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Middle ear effusion and sinusitis

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Introduction

ALTHOUGH middle ear effusion (MEE) is the most common of the chronic conditions encountered in pediatric otology, its treatment is still palliative. The therapy of choice, the insertion of middle ear ventilating tubes, has shown to be an effective treatment since its introduction by Armstrong (1954), but it gives only temporary relief, as long as the tubes remain in the tympanic membrane (Kilby *et al.*, 1972). The question of whether other measures, such as adenoidectomy, antibiotics, anti-allergic drugs or vaccines, are valuable in the treatment or prevention of this disease, is still under discussion.

The lack of unanimity of opinion about the treatment of this disease is due, at least partly, to a lack of understanding of the aetiology and pathogenesis of MEE. Although it seems likely that more than one aetiological factor may apply, the only consistent finding, in most studies on the development of MEE, is Eustachian tube dysfunction (Politzer, 1894; Bluestone *et al.*, 1972; Holmquist and Renvall, 1974). For that reason, studies on the aetiology and pathogenesis of MEE have been focused mainly on the middle ear cavity and the Eustachian tube. In spite of the fact that these structures are part of the upper respiratory airway system, a possible relationship between the occurrence of MEE and of infection in other parts of the upper airway has received only scant attention. In the present investigation, the existence of such a relationship has been studied in a large series of patients.

Methods

This investigation comprises a retrospective study on 1,252 patients, with an age range between 0 and 10 years, treated for either MEE, adenoid enlargement, maxillary sinusitis, or a combination of these diseases, during 1975 and 1976, as well as a prospective study on 307 patients, treated for MEE during 1977.

The patients were divided into four age groups: 0–2, 2–4, 4–6 and 6–10 years old. The following diagnostic criteria were used: middle ear effusion: every form of chronic accumulation of fluid in the middle ear cavity, resulting in a conductive hearing loss. The diagnosis was based on otoscopic examination and, if possible, on pure tone audiometry and acoustic impedance measurements. In doubtful cases a test-myringotomy was performed. Adenoid enlargement was established by examination of the epipharynx and, if necessary, by a lateral radiograph. The diagnosis of maxillary sinusitis was based on the following criteria: a purulent rhinitis

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lasting for more than one month; inspection of the nasal cavity, showing an infected mucosa with a purulent discharge; and radiographs of the paranasal sinuses revealing opacification, fluid levels or mucosal thickening. It has to be noted that, in the retrospective study, in contrast to the prospective study, radiographs of the sinuses were not made routinely in all patients with MEE.

Therapy: in the retrospective group, adenoidectomy had been performed routinely in all patients with MEE and adenoid enlargement. When the middle ear effusion persisted, a myringostomy tube was inserted. If, after adenoidectomy, no improvement was found in those children with a combination of enlarged adenoids, sinusitis and MEE, the sinusitis was treated. This was performed by antral irrigation under general anaesthesia and thereafter antibiotics and decongestants were administered for seven days. If necessary, antral irrigation was repeated up to three times and, in those cases where even after repeated washings the sinusitis failed to heal, the patients were hospitalized and the sinus rinsed daily after the insertion of a polyethylene tube. In the prospective study sinusitis was treated in the same way. In those patients (both in the retrospective and in the prospective study) in whom MEE failed to heal after adequate treatment of the sinusitis and/or adenoidectomy, a myringostomy tube was inserted. This was also done in patients with middle ear effusion alone.

Microscopic study: from thirty patients, randomly selected from the prospective group, samples of the middle ear fluid were fixed in alcohol 70 per cent, dehydrated, embedded in paraffin and sectioned. The sections were stained with hematoxylin or with PAS/alcian blue.

Results

Retrospective study

From the total number of 1,252 patients, between 0 and 10 years, with infective diseases of the upper airway system, 467 (37 per cent) had MEE. The highest frequency of this disease was observed in the age group between 4 and 10 years. Middle ear effusion without any other disease of the upper airway was found in 157 patients. Maxillary sinusitis was observed in 471 patients, of whom 153 had a middle ear effusion. Of 596 patients with adenoid enlargement, 157 showed a middle ear effusion, while 28 patients had a combination of sinusitis, enlarged adenoids and middle ear effusion. The results obtained in this study with various therapeutic modalities are summarized in Fig. 1. It appeared that, in the patients with a combination of adenoid enlargement and MEE, 24 per cent of the cases MEE healed after adenoidectomy. A combination of MEE and sinusitis showed resolution in 82 per cent after treatment of the sinusitis; while in the group of children with a combination of adenoid enlargement, sinusitis and MEE, adenoidectomy alone had no effect on the middle ear effusion. Subsequent lavage of the sinuses resulted in healing of the MEE in 71 per cent of the cases.

