Otitis media with effusion: is medical management an option?

PETER BURKE

SUMMARY. Persistent middle ear effusion is a common cause of hearing impairment and remains underdiagnosed, particularly among younger children. Detection can be improved by adequate follow-up of otitis media. Decisions on management need to take into account the child's age, duration and severity of illness, degree of hearing impairment, and any evidence of learning difficulties. There is no definitive cure but both medical and surgical treatments may improve outcome. With increasing evidence that antihistamine-decongestant mixtures are ineffective, there may in the future be a role for antibiotics and steroids.

Introduction

A S long ago as 1655 Riverius observed that 'a deafness increasing and decreasing by degrees, is curable, for it signifieth that it comes from moving humour, which sometimes is more, sometimes less, in quantity.' Today this description of the child with persisting conductive deafness owing to fluid in the middle ear sounds all too familiar. We now have numerous labels, often treated as interchangeable, for the condition in question: catarrhal deafness; (chronic) secretory (not to be confused with suppurative) otitis media; non-suppurative, exudative, catarrhal, mucinous or seromucinous otitis media; persistent middle ear effusion; chronic otitis media with effusion and glue ear. Though the latter term implies the presence of thick, tenacious fluid, the nature of the fluid can often be determined only at surgery, and therefore in practice the term has been used more loosely. The term 'otitis media with effusion' is now preferred by otologists, but in this article I will refer to 'glue ear' for the sake of brevity.

Several epidemiological studies highlight the commonness of the condition. A Danish study1 of healthy seven year old children found a point prevalence of middle ear effusion of 3–9%, but 26% of children experienced an effusion at least once over the course of a year. A study of 1100 school children in Worcestershire2 yielded a point prevalence of probable effusion of 12%, though this was persistent over two months in only 1.4% of cases.

The condition is more frequently present — and more frequently missed — in the younger age groups.1 Another Scandinavian study3 found the point prevalence of middle ear effusion at the age of three years to be 20%, with 6% of the total showing persistent effusions over a six month period. Similarly, Reves and colleagues4 found effusions in 31% of a group of London children aged three months to six years, and these were bilateral in over half of cases. Even the third national morbidity survey,5 which includes only those patients in whom the diagnosis has been made by a general practitioner, reports episode rates as high as 100.7 per 1000 in the 0–4 years age group.

The importance of glue ear lies in its impact on hearing and indirectly on learning. Because of the large number of possible confounding variables, it is notoriously difficult to establish that glue ear leads to delay in intellectual development.8 A recent study by Wallace and colleagues9 claimed a measurable impact on expressive language development in children as young as one year. Similarly, Teele and colleagues,10 in a prospective study of 205 children, showed a convincing inverse relationship between time spent with middle ear effusion and speech and language development at age three years. Hall and Hill11 discuss the factors which might account for such observations. Other authors have found it difficult to establish a causal relationship.12–18 Despite the relative lack of conclusive evidence, many would argue that the child's education should not be placed at risk by leaving the condition untreated.

Aetiology

Speculation on the aetiology of glue ear, as Black19 has pointed out, has followed the fashions of medicine. At a strictly structural level the 'ex-vacuo' mechanism is now widely accepted.20 Alterations occur in the mucociliary system in the middle ear cleft, with dysfunction of the eustachian tube. This leads to inadequate ventilation of the middle ear, resorption of air, tissue hypoxaemia and hypercapnia, and metaplasia of the cupoidal epithelium lining the middle ear. Columnar epithelium and goblet cells result. There follows secretion of fluid, either sterile or infected, ultimately leading to retraction of the tympanic membrane, impaired mobility of the ossicles, and, in a few unlucky patients, the formation of an inspissated mass of growing squamous epithelium, or cholesteatoma, with bony erosion and its sequelae.

Infection

The role of infection is still the subject of debate. Several studies have established that bacteria can be isolated from a substantial proportion of chronic middle ear effusions. However a chicken-and-egg situation applies to infection and effusion. While some effusions follow directly on an attack of acute otitis media, this by no means applies to all. Conversely, the incidence of acute otitis media is higher among children with established effusions. Acute and chronic otitis media merge imperceptibly. Bluestone21 suggests a cut-off point of three months, beyond which effusion may be called chronic. This seems to occur following some 10% of episodes of acute otitis media.22

