Original Research Article

Factors Leading to Conductive Hearing Loss Among Children Living In Delhi Slum Areas

Abstract

Background: Middle-ear diseases in children pose a significant burden to the healthcare system. Recurrent upper respiratory tract infections, cold, and cough often initiate middle ear disease. It results in mild to moderate hearing impairment that can be detrimental to the child's linguistic development. It can further lead to behavioural and cognitive problems. The study was designed to establish a relationship between common middle pathologies like CSOM and OME with hearing loss in children. **Objective:** To determine the prevalence of middle ear pathology and its association with hearing loss in slum children of Delhi. **Method:** A study was conducted with 269 children aged five to ten years. The children were screened by otoscopic examination, followed by Tympanometry and then by Pure Tone Audiometry. **Results:** The prevalence of middle ear problems was 24.2%, out of which the prevalence of Chronic Suppurative Otitis Media (CSOM) was 10.8%, Otitis media with effusion (OME) was 12.3% and Acute Otitis Media (AOM) was 1.1%. A significant correlation ($p < 0.005$) was found between hearing loss and middle ear pathology like CSOM and OME. Out of the 65 children with ear pathology, hearing loss was detected in 55 children, out of which 29 children with CSOM, moderated conductive hearing loss was detected in 28 children and out of 33 OME children, mild to moderate conductive hearing loss was detected in 26 children. **Conclusion:** The article highlights the high prevalence of middle ear pathology in underprivileged children. The study also concludes the high probability of conductive hearing loss in these children. It is recommended that there is more need for awareness for early detection and treatment of middle ear infection to avoid any language and behavioural problems in the future. Also, the disparity between children living in urban and rural areas needs to be bridged.

Keywords: Chronic suppurative otitis media, otitis media effusion, slum area, childhood hearing loss, pure tone audiometry.

Introduction:

Hearing Impairment is one of the most common problems in the world. It affects individuals of all age groups. According to the World Health Organization (WHO) 2022, more than 1.5 billion people (nearly 20 % of the global population) have hearing loss. The number of individuals with disabling hearing loss is expected to reach over 700 million by 2050. Globally 34 million children worldwide have hearing loss, of which 60 % of hearing loss is due to preventable causes [1]. In children, the prevalence of HL was 6.6% to 16.47% [2]. Childhood-onset hearing loss significantly affects lifelong disability and Quality of Life (QoL) [3]. Otitis media with effusion (OME) and Chronic Suppurative Otitis Media (CSOM) were the most common cause of hearing loss in children [4][5][6]. Unidentified childhood hearing impairment, even mild, may harm linguistic and educational development, resulting in social and psychological problems for affected children and their families [7]. A high prevalence of mild hearing loss affects children's academic performance [6]. Hearing loss in chronic otitis media can range from minimal (25dB) to severe (60 dB) [8]. The majority population suffers from conductive hearing loss, followed by the mixed type. A component of sensorineural hearing loss is seen in complicated cases of chronic otitis media [9].

Children in rural areas have a high prevalence (11.9%) of hearing loss [10][11]. Episodes of cold attacks and runny noses are found to be precursors of the prevalent conductive deafness [12]. Approximately 95% of preschool children experience at least one episode of otitis media with effusion. It has a prevalence of about 20% at the age of two years, which is a crucial time for rapid language development. Therefore, children should be screened early for OME [13]. Mawson, in 1976 defined otitis media with effusion (OME, also referred to as seromucous otitis media) as the presence of liquid in the cavities of the middle ear and the absence of signs of acute infection. It is a chronic form of otitis media with an intact tympanic membrane. It can affect children as young as one year or less. The condition is often asymptomatic and so can easily be missed. However, OME can lead to hearing loss, impairing the child's language and behavioural development. The diagnosis is clinical and is based on otoscopy and (in some cases) tympanometry [14]. Chronic suppurative otitis media (CSOM) is a long-standing bacterial infection of the middle ear that results in the persistent discharge of pus from the ear. It is a common condition affecting people of all ages but is more common in children.

A perforation usually causes CSOM in the eardrum, which allows bacteria to enter and infect the middle ear. The infection can lead to a persistent discharge that is often foul-smelling and can cause hearing loss, tinnitus (ringing in the ear), and dizziness. Treatment of CSOM typically involves antibiotic therapy to clear the infection and surgical intervention to repair the perforation in the eardrum. Sometimes, a doctor may recommend a hearing aid or other assistive devices to improve hearing loss caused by the condition. It's essential to seek medical attention if you suspect you have chronic suppurative otitis media, as untreated cases can lead to more severe complications, including hearing loss, meningitis, and brain abscess [15].

