

Incidence of acute otitis media in infants in a general practice

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SUMMARY. A 12-month study of the incidence of acute otitis media in children under three years of age in an urban practice of 10 000 patients showed that acute otitis media accounted for one in 10 of all episodes of illness presented. In contrast to findings in Scandinavia and the USA the incidence of acute otitis media in the first year of life (11.5%) was lower than in the second year (28.6%). The study included a number of children in their third year and the incidence in this group was higher still (30.8%).

The problems of defining acceptable diagnostic criteria for acute otitis media, and the relation of these diagnostic criteria to the differences in our results compared with previous studies are discussed.

Introduction

IN UK general practice otitis media is still regarded as an acute, usually febrile condition associated with earache and/or malaise, and a red ear drum. Although it is one of the commonest diseases in young children, its aetiology and natural history are not fully understood. This is partly due to the problems of diagnosis, particularly in infants, and there is little convincing epidemiological data for this group. Studies reporting the incidence of this condition have been difficult to compare because of differing criteria of diagnosis, differing expressions of occurrence and imprecise definitions of study populations.

Despite these problems, it has been generally agreed that there is a high incidence of acute otitis media among three to six year olds.^{1,2} More recent publications, however, have described a higher risk in younger children. Ingvarsson,³ Paterson and MacLean,⁴ and Pukander⁵ found a peak incidence in the six to 11 months age group, Pukander's study describing an 'annual incidence rate' of 75.5%.

Examination of our practice diagnostic register for a three-year period showed a peak occurrence of acute otitis media in the three to five years age group, with a lower rate for children aged under two years. The discrepancy between these findings and recent literature suggested we might be missing cases in the younger age group, particularly among children in the first year of life. This led to the present study, the aim of which was to establish the incidence of acute otitis media in children under three years of age.

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Method

The study took place in an urban practice with approximately 10 000 patients and five principals. The population of children aged under two years was identified by cross-checking the medical record envelopes and age-sex register with the practice list held by the family practitioner committee. The children's medical record envelopes were filed separately for convenience during the study. Each envelope contained a questionnaire to be completed at every examination by the examining doctor.

Any child in the study group presenting at the surgery, at home or elsewhere with fever and/or an upper respiratory tract infection, or malaise, was examined by the doctor for evidence of acute otitis media and the findings recorded on the questionnaire. All the doctors used a Keeler otoscope with no inflation bag. Provision was made to include children seen out of hours and at weekends. Children presenting to the practice nurses were referred to one of the doctors.

The completed questionnaire identified the child, doctor and date of examination; indicated whether it was the child's first attack of acute otitis media; identified new episodes from review visits; and gave details of the symptomatology, drum appearance and treatment given, if any.

Study population

The study took place over a period of 12 months and the initial study group consisted of all those children on the practice list under the age of two years on the starting date. The year was divided into quarters and by recording the number of children in the relevant age groups joining or leaving the practice, a mid-point population was identified for each quarter, and for the whole year.

Expression of occurrence

The definition of incidence of acute otitis media used here is the number of new episodes per 100 children at risk per annum. The criteria for defining a new episode is given below.

Diagnostic criteria

Before defining the diagnostic criteria for this study, an attempt was made to measure the degree of concordance among the doctors on drum appearance, and on clinical diagnosis. Fifty consecutive children attending the surgery were examined independently by varied pairings of the five doctors, each of whom completed the questionnaire, and the level of agreement between the doctors was assessed. This was done using the kappa statistic,⁶ which may vary from -1 for total disagreement between observers, to +1 for total agreement: a kappa value of zero indicates chance agreement only. The following positive kappa values were obtained for the agreement of observers on drum description: visualization, 0.74; presence of redness, 0.89; degree of redness, 0.70. On clinical diagnosis kappa was 0.49.

It was decided to base our diagnostic criteria of acute otitis media on the presence and degree of redness of the ear drum. The questionnaire gave the doctor the choice of one out of four descriptions for the redness of the drum. These had been previously agreed by the doctors and were: 'normal', 'definitely red', and two intermediate categories, 'peripheral injection' or 'prominent drum vessels'. Those children with a definitely red

ear drum would be given a study diagnosis of 'acute otitis media'. Those with an intermediate drum appearance on their first presentation would be given a study diagnosis of 'suspect otitis media'. The doctors were also asked to indicate their own clinical diagnosis from a choice of 'acute otitis media', 'suspect otitis media', 'serous otitis media', 'upper respiratory tract infection' or 'other'.