Lim and colleagues23 identified bacteria in 45% of a series of 182 effusions, the commonest organism being Haemophilus influenzae. These findings were consistent with those of Rohn and colleagues,24 who found H. influenzae to be proportionately more prevalent in chronic than in acute otitis media, where Streptococcus pneumoniae predominates. Sorensen and colleagues25 found an excess of H. influenzae and Strep. pneumoniae in the nasopharyngeal secretions of currently and previously affected children. The increasing importance as a pathogen of Branhamella (previously called Neisseria) catarrhalis as a pathogen is coming to be recognized.24,26 Interestingly, the Chapel Hill group27 showed acute effusions to be more closely associated with viral than with bacterial infections. Adenovirus, respiratory syncytial virus and influenza virus were most commonly implicated.
Allergy

An association between glue ear and allergy has also been repeatedly shown, but the mechanism for this is not fully understood. Several hypotheses exist. One is that eustachian tube dysfunction is initiated in certain patients by mucosal swelling analogous to that which occurs in the bronchi in asthma. However, studies looking for confirmation of IgE-mediated reactions in the middle ear have given highly variable results.

In common with other 'atopic' conditions, glue ear appears to occur more frequently in children bottle-fed from birth than in those who have been breast-fed. However, it has been suggested that this fact is at least partly attributable to the habit of administering the bottle in the recumbent position. As yet, there is no evidence to implicate food allergy in the aetiology of the condition.

Structure

In certain individuals, structural factors are important. Therefore, for example, glue ear almost invariably occurs in the presence of unrepaired cleft palate and is common even after repair. Likewise it is common in children with Down's syndrome, possibly because of muscular hypotonia. Occasionally the underlying cause of a persistent unilateral effusion turns out to be malignancy in the postnasal space. Such an effusion in an adult always warrants full investigation for this reason.

Diagnosis

The clinical presentation of glue ear is often undramatic. The affected child may or may not have had recent symptomatic acute otitis media. Older children may report discomfort, fullness, 'popping' or 'crackling' of the ear(s). Occasionally tinnitus or vertigo are present. However, most important feature is hearing loss. This may be reported by the child, but in many cases is not — particularly if the problem is unilateral and is therefore apparent only, for example, on using the telephone. In many cases the complaint comes from the parents, who are constantly obliged to repeat themselves or to turn down the television. Maternal suspicions must be treated as valid until proven otherwise. Diagnosis may be delayed because the hearing loss is variable in intensity and is never profound (average loss is 27 decibels). The observation by parents that 'he can hear when he wants to' is a common pitfall. Equally, one should beware the child who is labelled 'uninterested' because he or she has simply stopped listening.

Because of these difficulties, screening for hearing loss in the preschool age group is one of the more worthwhile aspects of paediatric surveillance.

Examination may show an amber or purplish discoloration of the eardrum, with apparent thickening and/or injection, usually opacity, and possibly loss of landmarks. There may be retraction, which can manifest itself as rotation of the malleus and increased prominence of the short process. Bubbles or a fluid level may be visible. Demonstration of impaired drum mobility using pneumatic otoscopy is much more reliable than simple inspection. Reves and colleagues found that non-specialists could achieve a diagnostic sensitivity of 76% with pneumatic otoscopy, compared with 55% on inspection alone, with very little loss of specificity. Clinical suspicion of hearing loss may be reinforced by tuning fork tests or audiometry. In younger children the use of modified tests such as the McCormick toy test is necessary. If available, is a valuable and sensitive indicator of impaired drum compliance, eustachian dysfunction or middle ear fluid, but gives no information about the extent to which these abnormalities are impairing hearing or social function.

Prevention

Treatment of acute otitis media

Arguably general practitioners have a role in preventing persistent middle ear effusion, for example by appropriate treatment of acute otitis media. This begs the question of what is 'appropriate treatment'. While it is sometimes asserted that a course of antibiotics helps to prevent glue ear, there is little evidence in support of this. Indeed since the very earliest days of antimicrobial chemotherapy there have been those who have advocated the contrary. Initially these authorities predicted that use of antibiotics would lead to an epidemic of glue ear, and some continue to recommend a policy of watchful inactivity. There is some evidence that certain antibiotics are associated more frequently with glue ear than others; in particular Mills has implicated penicillin V and cephalaxin. In practice, however, glue ear has been observed with equal frequency in Holland, where antibiotics are rarely used, and in the UK, where they are the norm.

Follow up of acute otitis media

Perhaps the single point on which there is greatest agreement is the importance of following up children with acute otitis media in order to identify the minority in whom resolution is delayed (for example, beyond three months).

