

Prevalence of ear diseases in the children of Delhi

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Abstract

Objective: This study aimed to assess the prevalence and profile of ear diseases in children from Delhi, India.

Methods: A population-based cross-sectional door-to-door survey was carried out in two districts of Delhi, and involved children of all demographic sections of the region. A total of 4626 children aged between 18 days and 15 years underwent examinations including otoscopy, impedance audiometry and hearing screening.

Results: In all, 14.8 per cent of the study sample was diagnosed with one or more ear morbidities, the most common being cerumen impaction (7.5 per cent) and chronic suppurative otitis media (3.6 per cent). There was clinical evidence of otitis media with effusion in 2 per cent of children, and 0.96 per cent had otitis externa (bacterial and fungal). The point prevalence of acute suppurative otitis media was 0.39 per cent. In all, 0.45 per cent of children were found to have an undiagnosed foreign body within the ear canal.

Conclusion: The high prevalence of ear disease poses a significant public health problem in Delhi.

Key words: Ear Diseases; Otitis Media; Cerumen

Introduction

The World Health Organization estimates that 32 million children worldwide are affected by disabling hearing loss (i.e. hearing loss greater than 30 dB in the better hearing ear), with many more suffering a lesser degree of hearing loss.^{1,2} Most children with hearing loss live in developing countries.³ Six per cent of the population of India is reported to have hearing loss, suggesting that over 70 million persons in the world's second most populous country have at least a moderate degree of hearing loss.⁴ Ear morbidities associated with hearing loss, such as cerumen impaction and chronic otitis media, frequently occur in children.^{5–8} Otitis media is the leading cause of illness-related medical visits, and every year billions of dollars are spent treating middle-ear diseases.⁹ Chronic suppurative otitis media (CSOM) is one of the commonest infectious diseases of childhood,¹⁰ accounting for 28 000 deaths per year and contributing a burden of 2 million disability-adjusted life years worldwide.¹⁰ The present study investigated the prevalence and profile of common ear diseases among children living in the region of the capital city of India. It aimed to highlight the burden of ear morbidities within different communities to public health experts and planners, both within India and worldwide.

Materials and methods

The study was approved by the institutional ethics committee of Maulana Azad Medical College, New Delhi.

It was carried out from 2010 to 2011 in two districts of the Delhi National Capital Region. A pilot study had found approximately 16 per cent of children to have ear disease. Based on this figure and including a 10 per cent allowable error, the required sample size was estimated to be 2100. This number was doubled to account for the design effect, and 10 per cent was added to allow for possible attrition. Thus, it was proposed to survey 4620 children between the ages of 0 and 15 years to determine the prevalence of ear morbidities in this age group.

Information on the population distribution between and within the two districts was obtained from 2001 Census data.^{11,12} The three forms of habitation within the Delhi region are classified as non-slum urban areas, urban slums and rural areas. The sample population distribution among these habitation types by district and overall is shown (Table I). Within each district, two localities of each type (urban slum, non-slum urban, rural) were randomly selected. Within each locality, houses were allocated numbers and sampling was performed using a random number table. The study was participatory and cross-sectional: door-to-door surveys were performed within the identified areas and informed consent was obtained from the parents of participating children.

The examination protocol was designed in consultation with subject experts and public health specialists. It included taking a history of ear disease or hearing

TABLE I
STUDY PARTICIPANT DISTRIBUTION BY
HABITATION TYPE

Habitation type	North-West District (n (%))	South District (n (%))	Total (n (%))
Rural area	238 (9.2)	166 (8.2)	404 (8.7)
Urban slum area	516 (20.0)	408 (20.0)	924 (20.0)
Non-slum urban area	1824 (70.8)	1468 (71.8)	3292 (71.2)
Total	2578	2042	4620

loss; examining the external ear; performing an otoscopic examination of the ear using a 3.5 V otoscope; performing tuning fork and voice tests, and making behavioural assessments (as applicable) of hearing status (for children older than two years); performing oto-acoustic emission tests (for infants younger than two years); and performing impedance audiometry with a portable tympanometer to assess the middle-ear status. All examinations were performed by persons trained in ear examination and diagnoses were verified by an ENT specialist. Where cerumen or a foreign body was obstructing the ear canal, it was removed by an ENT specialist where appropriate. If it was not possible to remove the cerumen at the first examination, then it was treated with wax softeners and the child was re-examined after its removal.