Mucosal variety is common in underprivileged children. The root cause of OME and CSOM is lack of education, access to primary health care, overcrowding, and malnutrition. Other contributing causes are poor hygiene, inadequate housing, smoking, and impaired immunological status [16]. Literature reports a prevalence of 16-34% hearing impairment in rural primary school children of India, conductive hearing loss was responsible for most (81.6% to 98.6%) of the hearing loss [17][18][19]. Not all CSOM and OME children have hearing loss, but these children are at risk of having hearing loss (specifically in slum and urban-rural areas [20]. This study has been designed to determine the prevalence of common middle ear pathology in children and its relation with hearing loss in children living in slum areas.

Aim:

To determine the prevalence and factors contributing to conductive hearing loss among children living in Delhi slum areas

Methodology:

Study design: Cross-sectional survey

Study population: Childrens with age range of 5 to 10 years were the prime subjects of the study. Childrens were from slum areas of Paharganj and Sangam vihar because of its dense population. All the children present at that time were included in the study. This population was chosen because the determination of any forms of middle ear pathologies required a large number of children with high risk factors.

Study Period: The data was collected from November 2018 to December 2018 (i.e., two months). This time was taken because, at this particular time, infections in the middle ear were high due to cold weather.

Inclusion criteria:

1. Children aged 5 to 10 years

2. Children who could reliably follow the instructions of the Pure tone audiometry test.

Exclusion Criteria:

1. Children with congenital hearing loss

2. Children having hearing loss following trauma

3. Children having any history of mental illness or low IQ

Sampling method: Random sampling of children from different slum areas in Delhi.

Data collection method:

Our study enrolled two hundred sixty- nine children aged 5 to 10 years from four different slum areas of Delhi for over two months.

1. An Otorhinolaryngologist does the initial screening. This included an examination of the external ear, followed by a middle ear evaluation using an otoscope. Any wax, debris, or discharge filling the middle ear was removed using gentle syringing, curette, or cotton-tipped probes as applicable. The tympanic membrane was then assessed using an otoscope to look for any middle ear pathology. Participants with conditions such as wax or any other external ear pathology were not allowed for further examination and were referred for medical intervention after.

2. Tympanometry was performed for all subjects except for children's having CSOM and Wax for confirming the middle ear status. Those with intact tympanic membranes were evaluated for signs of inflammation or retro tympanic fluid collection. Pneumatic otoscopy was performed for signs of retraction or effusion, followed by impedance audiometry by a certified audiologist. After this all subjects including children with perforation were advised for pure tone audiometry by certified

Audiologist for checking the hearing thresholds at 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz. The children, in the presence of the parents, were explained the procedure of PTA as it is a subjective test. It was paramount only those children who could understand the instructions were allowed to undergo testing. Impedance being a subjective test, imposed no such challenges.

3. Subjects and their guardians were administered a structured questionnaire to collect data on demographic characteristics (age, gender, education level, income), environmental factors (housing conditions, noise exposure, water quality), medical history (ear infections, other medical conditions), and lifestyle factors (diet, smoking exposure).

   In addition, the researchers conducted key informant interviews and focus group discussions to gather additional qualitative data on cultural practices and beliefs related to hearing loss.

Data Analysis:

All the collected data were coded and analysed using the Statistical Package for Social Scientist (SPSS) Version 23. The categorical variables related to the Demographic profile were presented using frequency and percentage. Statistical test such as the chi-square test was applied.

Ethical considerations:

Parents/guardians of children participating in the study gave their informed consent. Confidentiality and privacy of study participants was ensured.

Results

The present study investigated the prevalence of middle ear pathologies like CSOM and OME in slum children and their impact on hearing. Children were enrolled from slum areas of Delhi. An otoscopic examination was performed to check for outer and middle ear status, followed by Tympanometry and by pure tone audiometry.

