prior to ventilation tube insertion.

Objectives: To compare clinical outcomes associated with aspirating versus not aspirating the middle ear prior to ventilation tube insertion.

Methods: The Cochrane ENT group trials register, DARE, the Cochrane central register of controlled trials (CENTRAL), MEDLINE (1960–2005) and EMBASE (1960–2005) were searched using relevant terms. Reference lists of selected studies were scanned for additional research material.

Results: Seven studies were identified, of which three fitted the inclusion criteria of our review. Current evidence suggests that aspiration of middle-ear effusions prior to insertion of ventilation tubes is not associated with any improvement in clinical outcome, in terms of post-operative hearing levels, otorrhoea or rates of blockage of ventilation tubes. Significantly increased rates of tympanosclerosis were observed in one study and the development of acoustic trauma was observed; however, no significant association was confirmed. Although more research is needed, there is no evidence that aspiration of middle-ear effusion prior to grommet insertion confers any advantage.

**Key words: Otitis Media with Effusion; Middle Ear Ventilation; Hearing Loss, Noise Induced; Aspirations; Complications**

## Introduction

Myringotomy and ventilation tube insertion is an operation performed regularly in children with otitis media with effusion (OME).[1] Many surgeons completely evacuate the effusion from the middle ear prior to insertion of the ventilation tube. Although not considered mandatory when myringotomy is performed alone, in current practice, suctioning of the middle-ear fluid is often completed before the insertion of ventilation tubes.[2] It has been suggested that this technique improves hearing immediately after the operation by relieving the mechanical obstruction caused by the effusion and also prevents viscid secretions from obstructing the ventilation tube.[3]

At present, there is no clear evidence to suggest that the aspiration of middle-ear effusion is associated with a better clinical outcome in terms of hearing improvement and tube patency. Concerns about the safety of middle-ear effusion aspiration have been expressed over the years, including the possibility of acoustic trauma to the inner ear due to suction noise[2,4] and the increased risk of tympanosclerosis resulting from the additional mechanical trauma of clearing the effusion, causing inflammation and bleeding of the tympanic membrane.[3]

We undertook a review of the literature in order to determine the evidence for any significant benefits or side effects associated with middle-ear aspiration prior to ventilation tube insertion.

### *Objectives*

Our objective was to compare the clinical outcomes associated with aspirating versus not aspirating the middle ear prior to the insertion of ventilation tubes.

## Search process

### *Criteria for considering studies*

Generally, only randomized, controlled trials were included; however, we also included trials in which

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sides were randomized when bilateral disease was present.

We only included studies in which patients underwent myringotomy and ventilation tube insertion for the management of bilateral or unilateral OME. Studies containing participants who had a history of previous ear surgery or pathology other than OME were excluded.

Outcome measures included immediate and middle-term hearing levels, post-operative otorrhoea, ventilation tube patency and time to ventilation tube extraction, as well as possible complications such as acoustic trauma and the development of tympanosclerosis.

*Search strategy for study identification*

We searched the Cochrane ENT group trials register, Database of Abstracts of Reviews of Effectiveness (DARE), the Cochrane central register of controlled trials (CENTRAL), MEDLINE (1960–2005) and EMBASE (1960–2005) using the terms 'aspiration', 'middle ear', 'suction', 'ventilation tubes', 'grommets', 'myringotomy', 'glue ear', 'tympanosclerosis', 'otorrhoea', 'hearing loss' and 'acoustic trauma'. The date of the last search was June 2005.

The relevant papers thus identified were retrieved as full text articles for independent assessment. Only randomized controlled trials were considered. Reference lists were scanned for additional references.

## Description of studies

Seven studies were identified (Table I), of which three were relevant and satisfied the study selection criteria described above.

*Excluded studies*

The following trials were excluded because they were either inadequately randomized or not randomized at all: Egeli and Kiris (1998),[7] Sadé *et al.* (1976)[6] (in both of which application of aspiration was determined by side, not randomization), Wetmore *et al.* (1993)[2] (no randomization), and Mason *et al.* (1995)[4] (retrospective study).