Pneumococcal vaccine

Several studies have shown short-term benefit from pneumococcal vaccine in the prevention of recurrent acute otitis media caused by certain serotypes of pneumococci provided that the vaccine was given in the first year of life. The benefit may be greater among black than among white children. Since measurable benefit declines with time, being very little after six months, this intervention is not likely to become part of the general practitioner's routine immunization package. The use of pneumococcal vaccine is still valid for other indications in high-risk individuals.

Advice

Prevention of glue ear also includes advice about avoidable risk factors. As mentioned earlier, these are likely to include artificial feeding, particularly in the recumbent position. More recent literature suggests that other aspects of lifestyle may be equally important. An example is smoking by the parents, or at least by the mother. Kraemer and colleagues found an almost threefold excess of glue ear among children exposed to three or more cigarette smokers, though it must be admitted that this often-quoted finding is based on small numbers of children. Subsequently Hinton and Buckley, in a case-control study, showed a similar trend for the children of smokers to be affected. They suggested several possible mechanisms: an irritant effect on the middle ear, eustachian tube or adenoidal tissue; more frequent respiratory infections because of passive smoking; or increased transmission of respiratory pathogens from parents who smoke. Social class differences alone do not seem to explain the finding. A recent study by Strachan and colleagues offers even more convincing support for the influence of smoking.

Management

In most children chronic otitis media with effusion is benign and transient. The tragedy is that in the few years during which they are affected children are exposed to, and unable to take advantage of, many thousands of once-only learning opportunities. Besides the prevention of mastoid disease, then, the main
objective of treatment is curtailing the period of hearing loss.

Given the finding of a middle ear effusion following acute otitis media, there is an argument for 'tincture of time'. Three months after an acute episode of otitis media, the majority of children will be effusion-free, with figures ranging from 65% (personal observation) to 95%.\(^3\) It is only in the remainder that the term 'chronic otitis media with effusion' applies.

Decisions about management need to be based on information at three levels:
1. Is significant pathology present? Simple inspection of the eardrum is not a highly sensitive technique for the identification of effusions. While pneumatic otoscopy is helpful, there is a case for increasing access to tympanometry both as a screening and a diagnostic instrument.
2. What is the child's level of disability (hearing loss)? Here parental history and testing (by audiometry or with Royal National Institute for the Deaf cards or toys) are of some value, provided that the findings are appraised critically. As a rough guide, proven hearing loss of 25 decibels at three or more frequencies in the better ear is likely to warrant treatment.\(^3\)\(^4\)
3. What degree of handicap is attributable to this disability? Handicap represents learning delay and social dysfunction, and varies widely between children with comparable disability because the degree of handicap is heavily dependent on coping skills, compensatory factors and parental input.

Factors which will influence the decision whether to treat include the level of parental concern, the age of the child (younger children perhaps benefiting more from prompt treatment), and the time of year. Because middle ear effusions are less prevalent in summer, those identified during the winter months have a higher probability of resolving spontaneously.\(^3\)\(^5\) On the other hand, effusions still present after three months without recurrence of otitis media, particularly in the summer, are unlikely to show early spontaneous resolution.\(^3\)\(^5\) In the light of this, treatment should probably be considered for this group of children.\(^3\)\(^6\)

**Surgery**

To many doctors glue ear is perhaps unfortunately seen as a 'surgical disease'. There is reasonably convincing evidence that, for carefully selected children with substantial objective deafness, surgery in the form of myringotomy and, in particular, insertion of grommets (tympanostomy tubes), produces short-term improvement in hearing.\(^3\)\(^7\) However, this may be sustained for less than six months.\(^3\)\(^8\) The mechanism seems to be primarily improved ventilation rather than drainage. The addition of adenoidectomy appears to have a sparing effect on future ear surgery, while tonsillectomy, formerly a conspicuous part of treatment, is of no demonstrable value.\(^3\)\(^7\) Evidence is lacking that surgery prevents cholesteatoma, although on intuitive grounds this is to be expected.

The trend towards increasingly frequent insertion of grommets has been criticized by Black\(^3\)\(^9\) as a fashionable trend in surgery, with wide regional variations which depend on the views of individual surgeons. Furthermore, as Black points out, the probability of having surgery for glue ear is twice as high among children from social class 1 than among those from social class 5, in contrast to the condition itself, which appears to affect all social groups equally. Surgery is not without its costs: in a minority of children it leads to irreversible tympanic scarring\(^1\)\(^6\) and in some to mild degrees of permanent hearing loss.\(^3\)\(^8\) For this reason, it has occasionally been proposed\(^3\)\(^0\) that grommet insertion should be a unilateral procedure.