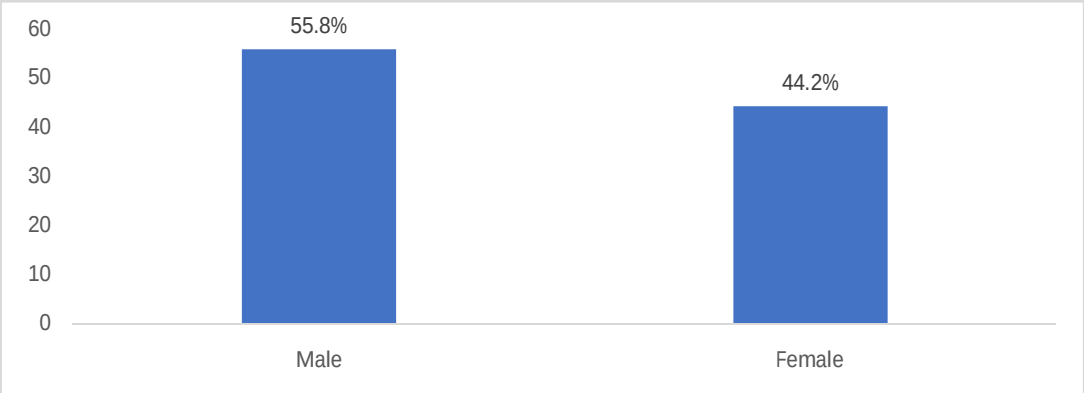

Figure 1: Sex distribution in percentage

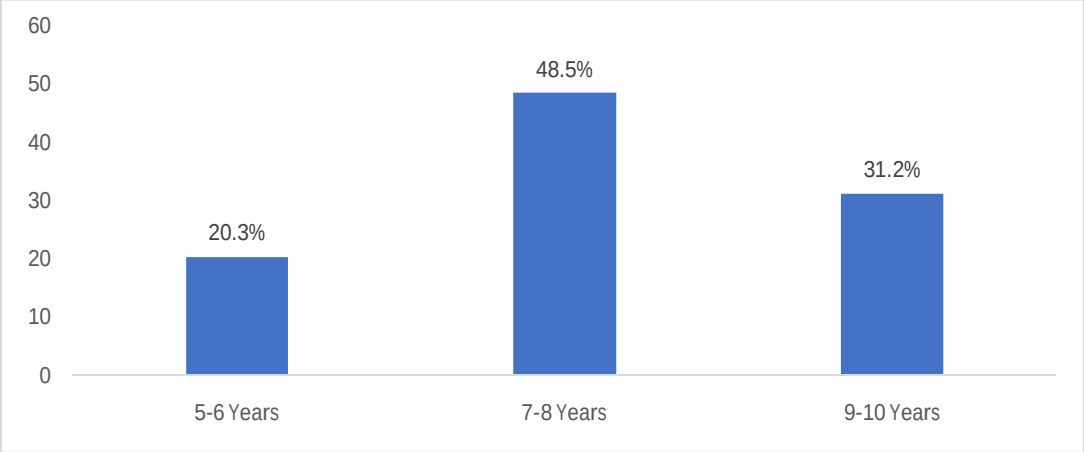

Figure 2: Age distribution in percentage

A total of 269 children were randomly selected from slum areas of Delhi with male to female ratio of 1:1.2 (150 male and 119 female) participated in the study, with ages ranging from 5 to 10 years of different slum areas of Delhi, as shown in figure 1 & 2.

Table 1: Factors identification by otoscopic examination (N= 269)

Ear Disease	Total Count (%)
Normal TM	162 (60.2%)
Wax	42 (15.6%)
Otits Media with effusion (OME)	33 (12.3%)

CSOM	29(10.8%)
AOM	3 (1.1 %)
Total	269(100%)

Table 1, shows the results of the otoscopic examination of 269 children, normal TM was found in 162 (60.22%) children, CSOM was found in 29 (10.8%) children, OME in 33(12.2%) children, wax in 42 (39.25%) children, and AOM in 3(1.1%).

Table 2: Distribution of Tympanometry results in rural area children (N= 198)

	Tympanometry				
	Type A	Type B	Type C	Type As	Type Ad
Normal TM (n= 162)	152	0	10	0	0
OME (n = 33)	0	33	0	0	0
AOM (n = 3)	0	3	0	0	0
Total (n = 198)	152	36	10	0	0

Children with CSOM and wax were eliminated for the tympanometry test, rest all the children were gone through tympanometry to confirm the middle ear status, as shown above (Table 2). Table 2 shows that, out of 162 children whose TM was normal in otoscopy, 152 children had Type A graph in tympanometry, and only ten children had Type C graph. Type C tympanogram shows, a probability of Eustachian tube dysfunction in the children due to cough and cold. All children having OME, and AOM had Type B graph on tympanometry, confirming middle ear pathology. So, the prevalence of middle ear pathology was 10.8% (29) for CSOM, 12.3% (33) for OME, and 1.1% (3) for AOM. So, the prevalence of Middle ear pathology was 24.2%.