*Included studies*

Youngs and Gatland[1] included 38 children with bilateral middle-ear effusions but no other ear pathology, in a prospective, randomized, controlled study. One ear was randomized to be aspirated by microsuction, the non-aspirated ear acting as the control of the aspirated ear. A Shah ventilation tube was then inserted into both ears. Subjects were evaluated on the day before surgery, at 24 hours post-operatively, at one month and finally at three months. Data were collected on ventilation tube patency and time to extrusion as well as on audiometric results. The average threshold was defined as the average of air conduction thresholds at 500, 1000 and 2000 Hz.

McRae *et al.*[5] carried out a follow-up study of the patients in the Youngs *et al.* study, investigating the effect of middle-ear effusion aspiration on the development of tympanosclerosis and ventilation tube extrusion times. The tympanic membranes of these children were inspected at three, six, 12 and 18 months post-operatively by an independent clinician in order to assess whether the ventilation tube had been extruded. At 24 months, the tympanic membranes were assessed micro-otoscopically for the presence of tympanosclerosis.

Dawes *et al.*[3] carried out a randomized, controlled trial examining the influence of aspiration of middle-ear fluid on the subsequent development of otorrhoea, ventilation tube obstruction and the later development of tympanosclerosis. Fifty children (100 ears) with bilateral middle-ear effusions, who had not had previous myringotomies or other coexisting ear disease (including tympanosclerosis), were recruited into the study and were randomly allocated into an aspiration or non-aspiration group. In the aspiration group, complete aspiration of the middle-ear effusion was attempted by inserting the fine end of a microsucker through the myringotomy incision. In the non-aspiration group, only minimal suction was used in order to provide a clear view of the incision. Demographic and intra-operative complication data (including bleeding at myringotomy and at aspiration and development of a subepithelial haematoma) were collected on the day of the operation. A month later,

TABLE I

CHARACTERISTICS OF STUDIES ASSESSED

| Study | RCT | Subjects (ears) | Randomization | Intervention | Outcomes |
|---|---|---|---|---|---|
| *Included studies* | | | | | |
| Youngs & Gatland (1988)[1] | Yes | 38 (76) | Adequate | Aspiration *vs* non-aspiration | 1, 2, 3 |
| McRae *et al.* (1989)[5] | Yes | 38 (76) | Adequate | Aspiration *vs* non-aspiration | 2, 4 |
| Dawes *et al.* (1991)[3] | Yes | 50 (100) | Adequate | Aspiration *vs* non-aspiration | 1, 3, 4, 5 |
| *Excluded studies* | | | | | |
| Sadé *et al.* (1976)[6] | No | 26 (41) | Inadequate | Aspiration *vs* non-aspiration | Clearance middle-ear effusions & pressures |
| Egeli & Kiris (1998)[7] | No | 27 (51) | Inadequate | Aspiration *vs* non-aspiration | 3 |
| Wetmore *et al.* (1993)[2] | No | 124 (245) | None | Aspiration *vs* non-aspiration | Intra-operative noise |
| Mason *et al.* (1995)[4] | No | 13 (25) | None | Aspiration *vs* non-aspiration | Post-operative ABR thresholds |

Outcomes: 1 = ventilation tube patency; 2 = ventilation tube extrusion times; 3 = hearing levels/audiometry; 4 = tympanosclerosis; 5 = otorrhoea. RCT = randomized, controlled trial; ABR = auditory brainstem response

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the children were followed up and the presence, nature and duration of any aural discharge were recorded. At the same time, patency of the ventilation tube was assessed. Eighteen months later, the children were followed up again, and the presence of tympanosclerosis was recorded, expressed as a percentage of the surface. Pure tone audiometry and tympanometry were performed during this visit.

