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Point prevalence of type B tympanogram in Riyadh

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Abstract

Secretory otitis media (SOM) is primarily a disease of children which can have deleterious effect on their medical, social, educational and psychological welfare. It is well known that SOM is a common disease, but exact figures about its prevalence and incidence are scarce and fragmentary. In this community study, we determined the point prevalence of type B tympanogram as an indication to the prevalance of SOM. The study population consisted of a random sample of 4214 children aged 1-8 years. The point prevalance rates of unilateral and bilateral type B tympanogram among the children were 5 7% and 8.1%, respectively. The point prevalance rate per ears (a total of 8428) was 10.9%. The prevalence was found to be related to the age. the season and to the occurrance of the ear and upper respiratory tract infections. No correlation was found in relation to sex, allergy or the socio-economic condition. The findings are discussed in the light of *studies* conducted elsewhere.

Keywords. Secretory otitis media; Tympanogram; Middle ear *effusion*

1. Introduction

Secretory otitis media (SOM) is a disease in which there is middle ear effusion, the tympanic membrane is intact, and symptoms of acute inflammation are absent [3]. Our scanty knowledge about the epidemiology of SOM is in sharp contrast to

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the large number of children treated for this condition. This deficient epidemiological data limit not merely our insight into the etiological mechanisms of the condition but also the possibilities of early detection and treatment. Such early treatment is highly desirable for the health and educational welfare of the affected children. Those children who have had prolonged SOM have shown depressed scores on intelligence tests, impaired development of speech and language, and poor performance in school [9]. Moreover, evidence indicates that unheeded or neglected middle ear disturbances during preschool age may cause irreversible conductive middle ear malfunction [7].

Most of the published material on the prevalence of SOM comes from epidemiologic studies in Europe [3,6,23], USA [2] and Japan [17]. The need for epidemiology data from other parts of the world cannot be over emphasized. Our study was performed with its primary objective being to determine the prevalence of SOM among 1–8 year old Saudi children living in Riyadh; and also to explore some of the possible predisposing factors for the disease. Point prevalance of type B tympanogram was considered as an indication of the prevalance of the disease.

2. Methods

This study was conducted as a part of a comprehensive survey undertaken to assess the epidemiology and aetiology of hearing impairment among Saudi infants and children. The survey was conducted in Riyadh for a 28-month period from May 1988 to September 1990. The sampling plan was designed to have an adequate and representative coverage of all socio-economic and demographic groups of Saudi population living in Riyadh. This sampling design was essentially a three stages stratified random sampling, using age and sex as stratifying factors in the final stage. The city was divided into 93 administrative areas and these areas were distributed into 6 strata according to socio-economic homogeneity. One fifth of the areas in each stratum were chosen by the sample random method. Each area was further subdivided into roads and the latter were subsequently divided into smaller blocks of approximately equal size, and a sample of each block was randomly selected. Within each block selected, a systemic process whereby a random starting point was chosen and a predetermined zigzag route followed, calling at every other household encountered. There were two survey teams. Each team comprised of an otolaryngologist, a nurse trained in performing tympanometry, a social worker and a field supervisor. The team established whether there were any children in the household and if so, after obtaining consent from the family, completed the relevant questionnaire which included, among other variables, the age, sex, social status (income and education level), ear symptoms, episodes of ear infections diagnosed by a physician, history of frequent upper respiratory tract infections and presence of allergy in the child, parents or grandparents. The parents' social status was divided into 3 groups according to the level of the parents' education and the family income. We defined socio-economic standard above the median as high and below the median as low.

