Factors affecting adenoidectomy for otitis media with effusion (glue ear)[1]

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Summary: One hundred and fifty-five children suffering bilateral otitis media with effusion (OME) and observed for three months have been followed postoperatively for twelve months. Surgery was randomly allocated into three groups: adenotonsillectomy; adenoidectomy; and no surgery. In all cases unilateral myringotomy and grommet insertion was performed. The contralateral unoperated ear was assessed subsequently for clearance of the effusion. Adenoidectomy produced resolution of the effusion in 31–45% of cases at one year, but tonsillectomy conferred no additional benefit. There was improved resolution in those with longer compared with shorter histories, and in older as opposed to younger children. Assessment of preoperative lateral cephalometric radiographs show improved resolution of the effusion following removal of larger, compared with smaller adenoids, but this effect was only demonstrable for three months. The effect of age was longer-lasting for up to one year postoperatively.

Introduction

The development of the nasopharynx and its contents in normal children has been studied. Jeans *et al.* (1981) examined lateral cephalometric radiographs of normal children without known ENT abnormality undergoing serial examinations for their dentition. As expected, during childhood and adolescence there is a steady growth of the nasopharynx with a significant difference between males and females. From the age of 3–6 years, there is a real increase in size of the postnasal space soft tissues, as shown radiographically, and there is a commensurate reduction in the postnasal space airway which is narrowest at about the age of 5–6 years. Thereafter, as the nasopharynx increases in size, postnasal space soft tissues remain relatively constant and the airway increases.

In the United Kingdom a survey by Hibbert (1977) showed that adenoidectomy is still recommended by the majority of otolaryngologists for the treatment of recurrent suppurative middle ear disease. Although the number of combined tonsillectomy and adenoidectomy procedures performed in children has decreased in recent years, the reduction has been less marked for adenoidectomy alone (Black 1984). The recognition that middle ear effusions develop primarily as a result of Eustachian tube malfunction or obstruction has led to the recommendation that children with chronic otitis media with effusion (OME) be treated by adenoidectomy. Sataloff & Menduke (1958) and later McKee (1963) provided some evidence of a limited efficacy of adenoidectomy in cases with otitis media. However, Mawson & Brennand (1969) and Dawes (1970) showed that middle ear effusions were still present in 60% of cases where the adenoids either had previously been removed or were not found clinically to be present. In some centres tonsillectomy, in addition to adenoidectomy, has been recommended for the treatment of middle ear effusions, probably on grounds which on their own merit would not constitute a usual indication for removal of the tonsils alone. In those instances where the adenoids are thought or seen to be small and nonobstructive, their role as a focus of ascending Eustachian tube infection is postulated to support adenoidectomy, and frequently tonsillectomy is advised for similar reasons. However, further data suggests that this is an unlikely explanation (Maw & Speller 1985). Notwithstanding these uncertainties,

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Black (1984) has demonstrated a significant increase in the number of childhood admissions to hospital for treatment of OME in the United Kingdom.

This paper updates a previous report (Maw 1983*a*) in which it was shown that adenoidectomy alone produced resolution of chronic OME in children even one year following surgery. No additional benefit with respect to clearance of the effusion was seen to derive from the addition of tonsillectomy. Even in the severe chronic cases studied, spontaneous improvement continues to occur in 19–27% during the same period of time which could not be related to any treatment. The present report confirms the initial study and shows that adenoidectomy resolves 31–45% of cases assessed for up to 12 months after operation. The study was designed to demonstrate whether the size of the adenoids or the age of the child are significant factors in relation to the beneficial effects of adenoidectomy for OME.

Materials and methods

A description of the methods has previously been reported (Maw 1983*a*,*b*). The present study includes 155 children aged between 2 and 9 years with bilateral OME. The mean age was 5.25 years. They were assessed on three occasions at 6-weekly intervals by a validated otoscopist with known specificity of 75% and sensitivity of 90% (Maw 1979). All of the children were referred because of significant hearing difficulty. The duration of suspected hearing loss was elicited from the parents as part of an administered questionnaire. At each of the three preoperative assessments, in addition to pneumatic otoscopy, impedance studies were performed using a Grayson Stadler 1722 Middle Ear Analyser. Age permitting, pure-tone audiometry was also performed using a Peters AP62 Audiometer.

