SHORT COMMUNICATION

Frequency of hearing impairment in children between the ages of 2 and 10 years with middle ear infection

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Abstract

This study was conducted on children between 2 and 10 years age to determine the frequency of hearing impairment in middle ear infection. It was a cross-sectional survey, done at Riphah International University from August 2018 to January 2019. Data was collected from the ENT Department of Children's Hospital Lahore through convenience sampling technique and included 52 patients with middle ear infection. Measurements for the level of hearing impairment were taken, and data was analysed using statistical package for social sciences, SPSS 20.0. Of the total 52 patients, 15 (28.8%) had ear infection once a month and 37 (71.2%) had it off and on. Mild hearing loss was determined in 35 (67.3%) patients,13 (25%) had moderate, 2 (3.8%) severe and 2 (3.8%) had normal hearing. It was concluded that most of the children with middle ear infections developed hearing loss.

Keywords: Hearing Impairment, Middle Ear Infection, Otitis Media.

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Introduction

Middle ear infection, or acute otitis media, is caused by fluid accumulation in the air filled space of the ear, which resultantly causes pain and inflammation because of the infective agents or infections and are linked to mild hearing loss.[1-3]

Infection of the middle ear because of a common cold is most common in children. Two responsible factors are weakness of the immune system and structure of Eustachian tube. Since the tube is horizontal it is difficult for the secretions of the ear to drain out, due to which it is easy for the infection to travel into the middle ear. Another predisposing factor is chronic adenoid infection or tonsillitis.[4-6] Long-term hearing impairment may result in delay in speech, language and cognitive skill development, especially in commencing prelingually.[7]

Hearing impairment is defined as partial or total inability to hear. It may be in both the ears or in one. There are two types of hearing loss: Conductive Hearing Loss, and Sensory Neural Hearing Loss. The degree of hearing loss was classified as Mild hearing loss is 26-40 dB, Moderate hearing loss is from 41-55 dB, Moderately Severe hearing loss is from 56-70 dB, Severe hearing loss is from 71-91 dB, Profound hearing loss is from 91 dB to above.[8] Causes of hearing loss are: upper respiratory tract infections, recurrent attacks of common cold, Adenoid and tonsil infections, nasal allergy, chronic rhinitis and sinusitis, tumours of head and neck, and cleft palate. Bacteriology includes microorganisms commonly found in infants and children such as *streptococcus pneumonia, Haemophilus Influenzae, Streptococcus Pyogenes, Staphylococcus Aureus and Moraxella Catarrhalis*.[9,10]

Consequences and outcomes of middle ear infection include varied intensity of hearing impairment that leads to speech delays, development of cognitive skills and language. Consequences of impaired hearing include employment problems and other social interactions. There are a number of reports in literature which shows that school going children with impaired hearing are less successful in achieving life goals as compared to their peers. The same issues have been reported with all types of ear problems such as otitis media and middle ear infection.[11]

In 2016, Mulwafu et al conducted research in African region among population with hearing impairment. Data was gathered by using a standardised questionnaire and the limitation of this study was it was done on hearing impaired population only. Evidenced suggested that the rate of hearing impairment in Africa is higher and if it is not treated properly, it would increase with the passage of time.[12] Kaspar et al in 2016, conducted research among younger and older population. It was found that mild hearing loss was most common in younger children because of middle and outer ear infections which are usually linked with respiratory infections, while moderate

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hearing loss was most common in elderly people — aged 80 years or more — which can be called age-related hearing loss.[13,14] Research conducted in 2016 by Cruhan et al describe global percentage of hearing-impaired population to be almost 5.3 percent or 360 million; this is almost the same number considered hearing disabled by World Health Organisation.[15] In 2015, Aarhus et al conducted population-based research among 32,430 adults aged 20-56 years and determined positive relationship between childhood hearing disorders and adult tinnitus.[16] A pilot study was conducted in India among children with hearing impairment and found that infections of the middle and outer ear was common cause of hearing loss. this study was conducted in rural areas and the subjects were examined through Otoscope, tympanometry and audiometry. Conductive hearing loss was also observed.[17-19]

In China, a study was conducted among children with hearing impairment and age-related prevalence was found and classified; children aged 3-6 years had more hearing loss. It was 14% at the age of two years, 5 % in four years olds and 4.9% was observed at the age of five years.[17]

Study conducted in Uganda on 6041 participants were enrolled and underwent audiometric evaluation and an ear examination. The prevalence of disabling hearing impairment was 11.7% in adults and 10.2% in children.[18] An observational hospital-based study which included 1,724 children aged older than two years, showed the rate of hearing-impairment at 4.4 %.[19] This present study was designed to assess the relationship between middle ear infection with hearing impairment. Early middle ear infections are a cause of hearing impairment which directly causes delay or disorders of speech, language and cognitive skills development. This leads to decreased employability in adulthood. So, middle ear infections should be prevented or treated as soon as possible to decrease the percentage of hearing impairment.