Table 1
Distribution of children according to sex and age

Age (Year)	Male	Female	Total number	Percentage
1–2	460	399	859	20.4
2-3	357	325	682	16.2
3-4	353	310	663	15.7
4-5	328	295	623	14.8
5-6	331	305	642	15.2
6-7	207	177	384	9.1
7-8	191	170	361	8.6
Total (%)	2233 (53)	1981 (47)	4214	100

After taking the history, the otolaryngologist proceeded with examination of the ears using a pneumatic otoscope. Children with a grommet or a perforated drum in any ear were excluded from this study. Tympanometry was performed by the trained nurse using a Madsen 2073 elecrroacoustic impedance bridge with a testing tone of 220 Hz coupled to a Hawlett Pakard XY plotter. The tympanograms were divided in to type A (O-99 mmH_2O pressure), type C, (–100 to -199 mmH_2O), type C_2 (-200 to -350 mmH_2O) and type B (flat curve without an impedence minimum). Children with B type tympanograms were excluded if these were associated with occluding wax and a PVT (physical volume test) of 0.5 ml or less, because such tympanograms could indicate wax. The completed encounter forms were collected and checked for accuracy and entered into a master computerized file.

3. Results

The total number of children examined was 4370 but 156 children were excluded because of perforated drums, ventilation tubes in situ or obstructed external canals. Data were analyzed from 4214 children yielding 8428 ears. The age ranged between

Table 2
Tympanometry findings

Type	Number of ears	Percentage
Type A	5683	67.4
Type B	922	10.9
Type C_1	1169	13.9
Type C_2	654	7.6
Total	8428	99.8

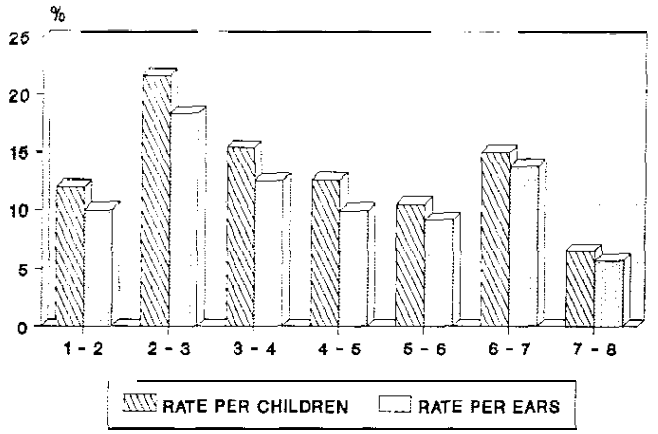

Fig. 1. Distribution of prevalence rates against age (year).

12 months and 8 years. The age and sex distribution of the children is shown in Table 1.

The tympanometry findings of the ears are displayed in Table 2. The point prevalence rate of type B tympanogram was 10.9% as calculated for each ear separately. The overall number of children having a flat tympanogram in one or both ears was 582 (13.8%). The number of bilateral cases was 340 (8.1%) and of the unilateral cases was 242 (5.7%). Fig. 1 shows the distribution of the rates against age. Fig. 2 shows the prevalence/children for each month separately.

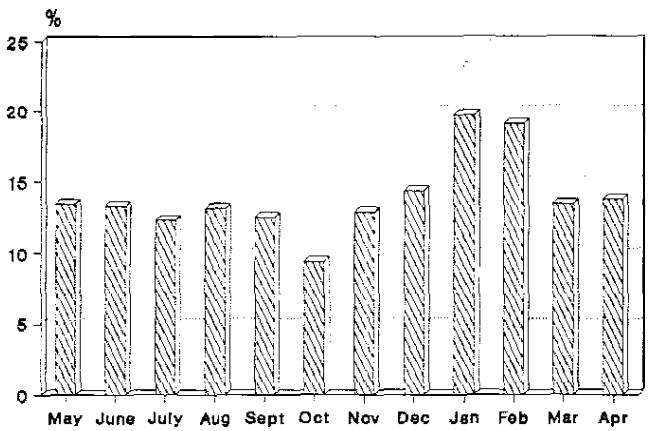

Fig. 2. Prevalence rate per child for each month

The relations between type B tympanogram and the sex, socio-economic status, occurrence of upper respiratory tract, occurrence of earlier otitis media and the history of allergy are shown in Table 3.