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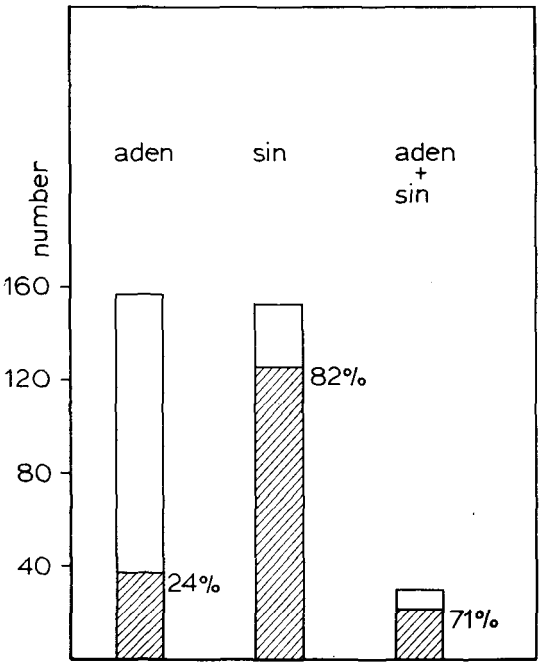


FIG. 1

Diagram of the number of patients from a retrospective study of middle ear effusion (MEE) in combination with enlarged adenoids (left column), with sinusitis (middle column) and with enlarged adenoids and sinusitis (right column). The dashed parts indicate the number of patients in whom MEE healed after adenoidectomy (left), after lavage of infected sinuses (middle), and after adenoidectomy and lavage of infected sinuses (right).

Prospective study

In this study, 307 children were treated for middle ear effusion. In this group, 123 children (40 per cent) had MEE without other diseases of the upper airway system, while 184 (60 per cent) revealed MEE and maxillary sinusitis (Fig. 2). In this group, MEE was cured in 170 patients (92 per cent) after lavage of the infected sinuses without further therapy. In 14 patients (8 per cent) no amelioration was observed after disappearance of the sinusitis and a myringostomy tube was inserted.

Microscopy of the fluid samples

Microscopy of the accumulated fluid in the middle ear cavity of various patients revealed a difference in stainability and cellular content (Fig. 3). Of 14 samples obtained from patients with middle ear effusion alone, ten failed to stain with PAS/alcian blue and contained a moderate amount of cell debris and some intact cells. The clinical data on those ears showed, in all cases, a thin retracted tympanic membrane with a yellow colour. From four other patients with only MEE, two samples

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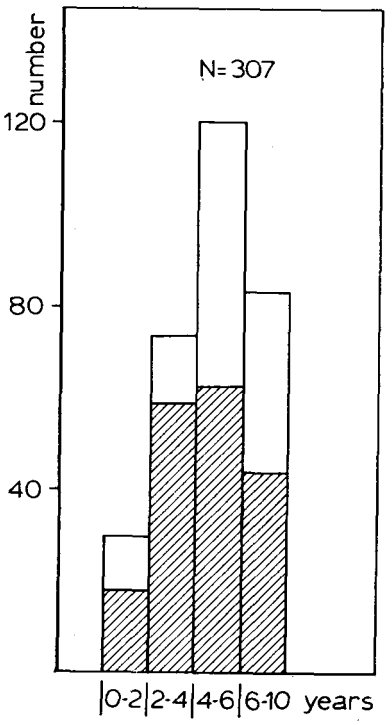


FIG. 2

Age distribution of patients from a prospective study of MEE. The white parts of the columns indicate the number of patients with only MEE, the dashed parts the patients with MEE and maxillary sinusitis.