The four criteria for inclusion in the study were (1) significant subjective hearing loss; (2) the presence of bilateral middle ear effusions confirmed by pneumatic otoscopy and observed for a minimum period of three months; (3) a flat type B or type C impedance curve with negative middle ear pressures of greater than −100 mm of water (in no case was a type A curve present); (4) significant audiometric hearing loss. The average hearing loss on the three preoperative visits in each ear for the frequency range 250 Hz to 8 kHz in each treatment group was greater than 30 dB. Preoperatively a lateral cephalometric radiograph of the nasopharynx was taken. Surgery was performed by the investigator in all but 3 cases.

Patients were allocated on a random basis to one of three treatment groups: adenotonsillectomy (53 cases); adenoidectomy (50 cases); 'No surgery' (52 cases). In the two groups in which the adenoids were removed a curettage technique was used. The adenoid tissue was dried on a gauze swab and then measured volumetrically in a 10 ml syringe. The volume of adenoid tissue removed ranged from 1.5 to 8 ml. In addition, all cases had a unilateral myringotomy performed on a random basis. The effusion was aspirated and assessed for type and quantity. A Shepard Xomed grommet was inserted anteroinferiorly. The contralateral unoperated ear was examined using 6 times magnification to confirm the presence of an effusion clinically, but myringotomy was not performed. At subsequent follow-up appointments 6 weeks, 3 months, 6 months, 9 months and one year postoperatively, the unoperated ear was assessed otoscopically by the investigator and the presence or absence of an effusion was noted. Assessment was made without prior examination of the pharynx or case notes. In this way an 'improvement rate' was calculated based on the presence or absence of fluid in the unoperated ear.

Measurements were taken from the lateral cephalometric radiographs of the minimum distance between the superior aspect of the soft palate and the convex surface of the adenoid. Further measurement of the 'depth' of the adenoid was taken from that point extended superiorly to the bony extremity of the nasopharynx. Radiographs were available in 148 cases in which the adenoid size was measured. It was only possible to measure the airway size in 145 cases. The radiographs were divided into 3 groups with regard to adenoid size: small (0.7–1.2 cm; $n=37$), medium (1.3–1.5 cm; $n=69$), and large (1.6–2.0 cm; $n=42$). A similar division of the airway size into 3 groups was made: small (0–2.5 mm; $n=40$), medium (3.0–5.5 mm; $n=71$), and large (6.0–10.0 mm; $n=34$).

The three surgical groups were identical with respect to age, sex, type of effusion and duration of history of hearing loss. They were also identical with regard to the season of the

year in which the operation was performed. There was no difference radiologically in the size of the adenoid or the postnasal airway in any of the groups. Where the adenoids were removed, the volume measured was identical in the two treatment groups (Maw 1983*a,b*).

Results

Duration of history of hearing loss: The mean duration was the same in the three groups: adenotonsillectomy 19.0 months, adenoidectomy 19.2 months, no surgery 21.6 months. There was an overall range of 1–69 months.

Clearance of the effusion following surgery: As previously described (Maw 1983*a,b*), an interpolated assessment of the presence or absence of fluid in the unoperated ear was made at each follow-up time 6 weeks, 3 months, 6 months, 9 months and one year after operation. This was based on the middle ear findings at the next appointment. Chi-squared analysis has shown no difference between the observed findings at the precise follow-up time and the interpolated findings. Therefore the larger numbers of the interpolated data are used for analysis. The improvement rate represents percentage of unoperated ears in which fluid was no longer present, as judged by pneumatic otoscopy.

The improvement rate following adenoidectomy increased from 42% at 6 weeks through 52% at 3 months, 60% at 6 months, 56% at 9 months to 72% at one year. After adenotonsillectomy the improvement rate increased from 58% at 6 weeks, to 53% at 3 months, 62% at 6 months and 9 months and 58% at one year. In the group that did not receive surgery to either the tonsils nor adenoids, the improvement rate in the unoperated ear increased from 19% at 6 weeks to 27% at 3 months, 25% at 6 and 9 months and 27% at one year. Chi-squared analysis shows that compared with the 'no surgery' group, the effect of adenotonsillectomy was significant at 3 months ($P<0.05$), at 12 months ($P<0.01$), at 6 weeks, 6 months and 9 months ($P<0.001$). Similarly, comparison of adenoidectomy alone with the 'no surgery' group shows significant improvement at 6 weeks and 3 months ($P<0.05$), at 6 and 9 months ($P<0.01$) and at one year ($P<0.001$). At none of the follow up times was any significant difference demonstrated between the group treated by adenotonsillectomy and the group treated by adenoidectomy alone.