4. Discussion

In spite of extensive clinical research and the recent advances in technology, there is probably no such thing as a diagnostic marker that enables perfect identification of middle ear effusion. Nevertheless, some markers are better than others. Clinical examination, even if performed by experienced individuals using a pneumatic otoscope, is a subjective manoeuvre with substantial inter-observer difference and has low sensitivity and low specificity [6,22]. On the other hand, tympanometry is objective and reliable, with a high degree of sensitivity and specificity [4,6,12,22]. Middle ear effusion has been demonstrated by several authors in 85–100% of children with *type* B tympanogram, in 15–50% of ears with type C_2, in 17% of ears with type C_1 and 3% with type A [19,20]. There was generally a sparse amount of middle ear effusion with types C_1 and C_2 and A tympanogram. The prevalence of type B thus may be taken to indicate the prevalence of secretory otitis media [4,12,19,20]. Therefore, in the present study the clinical findings were not considered for identification of the disease and only the prevalence of B type tympanogram has been analyzed.

Table 3
Relation between type B tympanograms and some of the possible aetiological factors

Possible aetiological factor	No. of children (percentage)	No. of B tympanogram children (percentage)	*P*-value
Sex			
Boys	2233 (53)	311 (13.9)	
Girls	1981 (47)	271 (13.6)	0.851
Socio-economic status			
High	514 (12.2)	70 (13.6)	
Median	2865 (68)	398 (13.9)	
Low	835 (19.8)	114 (13.7)	0.97566
Allergy			
Own allergy	635 (15.1)	91 (14.3)	
Allergy in parents or grandparents	887 (21)	123 (13.9)	
No allergy	2692 (63.9)	368 (13.7)	0.90878
Upper respiratory tract infections			
Frequent	1012 (24)	212 (20.9)	
Not frequent	2650 (62.9)	309 (11.7)	
Equivocal	552 (13.1)	61 (11.1)	≤0.05
History of ear infections			
Present	1476 (35)	286 (19.4)	
Absent	1772 (42.1)	171 (9.7)	
Equivocal	966 (22.9)	125 (12.9)	<0.05

In the literature, data for incidence and prevalence of SOM vary according to the methods of detection, observation intervals and prevalence windows, as well as the population characteristics. Also, the results are influenced by the methods of calculating the prevalence rate. Some of the published studies give prevalence rate of SOM expressed in relation to the number of ears [19], while others express it in relation to the number of children [3]. Far the purpose of comparison, Tos et al. estimated that calculations per child are about 20% higher than calculation per ear [19] (in this study it was about 17.9% higher). They recommended calculation per ear instead of per child because the later would weight unilateral cases equally with bilateral cases. Also, they suggested that long term studies of the natural history of the disease can only be performed by observing individual ears over a long period of time.

On the other hand, Fiellan-Nikolajsen suggested that for etiological research, the prevalence rate per children is the most useful because the prevalence rate per ears poses some statistical problems (interdependency for the two ears) [3]. Also in the clinical situation, the important consideration is whether something is the matter with the child. Moreover, it is known than an ear with a counterpart that is affected by the disease has a higher probability of becoming affected than an ear with a healthy counterpart.

Irrespective of the mode of study, most of the published studies showed clearly that age is one of the most important nsk factors for the development of SOM. Fiellan-Nikolajsen studied 404 3-year old children in Denmark by tympanometry and found 17–20% of the subjects (13–16% of ears) had SOM [3]. Also, a points prevalence of 9% for ?-year-old Danish children was reported in a l-year prospective study comprising monthly tympanometry [10].

From Spain, Suarez Nieto et al. recorded a prevalence of 8.7% per child from a population of 5414 aged between 2 and 12 years. The prevalence decreased with increasing age from 38.3% at 2 years to 1.1% at 11 years, fitting a logarithmic regression curve [16].