In the NHS, increasing waiting lists in ear, nose and throat departments are a major source of concern. Several months may pass between assessment and surgery, and a percentage of effusions will have cleared in the interim, resulting in 'dry taps'. Dry taps reflect the unpredictability of the condition rather than the inappropriateness of selection. This underlines the potential value of general practitioners keeping children under review while they are on the waiting list for surgery.

Repeat grommet insertion is required in between one-third and two-thirds of children — more commonly following operations performed in July to October and on children aged four to six years.\(^6\)\(^2\)

The morbidity and economic costs of surgery raise the question of whether alternative strategies should be considered.

**Medical management**

An ideal medical intervention would be capable of taking the place of surgery. Failing this, treatment should at least offer the hope of alleviating symptoms while the child is waiting for surgery. Currently the options include antihistamine–decongestant mixtures, mucolytics, steroids (nasal or systemic), antibiotics, and various kinds of eustachian tube manipulation (Valsalva and Politzer manoeuvres). In the future we may see a role for such drugs as sodium cromoglycate.

**Antihistamines and decongestants**

Antihistamine–decongestant mixtures have long been prescribed routinely for glue ear. The theoretical basis is that antihistamines should help reduce the postulated histamine-related allergic element, while decongestants should cause mucosal shrinkage and improve the patency of the eustachian tube. Oral decongestants have a measurable effect on manometrically-assessed eustachian tube function, and they may reduce ear pain during air travel. However, several studies have failed to demonstrate any practical impact of these drugs, either in glue ear\(^4\)\(^3\)\(^6\)\(^4\) or in acute otitis media.\(^6\)\(^5\) In recognition of their questionable value many such preparations have been taken off the list of drugs which can be prescribed on the NHS, although for those reluctant to abandon them, brompheniramine/pseudoephedrine liquid (Dimotane Plus, Robins) has for the present been restored. Many general practitioners probably still use this treatment pragmatically, on the grounds that if they do not, the local otolaryngologist will — if only on a 'trial' basis — thereby delaying surgery.

**Mucolytics**

Mucolytics — for example carbocisteine (Mucodyne, Berk) and bromhexine hydrochloride (Bisolvon, Boehringer) — have enjoyed favour. It is possible that in some children the eustachian tube is obstructed by excessively viscous mucus, and that these drugs will have a dispersing action comparable to that in chronic lung disease. One study by Taylor and Dereshaw\(^6\)\(^6\) offers tantalizing support to carbocisteine: after one month of treatment, 16 of 46 treated ears were better, as against three of 46 on placebo. However, this trial may be criticized for its analysis of the data, with confusion between numbers of ears and numbers of children — a relatively common problem in ear research. Ramsden and colleagues\(^6\)\(^7\) failed to confirm these findings in a three-month follow-up study. Roydhouse,\(^6\)\(^8\) studying 113 children on antihistamine and decongestant treatment, found that the addition of bromhexine conferred substantial benefit (successful outcome in 49% versus 21% of ears at two months). Elock and Lord,\(^6\)\(^9\) on the other hand, had negative results with this agent.

**Antibiotics**

Though there remains uncertainty about the role of continuing infection in glue ear, there are good reasons for supposing that
antibiotic treatment is of value. In this regard chronic secretory otitis media contrasts with acute otitis media, in which the role of antibiotics is being increasingly questioned.40,70,71

One antibiotic to be studied systematically in glue ear is cotrimoxazole. Sixty four per cent of 25 children randomized to this drug by Mills and colleagues72 showed improvement at six weeks, compared with 27% of 26 children treated with brompheniramine/phenylephrine/phenylpropanolamine (Dimotapp, Robins). However, at one year follow-up73 this advantage had largely disappeared (28% of antibiotic treated children remained satisfactory, versus 18% of controls). Even more dramatically, in a non-blind study of 200 children74 resolution had occurred in 58% of ears on antibiotics at four weeks, compared with 6% on no treatment.

The most impressive study of antibiotics in glue ear is that of Mandel and colleagues.75 In a randomized, double-blind study they gave 158 children amoxicillin 40 g per kg per day for two weeks, together with decongestant/antihistamine for four weeks. Thirty one per cent of children were effusion-free, compared with 28% of 160 patients given the antibiotic alone and with 14% of 156 given placebo alone (there was no decongestant/antihistamine only group). There was no evidence of an excess of relapses among antibiotic-treated patients during the limited follow-up period of three months. Though this study can be criticized76 it provides compelling evidence of short-term benefit from vigorous antibiotic treatment.