All children who had any degree of a red drum were reviewed by one or other of two of the partners. Those children given a diagnosis of acute otitis media were seen two weeks after the first examination. If their drum then appeared normal, the children were discharged from further attendance, and any subsequent episode was regarded as a new one. 'Suspect otitis media' cases were seen 48–72 hours after the first presentation, when changes, if any, in the drum appearance and diagnosis were recorded and subsequent follow-up arranged according to the nature of any change.

Results

A total of 956 examinations were carried out including repeats. The mid-point population was 278 children, a total of 334 children were included in the study population and 248 children were examined. Of the 956 examinations, 530 (55.4%) were of boys and 426 (44.6%) girls. This sex ratio was almost identical to that of the population at the beginning of the study.

The total number of episodes of illness was 577, and 447 of these were associated with normal ear drums. Of the remaining 130 episodes, the initial examination produced 51 diagnoses of acute otitis media and 79 of suspect otitis media, using the study criteria. When the latter group were followed up a further nine cases of acute otitis media were diagnosed, giving a total of 60 episodes in the 12-month period. Of the remaining 70 cases, four were diagnosed as serous otitis media, 48 as having a normal drum and 18 did not attend for follow up. Table 1 shows the age distribution of the children suffering episodes of acute otitis media.

Table 1. Age distribution of patients suffering episodes of acute otitis media with incidence per 100 children in parentheses.

Age (months)	Total number of children	Number of episodes of acute otitis media (incidence)
0–5	59	3 (5.1)
6–11	63	11 (17.5)
12–23	91	26 (28.6)
24–35	65	20 (30.8)
Total	278	60 (21.6)

The symptomatology recorded at presentation (Table 2) confirmed the generally acute nature of the condition. The acute and suspect cases had a significantly higher incidence of ear pulling than the cases given a diagnosis of upper respiratory tract infection ($\chi^2 = 28$, $P < 0.001$).

While the study criteria produced 60 episodes of acute otitis media involving 52 children, the doctors made their own clinical diagnosis of acute otitis media in 71 episodes involving 61 children. The data also showed that in 96 episodes involving 74 children an antibiotic had been prescribed associated with some redness of the drum, the diagnostic criteria for acute otitis media used by Bain.⁷ The age distributions in these three groups were similar.

Table 2. Percentage distribution of symptoms at initial presentation for episodes diagnosed as acute otitis media, suspect otitis media and upper respiratory tract infection.

Symptoms	Percentage distribution of symptoms		
	Acute otitis media (n = 60)	Suspect otitis media (n = 70)	Upper respiratory tract infection (n = 135)
Catarrh	56.7	45.7	48.1
Cough	61.7	62.9	85.2
Crying	53.3	35.7	32.6
Diarrhoea	5.0	5.7	6.7
Discharge from ear	1.7	1.4	0.7
Ear pulling	40.0	38.6	11.1
Earache	10.0	7.1	1.5
Fever	31.7	38.6	23.7
Irritability	41.7	28.6	34.1
Sore throat	3.3	0	7.4
Vomiting	8.3	7.1	10.4
Other	6.7	11.4	19.3

n = number of episodes.

Discussion

This study involved the examination of the ears of virtually every child aged under three years who presented to the doctor in the study year. While the children were self-selected in that they were brought to the doctor or visited on request, it is difficult to believe that many cases were solely treated by parents, whose concern and treatment expectations are high for children in this age group and with this condition.

The incidence rate of acute otitis media in children aged under 12 months in this study was lower than that found in the USA^{8,9} and Scandinavia,^{3,5} and the peak incidence of acute otitis media was found to occur in the third year rather than during the first year of life. What are the reasons for these variations? The terminology may be different. In the USA, for instance, otitis media often includes both acutely presenting illness and routinely discovered middle ear effusion. However, in an article concerned with 'acute suppurative otitis media', Hayden found that the criteria most often cited in the American literature for this diagnosis were a red tympanic membrane plus brief duration of symptoms, while a red drum was the commonest symptom reported to him by physicians in a questionnaire.¹⁰ A large community study in Finland accepted 'distinct redness of the drum and an acute symptom' as one basis for diagnosis.⁵ So it seems that in clinical terms our definition would be recognized in other countries.