In Japan, Takasaka studied 14 509 ears in children between the ages of 4 and 8 years and found prevalence of type B and C_2 tympanogram in 8.7% [17]. The highest prevalence was seen in 4-year-old children (19.3%). and it decreased with age to 3.6% in S-year-old subjects. The prevalence rates were calculated per ear and type C_2 tympanogram was considered as evidence of SOM.

In USA, using a decision-tree algorithm which combined the findings of pneumatic otoscopy, tympanometry, and acoustic reflex measurements, Casselbrant et al. studied 103 children (aged from 2-6 years) and found point prevalence ranging from 5% to 35% [2].

In the Netherlands. a study of 1439 2-year-old children using serial tympanometry on 9 consecutive occasions up to 4 years of age showed the overall prevalence was about 33% of children (uni or bilateral), and 25% of the ears [23].

To study the influence of age, Zielhuis et al. reviewed 23 studies giving 56 age-specific prevalence rates. They have taken the figures together and displayed them in a graph which appeared as a sinusoidal curve with two modes around the second and fifth birthdays [22].

The prevalence rates revealed by our study are generally in line with some of the studies [16,17] although they are lower than others [2,3,23]. The best explanation for the discrepancy between our results and those of other authors probably lies in differences in population characteristics or climate. The general trend for improvement with increasing age is probably due to improvement in the functions of the Eustachian tube and the local defense system with advancing age. The deterioration occurring at the age of 5-6 years in some studies (including our study) could be correlated to upper respiratory tract infections.

Most studies demonstrated a higher incidence of SOM in males than in females [11]. The male predilection may reflect the overall male predominance for childhood infections. Tos and Stangerup have reported reduced pneumatization of the mastoid air cell system in children with history of SOM, with the boys having smaller systems and greater degree of pathology than girls [18]. However, in our study there was no significant difference in sex distribution of the disease (Table 3) which is not easy to explain.

The literature gives contradictory reports about the relation between the prevalence of SOM and the socio-economic status of the community. Some researchers found SOM to be most prevalent in areas of poorest social conditions [8,14], while several studies failed to demonstrate such association [15]. In this study the socio-economic status did not affect the prevalence. This is probably because there is no large discrepancy between the living standards of the social classes in this community.

The point prevalences of SOM have been known to show strong seasonal variations with the highest rate occurring in winter [2,5,6,17,19]. Our population was studied over a period of 28 consecutive months: therefore the prevalence rate forms a mean for all seasons. However, the monthly distribution showed a peak prevalence in the months of January and February (Fig. 2). This variation may be partially caused by a parallel seasonal variation in the upper respiratory tract infections and/or acute ear infections.

Our data also showed that the disease is more common in children who had frequent bouts of upper respiratory tract infections and in children in whom ear infection had previously been diagnosed and **treated** by a physician. The role of upper respiratory tract infections in the etiology of SOM is a complex matter and is discussed elsewhere [11,21]. On the other hand it was demonstrated that 30–40% of children with acute otitis media had effusion of the middle ear that persisted for 4 or more weeks [13–21].

In this survey, prevalence of SOM appeared not to be influenced by allergy. In a review paper, Black (1985) found that most of the published researches suggested that allergy was not usually responsible for SOM, although several authors challenged that conclusion [1].

This study is based on a single observation which may limit its value especially regarding the prognosis of SOM. The known high rate of spontaneous recovery and subsequent recurrence of SOM and its seasonal dependency emphasize the necessity of frequent observations in the epidemiologic studies and in the screening programmes. It should also be noted that although impedance measurements are very reliable

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methods in detecting SOM with an accuracy of 97% [3], they cannot distinguish the severity of the disease. More comprehensive epidemiological studies with long observation intervals are needed and a practical productive test for mass screening is required.

In summary, our results show that SOM is a common disease in children. It is age and seasonally dependent and may be frequently preceded by ear or upper respiratory tract infections. It was not found to be related to sex, allergy or the socioeconomic status.

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