Table 3: Distribution of Pure Tone Audiometry Test (N= 227)

Pure Tone Audiometry Test		
	Pass (Normal Hearing)	Refer (Hearing loss)
Normal TM (n=152)	151 (99.3%)	1 (0.7%)

CSOM (n=29)	1 (3.44%)	28 (96.56 %)
OME(n=33)	7 (21.22%)	26 (78.78%)
AOM (n= 3)	3 (100%)	0 (0%)
ETF (n= 10)	10 (100%)	0 (0%)
Total (n= 227)	172 (75.77%)	55 (24.23%)

Table 4: Correlation of Middle Ear Pathology and Pure Tone Audiometry Test

Middle ear pathology	Pure Tone Audiometry (Hearing Test)	
	Pass	Refer
CSOM (n=29)	1 (3.44%)	28 (96.56%)
X2 = 94.46 , df = 1, P value < 0.05 Significant		
OME(n=33)	7 (21.21%)	26 (78.78%)
X2 = 16.03, df = 1, P value < 0.05 Significant		
AOM (n= 3)	3 (100%)	0 (0%)
X2 = 30.857, df = 1, P value >0.05 Not significant		
Total (n= 65)	11(16.92%)	54(83.08%)
X2 = 238.72, df = 4, P value < 0.05 Significant		

Tables 3 & 4 show that, except for 42 children having wax, all 227 children went for the Pure Tone Audiometry test. The study shows that out of 227 children, hearing loss was detected in 55 (24.23%) children's and the rest, 172(75.77%) children had normal hearing (table 3). Out of 55 children having hearing loss, 54(23.78%) children were having mild to moderate conductive hearing loss and only 1(0.44%) child was having sensorineural hearing loss. So, the prevalence of hearing loss due to middle ear pathology was found to be 23.78%. Out of 29 children with CSOM, moderate conductive hearing loss was detected in all 28 (96.56%) children, and only 1(3.44%) had normal hearing. A significant

association between the prevalence of CSOM and hearing loss was found (P<0.05). OME was detected in 33 children, out of which mild to moderate conductive hearing loss was detected in 26 children (78.78%), which, if treated, can be cured. However, a statistical association between the prevalence of OME and hearing loss was detected (P<0.05). Three children of AOM had normal hearing sensitivity and did not show a significant association with hearing loss(P> 0.05). No hearing loss was seen in 10 children with ET dysfunction.

Discussion

In this cross-sectional study, 269 rural primary school children were selected from different slum areas of Delhi (Paharganj and Sangam Vihar). Boys to girl ratio were 1.12 (150 male and 119 female) participated in the study with ages ranging from 5 to 10 years. In the current study,162 (60.2%) students had no detectable ear problems on otoscopic examination. However, the prevalence of CSOM was 10.7%, OME was 12.2%, and AOM was 1.1 %. So, the prevalence of middle ear problems found was 24.16% in these children. Other studies supported these results by Rupa et al.;1991, which detected 70.1% no ear problems, 26.6% wax, OME (9.8%), and Shaheen et al.; the detected prevalence of Wax (26.4%), OME (9.8%), CSOM (5.2%) & OE (0.5%) in a rural area of Bangladesh [9][16]. Shaheen & Nahar stated that CSOM was more prevalent among girls than boys in rural areas (6.05 and 5.98%) [21].

In the current study, it was found that out of 29 children with CSOM, 28 (96.56%) children had moderate conductive hearing loss, and there was a statistical significance between the two(P<0.05). Out of 33 children with OME, 26 (78.78%) had mild to moderate conductive hearing loss (P<0.05), and there was a statistical significance between the prevalence of OME and hearing loss. Similar studies were seen by Verma et al (2022) study concluded that OME was the most common problem in children, with the prevalence of hearing loss in rural areas was 6.6% to 16.47% [2]. Kalpana & Chamyal found that the prevalence of CSOM was 43.18%, of which 96.22% have conductive hearing loss [20]. Rao et al. found the prevalence of Wax 86.3%, of which 81.6 have a hearing loss of more than 25 dB [11]. So, there is a high prevalence of hearing loss in CSOM and OME children, which if cannot treat can cause permanent hearing loss and further deadly complications like petrositis and intracranial abscesses [23][24]. Rupa & Raman noted that yearly, many slum area children undergo ear surgery for CSOM because of various complications [9].

CSOM and OME are the most typical preventable causes of hearing loss in children [2]. Educating children, guardians, and teachers through various awareness programs can help in the early detection of management of middle ear diseases and their complications. Early disease detection and prompt management are vital in preventing such complications [25][26].

Conclusion:

Current study results reflected the overall status of Middle ear infections like CSOM and OME in children living in slum areas of Delhi. The study also revealed a high prevalence of conductive hearing in children having CSOM and OME. The already difficult learning curve for these children is worsened if there is delayed speech and cognition development due to hearing loss [27]. The study recommends early detecting middle ear problems, which cause hearing loss, early in underprivileged children, to avoid any language and behavioural problems in the future.

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