**Steroids**

As there is epidemiological evidence of an allergic component in the aetiology of glue ear, steroids are another possible treatment option. There is no doubt that both topical and systemic steroids reduce mucosal oedema in the bronchi, and one can speculate on a similar action in the eustachian tube.29 In addition it has been suggested that they may enhance tubal surfactant production and decrease the viscosity of middle ear fluid. Shapiro and colleagues77 and Rees and colleagues78 have shown short-term benefit (over two weeks) from both topical flunisolide and dexamethasone. The principal drawback of topical steroids is the inaccessibility of the eustachian tube. If topical steroids are to have any value, they must be brought into contact with the eustachian tube ostium and kept there by repeated scrupulous technique. It is doubtful whether this can be done effectively by a large proportion of children in the community.

Systemic steroids, on the other hand, have been studied, mainly in conjunction with antibiotics.79-81 Where steroids have been used the dose has usually been about 1 mg per kg per day of prednisone. In Persico and colleagues80 study53 53% of 160 children given 10–14 days treatment with reducing doses of prednisone showed complete resolution of effusion, compared with only 17% of 116 children given ampicillin alone. Schwarz's group,80 in a double-blind trial including 41 children, found that effusion cleared in 15 out of 24 children given cotrimoxazole and a five-day course of prednisone, compared with one of 17 controls given cotrimoxazole alone. In a double-blind crossover study,81 28 patients received either prednisone for seven days and cotrimoxazole for 30 days, or placebo only. Partial or complete resolution of effusion was found one week after therapy in seven of 14 patients in the first group, but in none of 14 in the second. As in asthma, short-term steroids appear to be acceptably safe; Berman and colleagues,82 taking serial measurements of blood cortisol levels, found no evidence of adrenal suppression.

Despite the promising nature of these findings, information about the longer-term outcome of treatment with steroids alone is still insufficient to justify their use on a routine basis in chronic otitis media. In practice, whatever medical treatment is tried, it is vital that the child is kept under review in case of relapse, and is referred for surgery where the outcome of treatment is unsatisfactory.

**Non-drug interventions**

**Eustachian tube manipulation.** The idea of a middle-ear douche using an elastic bag dates back to the time of Politzer in 1863 and the method was used for many years without formal evaluation. A recent study83 suggests that the technique is effective in eliminating atelectasis and retraction pockets, but the ear returns to its previous state within minutes or hours. In the management of a chronic condition, therefore, it has little place.

**Educational input.** The child with deafness secondary to middle ear effusion has special educational needs, and teachers should be aware of the situation. The traditional advice to 'sit at the front of the class' may be inappropriate with today's less formal classrooms than it was 20 years ago.

**Hearing aids.** These have been proposed as a rare alternative to surgery, or where surgery has failed.34 Amplification in conductive deafness gives better results than in sensorineural deafness, but the inconvenience and 'stigma' of hearing aids, as well as the theoretical risk of masking progressive disease, restricts their usefulness.

**Conclusion**

It is becoming increasingly clear that the emphasis in the management of middle ear disease in children must be on identification and management of persistent effusions. Antibiotics will continue to be used in the treatment of acute otitis media, but will perhaps be given more selectively70 and for shorter periods.83,84 In contrast, in the ever-changing fashions in management of established middle ear effusion, the place of antibiotics may be confirmed. Longer and more vigorous courses than have traditionally been given may, however, prove to be necessary. Short sharp courses of systemic steroids may gain in popularity as a second-line treatment, but it remains to be shown that they can provide sustained relief without being given for a sufficient period to risk unacceptable side-effects. For a considerable number of children adenoidectomy and repeated myringotomy will continue to be the unavoidable consequences of persistent middle ear effusion.

**References**


P. Burke

Review article

Journal of the Royal College of General Practitioners, September 1989


Address for correspondence
Dr P. Burke, Aldermoor Health Centre, Aldermoor Close, Southampton SO1 6ST.

THE ROYAL COLLEGE OF GENERAL PRACTITIONERS NORTH AND WEST LONDON FACULTY
presents a

THREE DAY REFRESHER COURSE
to be held at the Royal College of General Practitioners 14 Princes Gate, Hyde Park, London
on 8-10 NOVEMBER, 1989

Each of the three days will be devoted to a separate specialty: Neurology (Professor J. Marshall), Gastroenterology (Dr J. Misiewicz), and The Care of the Elderly.

A management protocol will be prepared for improving the quality of care for some common clinical problems in each specialty.

For further information please apply to:
Mrs Barbara Brunswick
369 Kenton Road, Kenton
Middlesex HA3 OXF
Telephone: 01 907 7572.