Diagnostic criteria were established before the start of the study. An attempt was made to remove impacted cerumen from the ear canal only if this seemed practicable and after obtaining parental consent. If the cerumen could not be removed and was obstructing the view of the tympanic membrane, it was recorded as a morbidity. Diagnosis criteria for tubotympanic type CSOM were a history of ear discharge lasting more than two weeks and the presence of a central perforation.¹³ Diagnosis criteria for atticofurrow type CSOM were a history of ear discharge with evidence of cholesteatoma, marginal or attic perforation, or a retraction pocket. The clinical signs of otitis media with effusion were tympanic membrane retraction, reduced tympanic membrane mobility, evidence of

TABLE II
EAR DISEASE DISTRIBUTION IN THE SURVEY
POPULATION*

Morbidity	n (%)	Unilateral	Bilateral
Cerumen impaction	347 (7.5)	110	237
Chronic suppurative otitis media	168 (3.6)	126	42
Otitis media with effusion	93 (2.0)	35	58
Otitis externa	44 (1.0)	16	28
Foreign body in the ear	21 (0.4)	19	2
Acute suppurative otitis media	18 (0.4)	17	1
Others	14 (0.3)	10	4

*n = 4626.

TABLE III
EAR DISEASE PREVALENCE BY AGE

Age group	Total (n)	Ear disease (n (%))
Up to 1 year	381	36 (9.4)
1–5 years	1517	235 (15.5)
6–10 years	1236	183 (14.8)
11–15 years	1492	233 (15.6)
Total	4626	687 (14.8)

$\chi^2 = 9.073$, degrees of freedom = 3, $p = 0.028$

fluid in the middle ear upon otoscopy and a type B tympanogram. Diagnosis criteria for acute otitis externa were signs of acute inflammation of the external canal with or without ear discharge or fungal debris. A diagnosis of acute suppurative otitis media was based on congestion, bulging or an acute discharging perforation of the tympanic membrane, mainly with a history of acute ear pain. A diagnosis of foreign body in the ear was based on the presence of any external object or creature in the ear.

Children with ear morbidities which could be treated at the time of examination were given guidance or a referral slip for further evaluation and treatment at a health facility of their choice, as required. Health facilities had already been identified and links had been developed to facilitate management of the study participants.

Diagnoses were cross-checked periodically for verification and validation purposes. Samples of participants diagnosed with ear morbidities and those considered free of disease were re-examined by the lead researcher (who was not the examining ENT specialist) to verify the diagnoses.

Data from home visits were checked and analysed using IBM SPSS Statistics software version 16.0 (Chicago, Illinois, USA). The frequencies of various ear morbidities were calculated and demographic profiles were produced.

Results

A total of 5034 children aged 0–15 years were included in the study. Of these, 408 could not be fully evaluated and were therefore excluded from the study. Data were obtained from 4626 children aged between 18 days and 15 years, including 2461 boys (53.2 per cent) and 2165 girls (46.8 per cent). Of these, 687 children (14.8 per cent) were diagnosed with one or more ear morbidity. The distribution of morbidities is shown in Table II.

Of the 168 children with CSOM, 143 (3.1 per cent overall) had tubotympanic type and 25 (0.5 per cent overall) had atticofurrow type disease. Hence, 85 per cent of all CSOM was tubotympanic type. A total of 21 children had undiagnosed foreign bodies in the ear canal, including food grains, dead insects, stones and cotton wool balls. Eight children had tympanosclerosis, one had unilateral anopia, one had unilateral microtia and one had bilateral microtia.

There was no significant difference in ear disease prevalence between boys and girls. Ear disease prevalence was also compared among four age groups (shown in Table III) using Pearson's chi-square test. The overall prevalence of ear morbidities was significantly lower in infants aged below one year.

Discussion

The present survey was based in Delhi and aimed to assess the prevalence and types of ear disease found in the children of this region. Delhi comprises nine districts which vary in their demographic profiles and population distribution.¹² Of these, North West and South Delhi were selected because they are the most populous, together containing over 37 per cent of Delhi's population. Moreover, both districts contain urban and rural areas, and urban slums. It was considered essential to obtain data from a representative sample of all three habitation types. Although most of the Indian population is rural, the 2001 Census reported that only about 7 per cent of the population of Delhi resides in rural areas.¹² The sample distribution in Table I was based on figures obtained from the 2001 Census report, which was the most recent available at the time of planning the study (and not the Census 2011 report, which is available now).¹² The National Sample Survey estimated that 20 per cent of the population of Delhi lives in slum dwellings.¹⁴ As no separate data were available for the two districts under consideration, 20 per cent of the study sample was acquired from slum areas.