Other criteria often quoted for the diagnosis of acute otitis media are bulging of the drum and reduced drum mobility, the latter assessed with a pneumatic otoscope. Redness was preferred clinically in this study because bulging was more difficult to assess in infants. Pneumatic otoscopy is not used in our practice and, as far as we are aware, is not a routine feature of British clinical practice. Despite the respect granted the technique in the USA, fewer than 50% of physicians there use pneumatic otoscopes.¹⁰

Little attention has been given to the repeatability of these clinical signs in incidence studies. In this study drum colour carried the highest concordance between the observing doctors. There have been assessments of interobserver agreement on drum mobility, 75% in the hands of experienced otoscopists; but such reports relate either to children awaiting grommet insertion or to children who are symptom free.¹¹

Purulent fluid from the middle ear on myringotomy is often considered the best indicator of acute middle ear infection. The most frequently quoted source for the view that 'patients with a red tympanic membrane alone do not have acute otitis media',¹¹ is a myringotomy study reported by Halsted and colleagues¹² where 90% of children with a clearly bulging drum and loss of landmarks had culture-positive middle ear effusions. However, two-thirds of the children studied had bulging drums, while the conclusions on redness alone were based on only 15 of the 106 children in the study. Such results have not been reproduced. Another study reported no growth in 50% of effusions behind a bulging drum.¹³

We would agree that a bulging red drum with no landmarks in a symptomatic child is a more specific indicator of underlying pus in the middle ear than redness alone; but we have no evidence that it is a more sensitive criterion for acute middle ear infection in the general population. Since myringotomy studies would be considered unethical in a population study, we cannot rely on bacteriology to supply this evidence. Prospective studies of outcome in relation to clinical criteria and treatment would seem the only pragmatic method to assess the overall validity of the clinical findings.

There have been few reports on the association of impaired drum mobility and underlying bacterial infection. According to Coffey, serous exudates from myringotomy are often sterile, after pneumatic otoscopy has shown reduced mobility.¹⁴ Myringotomy certainly confirms the ability of otoscopy to define reduced drum mobility in children awaiting grommet insertion,¹¹ but this is a different issue to diagnosing acute otitis media, and raises again the original source of confusion, namely terminology. Pneumatic otoscopy, tympanometry and other innovative techniques are proving repeatable and valid as screening procedures for diagnosing middle ear effusion, and are important in the study of glue ear and the sequelae of acute otitis media.¹⁵ We would suggest that they are not relevant to the diagnosis of middle ear infection in acutely presenting children in general practice, which must depend on the appearance of the eardrum.

The distinction between grades of redness are less repeatable than the recognition of its presence or absence, but the natural history of the group with suspect otitis media suggests it is reasonable to exclude cases with intermediate degrees of redness only. However, it is worth noting that at least 11% of this suspect group were considered to have progressed to definite acute otitis media within 48 hours. In clinical terms it may be more important to have a sensitive criterion of diagnosis initially since the general practitioner may be willing to tolerate a certain level of overdiagnosis rather than failing to diagnose mild or early disease. Once again the corollary is that we lack prospective studies of outcome related to clinical presentation and management.

The influence of many other factors on the clinical label attached by the individual doctor and on the decision to use antibiotics is reflected in the different proportions of children falling into the 'clinical' and 'antibiotic' groups compared with the 'red ear' group in this study. However, the age structure of all three groups was similar and these different proportions do not alter our conclusion, namely that the incidence of acute otitis media rises in infants to 30 per 100 children at risk in their third year of life.

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Corrigenda

In the article 'Outcome of women booked into an isolated general practice maternity unit over eight years' by Garrett T, *et al* (November *Journal*, p.488) the first sentence of the results section should have read: 'Between 1978 and 1985 there were 1303 women booked and admitted to the unit: 18.2% were nulliparas and 81.8% were multiparas.'

In the article 'Discrepancies in the availability of open access services: comparison between the Northern and Oxford regions' by Douglass RA and Hungin AS (January *Journal*, p.28) the second half of the method should have read: 'A pilot study was conducted in 1985 and full data collection was done in December 1986, with a further confirmatory questionnaire in February 1987. In situations where conflicting or no replies were received the general practitioners were contacted by telephone, and where disagreement still existed the majority response was accepted.'

Similar questionnaires were sent with explanatory letters to community managers in each health authority. They were also invited to indicate reasons for any non-availability of services.

Some services such as isotope scans were excluded from analysis because of uniform unavailability or major confusion about their availability. The results relating to 22 services were analysed.