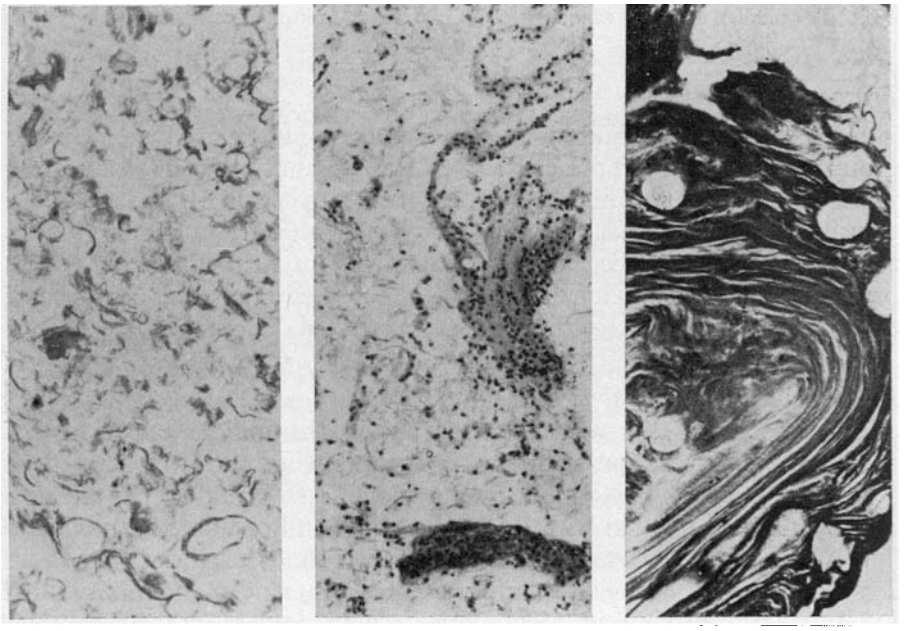


FIG. 3

Micrographs of various types of middle ear effusions: a. Serous type (hematoxylin-eosin); b. Serous type with inflammatory cells (hematoxylin-eosin); c. Mucoid type (PAS/alcian blue).

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stained with PAS/alcian blue and two showed a large number of inflammatory cells, while the tympanic membrane appeared to be white, thickened and hyperaemic. A second group of 16 patients with both MEE and sinusitis showed, in all cases, an effusion with a varying amount of inflammatory cells, which stained, in all but two cases, with PAS/alcian blue. The tympanic membrane was thickened in all cases and sometimes injected.

Discussion

The results obtained from these retrospective and prospective studies demonstrate that two different clinical types of middle ear effusions can be distinguished: an isolated form, and a form in which MEE is found in combination with infective disease of other parts of the upper airway system. The therapeutic results obtained in patients from this latter group clearly demonstrate that, in the group of patients where MEE was present in combination with maxillary sinusitis, lavage of the infected sinuses resulted in healing of the middle ear disease in the majority of the cases. In those patients in whom MEE was found in combination with both sinusitis and adenoid enlargement, a resolution was obtained in 71 per cent after lavage of the sinuses, whereas previous adenoidectomy had had no effect.

From these observations it seems justified to conclude that, in a substantial number of cases, middle ear effusion is part of a general pathological condition of the upper respiratory system and, in particular, is often associated with an infective disease of the maxillary sinuses. Support for this assumption can be derived from the observations made by Nickman (1978). He concluded, from a retrospective study in children, that antral sinusitis could very well play a significant part in persistent otitis media. Moreover, although adenoids are considered to be the commonest cause of tubal dysfunction in children, from the results presented in this study, any major contribution of adenoidectomy to the healing of MEE seems unlikely. This agrees with the observations made by Dawes (1970) and by Mawson *et al.* (1967). Dawes found that, in two-thirds of his patients with otitis media no adenoids were present: while Mawson *et al.*, in comparing a group of children who underwent adeno-tonsillectomy with a control group, failed to find any significant difference in the frequency of otitis in the two groups. However, it cannot be denied that, at least in patients with very large adenoids, the Eustachian tube can be blocked mechanically and in this way can give rise to a middle ear effusion (Bluestone *et al.*, 1972, 1975).

From our microscopical study of the fluid samples obtained from the middle ear, it appears that two main types can be distinguished: a serous type and a mucoid type (positive staining with PAS/alcian blue), both with varying amounts of inflammatory cells.

This variation in the composition of the middle ear effusion fits with the

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observations made by Senturia *et al.* (1958, 1963, 1976). In the present study the serous type appeared to be most frequent in children without infective disease in other parts of the upper airway system. The majority of the mucous (mucoid) samples, however, were found in patients with sinusitis. Because, in this small group of patients, the middle ear effusion appeared to heal only after lavage of the infected sinuses, this observation gives additional evidence for the assumption that, in many cases, MEE is closely related to an infective disease of the maxillary sinuses. The isolated form of MEE can be thought to be due to disease confined to the tubo-tympanic region. However, both types have in common their interference with the function of the Eustachian tube, resulting in an *ex vacuo* accumulation of serous fluid in the middle ear cavity (Holmgren, 1940; Senturia, 1963; Paparella *et al.*, 1970). This fluid can become infected, although the local defence mechanism of the middle ear (Veltri and Sprinkle, 1973) can be assumed to maintain a balance between MEE and purulent otitis. The mucoid form may be supposed to be the result of the chronically infected state of the middle ear mucosa, leading to an increase of mucus-producing cells and gland-like structures (Sadé, 1966; Tos and Bak-Pedersen, 1977; Kuijpers *et al.*, 1979).

Summary

The present investigation comprises a retrospective and a prospective study on children with middle ear effusion (MEE). It is shown that, in the majority of patients, middle ear effusion was found in combination with an infective disease of other parts of the upper respiratory system, especially in the maxillary sinuses. Lavage of the infected sinuses resulted in resolution of the middle ear effusion in about 85 per cent of the cases, while adenoidectomy, in patients in whom adenoid enlargement was found together with middle ear effusion, had only a minor effect.

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