Patients/Methods and Results

The study design was a cross-sectional survey, conducted for the duration of six months from August 2018 to January 2019 to find out the prevalence of hearing impairment caused due to middle ear infection. Study was conducted in Riphah University Lahore and Data was collected from ENT Department of Children's Hospital Lahore. Convenient sampling technique was used for this study. Sample size calculated was 41 on the basis of prevalence of unilateral hearing impaired 5.4% in chronic otitis media[20] by using 95% confidence interval and 7% confidence level through online sample size calculator.[21] Fifty-two children, aged two to 10 years, both male and female, with middle ear infections were included in this study. Co-morbidities such as cerebral palsy, cleft palate, congenital diseases and any other structural deformity with ear infections were excluded. The Performa was developed from literature review and expert opinion was used for data collection. Content validity index was used for validation of content. Cronbach Alpha was used for internal reliability of the questionnaire. The questionnaire consisted of four sections: demography, reviews of systems, medical/family/social history, past surgery and medications. After approval from the research ethical committee of Riphah International University, Lahore, and taking consent from the parents, the researcher himself filled the Performa to collect the data. Visual reinforcement audiometry was used in patients below the age of four years, Play Audiometry was used in patients between age of four and five years, in those above the age of five years, audiometer was used to test hearing impairment. Tympanometry was used to assess the mobility of tympanic membrane. The data was analysed in Statistical Package for Social Sciences, SPSS 20.0. The qualitative variables were analysed for frequency/ percentage.

Results

Table 1 shows that one patient had throat infection for the first time,19 (36.5%) patients had it twice a month and 32(61.5%) patients had it off and on. Moreover, 15(28.8%) had ear infection once a month and 37 (71.2%) had it off and on. It was also noted that 35 (67.3%) patients had mild hearing, 13(25%) had moderate, 2(3.8%) severe hearing loss and 2(3.8%) had normal hearing.

As shown in the table 2 mild hearing loss was found in 12(80%) of the participants who had ear infection once a month and 3(20%) participants had moderate infection.

Hearing loss was mild in 23(62.2%) of participants who had off and on ear infection and 2(5.4%) were severely impaired, while 2(5.4%) had normal hearing irrespective of ear infection.

Table 3 shows that 3(20%) participants who had ear

Table-1: Frequency of throat & Ear infection and Hearing Impairment.

Variables		n (%)	Total
Frequency of throat infection	First Time	1 (1.9)	52 (100)
	Twice a month	19 (36.5)	
	Off & On	32 (61.5)	
Frequency of Ear Infection	Once a month	15 (28.8)	52 (100)
	Off & On	37 (71.2)	
Hearing Impairment	Normal Hearing	2 (3.8)	52 (100)
	Mild	35 (67.3)	
	Moderate	13 (25.0)	
	Severe	2 (3.8)	

Table-2: Frequency of Ear Infection and Degree of Hearing loss.

Frequency of Ear Infection	Degree of Hearing Loss	Results [n(%)]
Once a month	Mild	12 (80.0)
	Moderate	3 (20.0)
	Total	15(28.84)
Off and on	Mild	23 (62.2)
	Moderate	10 (27.0)
	Severe	2 (5.4)
	Normal	2 (5.4)
	Total	37(71.15)

Table-3: Tympanometry and Ear Infection.

Frequency of Ear Infection		n (%)
Once a month	A	3 (20)
	B	12 (80)
Total		15(28.84)
Off and on	A	10 (27)
	B	27 (73)
Total		37(71.15)

infection once a month had type A Tympanogram and 12(80%) had type B Tympanogram, 10(27%) participants who had ear infection off and on had type A Tympanogram and 27(73%) had type B Tympanogram.

Conclusion

The findings of the current study show a large-scale hearing impairment in patients having middle ear infection. In comparison with previous literature, it also shows that the chances of hearing impairment are high if middle ear infection persists. However, in previous studies, there was less occurrence of chronic infection as compared to the participants of this study, and in that proportion hearing impairment is also high. Furthermore, most of the patients of our study remained undiagnosed and did not know about the presence of hearing loss.

Thus, it was concluded that most of the participants having middle ear infections experience hearing loss and had type B Tympanogram. It is recommended that these children should consult ENT surgeons and audiologists for hearing assessment.