The mean duration of history of subjective hearing loss, in those cases where fluid had resolved in the unoperated ear at one year, was 1.82 years (s.d. 1.31) whereas the duration was 1.41 years (s.d. 1.11) in those cases where fluid was still present in the unoperated ear ($P<0.05$). Comparison of the operation groups and the improvement rate at one year for children with a short history of 12 months or less shows that in both surgical groups and the 'no surgery' group there was a significant bias in favour of clearance of the effusion in older rather than younger children. This was highly significant in the combined adenotonsillectomy and adenoidectomy groups ($P<0.001$) and significant in the 'no surgery' group ($P<0.05$). A similar trend was demonstrable when comparing the operation group and improvement rate at one year in children with a long history of more than 12 months. However, the numbers in some of the cells were too small for analysis and did not reach statistical significance.

Lateral cephalometric radiographs: There was a statistically significant difference between the small, medium and large groups with respect to radiographic adenoid size and airway size ($P<0.001$). There was also a significant difference between the surgical groups with respect to adenoid volume.

Comparison of the improvement rates at each follow-up time for small, medium and large radiographic subgroups of adenoid size and airway size showed that within the first three months following operation there was a significant bias in favour of removal of larger adenoids. At 6 weeks there was a significant benefit when comparing large against small ($P<0.01$) and medium against small adenoids radiographically ($P<0.05$). At 3 months there was still a similar bias in favour of removal of large against small ($P<0.01$) and large against medium adenoids ($P<0.05$). Thereafter, although there was a trend favouring removal of large rather than small adenoids, it was not statistically significant. Conversely,

there was a significant bias in favour of small airways compared with medium airways at 6 weeks and small against large airways at 3 months ($P<0.05$). After three months there was still bias in favour of increased improvement rate for small against large airways but it was not statistically significant.

Age effect: In each of the three treatment groups the improvement rate was assessed for children aged less and more than 6 years of age. In the adenotonsillectomy group there was a significant bias in favour of older children at 3, 6 and 9 months following operation ($P<0.01$). In the adenoidectomy group there was a significant bias in favour of the older group but only 12 months following operation ($P<0.01$), and in the 'no surgery' group there was again bias in favour of older children but only 3 months after operation. However, at each follow-up time in all three groups the improvement rate was better for older than for younger children. Comparison of the mean age at one year in the two surgical groups shows that in cases where fluid was absent from the unoperated ear the children were aged on average 5.27 years (s.d. 1.47) whereas in those children where fluid was still present in the unoperated ear, the mean age was 4.31 years (s.d. 1.19) ($P<0.001$).

Discussion

This further report of an on-going study confirms the finding that adenoidectomy will resolve chronic OME in 31–45% of cases judged by pneumatic otoscopy. The addition of tonsillectomy is found to confer no extra benefit. The beneficial effect of adenoidectomy in the treatment of middle ear disorders in children has been thought to acrue from the removal of large obstructive adenoids which reduce the postnasal airway and interfere with Eustachian tube function. The present study confirms that the size of the adenoids has a significant effect, at least within the first 3 months following operation. Thereafter, although there is a bias in favour of the large adenoid and small airway group, it is not statistically significant and the effect has diminished markedly by 12 months postoperatively.

It would appear that the age of the child might be of more significance in relation to clearance of middle ear effusion postoperatively. There is a beneficial effect in children aged over 6 compared with those under 6 years of age from adenotonsillectomy when assessed at 3, 6 and 9 months, and from adenoidectomy at 12 months after surgery. However, in those not having surgery, there is still a better rate of clearance of fluid from the unoperated ear in older compared with younger children. This is only significant 3 months following anaesthesia for insertion of a contralateral grommet. In all groups at all follow-up times there is a bias in favour of children more than 6 compared with those less than 6 years of age.

The length of history of subjective hearing loss prior to the 3 months preoperative observation period is on average 19 to 21 months. Resolution of the effusion at one year is seen to be more likely in those children with longer histories in excess of 12 months, compared with shorter histories, irrespective of their type of operation. However it seems probable that this is likely to be an age effect, for clearance of the fluid in both the surgical and non-surgical groups is seen to occur in older rather than younger children.

The present data confirm that adenoidectomy will resolve OME for up to one year after operation. It further shows that, without any treatment, even in this severe chronic group, spontaneous resolution continues to take place with the passage of time. It further shows that the younger the child is at operation, the less likely will clearance of the effusion be at any follow-up time up to twelve months postoperatively. Finally it indicates that children less than 6 years of age may be expected to respond less well to adenoidectomy than children more than 6 years of age. More detailed analysis is required to show more precisely in which children adenoidectomy should be recommended for the management of chronic OME.

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