The study sample had a predominance of boys (53.2 per cent). This is explained by the low female-to-male ratio in the districts of Delhi (865 females per 1000 males in North West Delhi and 885 females per 1000 males in South Delhi).¹⁵

Overall, 14.8 per cent of children had an ear morbidity. Other studies have estimated the prevalence of ear disease in children to range from 3 per cent to over 80 per cent.^{5,16–24} A possible reason for discrepancies with other studies could be that the present study included all age groups and not only school-aged children, as in most other studies. The application of stringent diagnostic criteria may be another factor contributing to the overall lower prevalence rate compared with many other studies.^{5,17–21,24} However, results similar to the estimates obtained in this study have been reported from Kenya and India.^{16,23} For example, 7.5 per cent of children in this study were diagnosed with impacted cerumen obstructing the ear canal which could not be easily removed. Children with lower amounts of cerumen were excluded from the diagnosis. Hatcher *et al.* identified cerumen impaction in 8.6 per cent of a Kenyan population aged between 5 and 21 years, while Al Khabori *et al.* reported this condition in 11.7 per cent of the Omani population.^{16,25} In contrast, a study of children from Southern India identified cerumen impaction in

nearly 30 per cent, while studies from Nepal have reported a prevalence of over 60 per cent.^{17,19,20}

In this survey, CSOM was the second commonest ear morbidity (3.6 per cent). A literature review of CSOM found a wide variation in its prevalence, ranging from 1 per cent to 46 per cent in different study groups and different parts of the world.²⁶ A review by Bluestone in 1997 revealed that the lowest CSOM incidence occurs in developed countries such as Denmark, Finland, USA and UK, and the highest prevalence in the Inuits of Alaska, Greenland and Canada, as well as in Australian aboriginals. Asian, African and Pacific island countries have a reported prevalence of between 1.4 and 6 per cent.²⁷ In India, Jacob *et al.* estimated a prevalence of 7.8 per cent CSOM in rural children aged 6–10 years, and Rupa *et al.* reported a prevalence of 6 per cent in a similar location and population.^{17,28} Rao *et al.* examined schoolchildren aged between 5 and 7 years and found 3.9 per cent to have CSOM.⁵ In the current study, the prevalence of CSOM appeared to increase with age. Only 1.8 per cent of infants aged below one year had CSOM, while 4.6 per cent of those aged above 10 years were diagnosed with CSOM. Of children aged 1–5 and 6–10 years, 3.3 per cent and 3.4 per cent, respectively, were diagnosed with CSOM.

- **A cross-sectional door-to-door survey in Delhi assessed the prevalence and type of ear disease in children**
- **One or more ear morbidities were identified in 14.8 per cent of children in Delhi**
- **Cerumen impaction, chronic suppurative otitis media and otitis media with effusion were most common**
- **The incidence of unidentified foreign bodies in the ears was 0.45 per cent**
- **The high prevalence of ear disease in children requires improved public health efforts**

An interesting survey finding was the presence of undiagnosed foreign bodies in the ears of 0.45 per cent of the children examined. Varying figures for the prevalence of foreign bodies have been reported in different studies. Adhikari and colleagues reported prevalences of 0.4 per cent and 1.2 per cent in different studies.^{19,20} Hatcher *et al.* identified neglected foreign bodies in 0.9 per cent of Kenyan schoolchildren.¹⁶ These authors considered that foreign bodies may remain undiagnosed because children who have inserted these objects into their own ears may not report it because of fear of punishment. In addition, the irritation caused by the object may decrease with time and hence remain unreported. These data support the need to perform regular surveillance of ear diseases. A survey of schoolchildren from North India reported finding undiagnosed foreign bodies in

the ears of 0.34 per cent of the more than 15 000 examined.²³

Most of the morbidities diagnosed in this survey, including cerumen impaction, CSOM, otitis media with effusion (OME) and acute suppurative otitis media, can cause hearing loss.²⁹ Impacted cerumen can lead to a variety of symptoms including ear pain and hearing loss.³⁰ It is a major cause of primary care consultation and poses a heavy financial burden on the health-care system.^{25,31} CSOM is a leading cause of preventable hearing loss.¹⁰ Over 50 per cent of CSOM patients have associated hearing loss varying from mild to severe.¹⁰ Moreover, it can lead to a variety of potentially life-threatening complications such as meningitis, brain abscess and labyrinthitis and causes many deaths annually worldwide.^{10,32} OME is another preventable and treatable condition which affects children's hearing and therefore affects their language and academic development.³³ Acute suppurative otitis media and neglected foreign bodies can also lead to hearing loss.²⁹ This study highlights the continuing high prevalence of ear morbidities commonly associated with hearing loss in the community of Delhi. A literature review also revealed a wide variation in the reported prevalence of ear morbidities. This variation may be due to difference in aetiological factors, diverse living environments and variable access to ear care services. These findings underline the need for consistency in the definitions and diagnostic criteria of ear diseases to provide uniformity in epidemiological surveillance.

Conclusion

Nearly 15 per cent children in the National Capital Region of Delhi suffer from ear disease, the commonest being cerumen impaction, CSOM and otitis media with effusion. The high prevalence and possible consequences of ear morbidities pose a significant public health challenge which needs to be addressed by definitive and organised efforts to promote ear and hearing health within communities.

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