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References

1. Akyuz S, Turan F, Gurbuzler L, Arici A, Sogut E, Ozkan O. The anti-inflammatory and antioxidant effects of curcumin in middle ear infection. J Craniofac Surg 2016; 27: e494-e7.
2. Hirano T, Kodama S, Kawano T, Suzuki M. Accumulation of regulatory T cells and chronic inflammation in the middle ear in a mouse model of chronic otitis media with effusion induced by combined eustachian tube blockage and nontypeable Haemophilus influenzae infection. Infect Immun 2016; 84: 356-64.
3. Hood D, Moxon R, Purnell T, Richter C, Williams D, Azar A, et al. A new model for non-typeable Haemophilus influenzae middle ear infection in the Junbo mutant mouse. Dis Model Mech 2016; 9: 69-79.
4. Leach AJ, Wigger C, Hare K, Hampton V, Beissbarth J, Andrews R, et al. Reduced middle ear infection with non-typeable Haemophilus influenzae, but not Streptococcus pneumoniae, after transition to 10-valent pneumococcal non-typeable H. influenzae protein D conjugate vaccine. BMC pediatr 2015; 15: 162.
5. Monroy GL, Pande P, Shelton RL, Nolan RM, Spillman Jr DR, Porter RG, et al. Non-invasive optical assessment of viscosity of middle ear effusions in otitis media. J Biophotonics 2017; 10: 394-403.
6. Monroy GL, Shelton RL, Nolan RM, Nguyen CT, Novak MA, Hill MC, et al. Noninvasive depth-resolved optical measurements of the tympanic membrane and middle ear for differentiating otitis media. Laryngoscope 2015; 125: E276-82.
7. Ruegg TA, Cooper ME, Leslie EJ, Ford MD, Wehby GL, Deleyiannis FW, et al. Ear infection in isolated cleft lip: etiological implications. Cleft Palate Craniofac J 2017; 54: 189-92.
8. "Types of Hearing Loss." [Online] [Cited 2020 Dec 16]. Available from: URL: https://www.wyomingehdi.org/types-of-hearing-loss/.
9. Venekamp RP, Burton MJ, van Dongen TM, van der Heijden GJ, van Zon A, Schilder AG. Antibiotics for otitis media with effusion in children. Cochrane Database Syst Rev 2016; 2016: CD009163.
10. Yun NE, Ronca S, Tamura A, Koma T, Seregin AV, Dineley KT, et al. Animal model of sensorineural hearing loss associated with Lassa virus infection. J Virol 2016; 90: 2920-7.
11. Manickam V, Shott GS, Heithaus D, Shott SR. Hearing loss in Down Syndrome revisited–15 years later. Int J Pediatr Otorhinolaryngol 2016; 88: 203-7.
12. Mulwafu W, Kuper H, Ensink R. Prevalence and causes of hearing impairment in Africa. Trop Med Int Health 2016; 21: 158-65.
13. Kaspar A, Kei J, Driscoll C, Goulios H. Overview of a public health approach to pediatric hearing impairment in the Pacific Islands. Int J Pediatr Otorhinolaryngol 2016; 86: 43-52.
14. Korver AM, Smith RJ, Van Camp G, Schleiss MR, Bitner-Glindzicz MA, Lustig LR, et al. Congenital hearing loss. Nat Rev Dis Primers 2017; 3: 16094.
15. Curhan G, Curhan S. Epidemiology of hearing impairment. In: Hearing Aids. USA: Springer; 2016, pp 21-58.
16. Aarhus L, Engdahl B, Tambs K, Kvestad E, Hoffman HJ. Association between childhood hearing disorders and tinnitus in adulthood. JAMA Otolaryngol Head Neck Surg 2015; 14: 983-9.
17. Goderis J, Keymeulen A, Smets K, Van Hoecke H, De Leenheer E, Boudewyns A, et al. Hearing in children with congenital cytomegalovirus infection: results of a longitudinal study. J Pediatr 2016;172:110-5.
18. Westerberg BD, Lee PK, Lukwago L, Zaramba S, Bubikere S, Stewart I. Cross-sectional survey of hearing impairment and ear disease in Uganda. J Otolaryngol Head Neck Surg 2008; 37: 753-8.

19. Hall A, Wills A, Mahmoud O, Sell D, Waylen A, Grewal S, et al. Centre-level variation in outcomes and treatment for otitis media with effusion and hearing loss and the association of hearing loss with developmental outcomes at ages 5 and 7 years in children with non-syndromic unilateral cleft lip and palate: The Cleft Care UK study. Part 2. Orthod Craniofac Res 2017; 20: 8-18.
20. Karunanayake CP, Albritton W, Rennie DC, Lawson JA, McCallum L, Gardipy PJ, et al. Ear infection and its associated risk factors in first nations and rural school-aged Canadian children. Int J Pediatr 2016; 2016: 1523897.
21. Online Sampsize Calculator. [Online] [Cited 2018 Sep 07]. Available from: URL: http://sampsize.sourceforge.net/iface/.