## Results

### *Tympanosclerosis*

McRae *et al.*[5] showed aspiration to be a significant factor in the development of tympanosclerosis 24 months post-operatively. Of the 38 children included in their study, 17 developed tympanosclerosis bilaterally and 12 did not develop tympanosclerosis in either ear. Of the remaining nine children, eight developed tympanosclerosis in the aspirated ear only. This was found to be statistically significant ($p \leq 0.05$). The authors concluded that, of the aspirated ears which had developed tympanosclerosis, 32 per cent (eight out of 25) were attributable to aspiration ($p = 0.045$). This result was independent of the extrusion times of the ventilation tubes.

In the study by Dawes *et al.*,[3] tympanosclerosis was found to have developed in 48.6 per cent of all ears at 18 months post-operatively. There was no overall difference between the two groups. In the aspiration group, tympanic membrane bleeding was associated with the development of subsequent tympanosclerosis ($p = 0.048$). This association was very weak, and further studies will be needed to clarify this point. This association was not present in the non-aspiration group. The development of tympanosclerosis was not proven to have a significant effect on post-operative hearing levels.

### *Post-operative hearing levels*

Youngs and Gatland[1] observed that, in terms of post-operative improvement in average hearing thresholds (defined as the average of air conduction thresholds at 500, 1000 and 2000 Hz), there was no significant difference in hearing improvement between the two groups at 24 hours and one and three months post-operatively. The results of this study suggested that there were no short or medium-term benefits in terms of hearing improvement. The authors noted that there was considerable improvement in audiometric results in the non-aspirated ears once the middle ear was ventilated.

### *Otorrhoea, ventilation tube patency and extrusion times*

Youngs and Gatland[1] observed no difference between the two intervention groups in terms of ventilation tube patency and extrusion times in the short term, findings also reported by McRae *et al.*[5] Two of the aspirated ears were noted to have an obstructed ventilation tube, but this was thought to be due to clotted blood and not to effusion fluid.

Dawes *et al.*[3] observed that otorrhoea developed in four of the 50 aspirated ears and in eight of the 50 non-aspirated ears. This was not statistically significant ($p = 0.13$) and was not affected by perioperative bleeding. There was only one blocked ventilation tube in each intervention group at one month post-operative follow up.

### *Acoustic trauma*

Over the last 20 years, acoustic trauma secondary to the noise induced by suctioning the middle ear has been a concern raised among surgeons.[2,4] There have been no randomized, controlled studies to investigate this; however, a number of other studies suggest that acoustic trauma may be a significant limitation of this technique.

Tos *et al.*[8] have proposed a cause and effect relationship between suction-induced noise and acoustic trauma. In 1993, Wetmore *et al.*[2] studied 124 patients (245 ears) undergoing aspiration and ventilation tube insertion and observed that in 50 per cent of cases median intensities of noise exceeded 86 dB. Noise of this intensity is considered a potential hazard to hearing. Mason *et al.*,[4] in a retrospective study, concluded that intense noise, such as that induced by suction, could produce a temporary shift in hearing threshold; however, more studies are needed to exclude other confounding factors.

## Conclusions

The aspiration of effusion fluid from the middle ear is commonly performed prior to the insertion of grommets. Reasons for this include improved visibility of the myringotomy incision as well as the belief that the grommet will be less likely to become blocked and that hearing will improve more quickly post-operatively. It has also been suggested that leaving the effusion fluid in the middle ear will result in quicker extrusion of the ventilation tube.

Our review suggests that, although there are not many studies on the subject that have been adequately designed to show a reliable difference, those that do show a difference between aspiration and non-aspiration also demonstrate some interesting points. There is some evidence to suggest that tympanosclerosis and bleeding may be increased by aspiration. Despite widely held beliefs, the rates of ventilation tube blockage appear not to be increased by not aspirating the effusion. Extrusion rates were also unaffected. Although no study has clearly addressed the issue of acoustic trauma, this remains a significant risk associated with microsuction of the middle ear.

There seems to be little research to recommend the routine suction of effusion fluid from the middle ear prior to the insertion of grommets. More randomized, controlled trials are required to investigate more fully the extent of the additional risk of acoustic trauma and the longer term complications associated with aspiration prior to insertion of ventilation tubes.

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