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3 **Frequency of hearing impairment in children between the ages of**  
4 **2 and 10 years with middle ear infection**

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13  
14 **Abstract**

15 This study was conducted to find out the frequency of hearing impairment in  
16 middle ear infection. The study design was a cross-sectional survey, conducted  
17 at Riphah International university from August 2018 to January 2019 and data  
18 was collected from the ENT Department of Children's Hospital Lahore. The  
19 data was collected through convenience sampling technique among 52 patients  
20 of middle ear infection. Measurements for the level of hearing impairment were  
21 taken, and data was analysed using statistical package for social sciences, SPSS  
22 20.0. Out of the total 52 patients, 15 (28.8%) had infection once a month ear and  
23 37 (71.2%) had off and on, while 35 (67.3%) patients had mild hearing loss, 13  
24 (25%) had moderate, 2 (3.8%) severe and 2 (3.8%) had normal hearing loss. It  
25 was concluded that most of the participants with middle ear infections had  
26 hearing loss.

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

## 29 Introduction

30 Middle ear infection, or acute otitis media, is caused by fluid accumulation in  
31 the air filled space of the ear, which resultantly causes pain and inflammation  
32 because of the infective agents or infections and are linked to mild hearing  
33 loss.<sup>(1-3)</sup>

34 Infection of the middle ear because of cold is most common in children. Two  
35 responsible factors are weakness of the immune system and structure of  
36 Eustachian tube. Since the tube is horizontal it is difficult for the secretion of ear  
37 to drain out, due to which it is easy for the infection to travel into the middle  
38 ear. Another predisposing factor is chronic adenoid infection or tonsillitis.<sup>(4-6)</sup>

39 Long-term hearing impairment may result in delay in speech, language and  
40 cognitive skill development, especially in commencing prelingually.<sup>(7)</sup>

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

53 Consequences and outcomes of middle ear infection include varied intensity of  
54 hearing impairment that leads to speech delays, development of cognitive skills  
55 and language. Consequences of impaired hearing include employment problems  
56 and other social interactions. There are a number of reports in literature which  
57 shows that school going children with impaired hearing are less successful in

58 achieving life goals as compared to their peers. The same issues have been  
59 reported with all types of ear problems such as otitis media and middle ear  
60 infection.<sup>(11)</sup>

61 In 2016, Mulwafu et al conducted research in African region among population  
62 with hearing impairment. Data was gathered by using a standardised  
63 questionnaire and the limitation of this study was it was done on hearing  
64 impaired population only. Evidenced suggested that the rate of hearing  
65 impairment in Africa is higher and if it is not treated properly, it would increase  
66 with the passage of time.<sup>(12)</sup> Kaspar et al in 2016, conducted research among  
67 younger and older population. It was found that mild hearing loss was most  
68 common in younger children because of middle and outer ear infections which  
69 are usually linked with respiratory infections, while moderate hearing loss was  
70 most common in elderly people — aged 80 years or more — which can be  
71 called age-related hearing loss.<sup>(13, 14)</sup> Research conducted in 2016 by Cruhan et  
72 al describe global percentage of hearing-impaired population to be almost 5.3  
73 percent or 360 million; this is almost the same number considered hearing  
74 disabled by World Health Organisation.<sup>(15)</sup> In 2015, Aarhus et al conducted  
75 population-based research among 32,430 adults aged 20-56 years and  
76 determined positive relationship between childhood hearing disorders and adult  
77 tinnitus.<sup>(16)</sup> A pilot study was conducted in India among children with hearing  
78 impairment and found that infections of the middle and outer ear was common  
79 cause of hearing loss. this study was conducted in rural areas and the subjects  
80 were examined through horoscopy, tympanometry and audiometry. Conductive  
81 hearing loss was also observed.<sup>(17-19)</sup>

82 In China, a study was conducted among children with hearing impairment and  
83 age-related prevalence was found and classified; children aged 3-6 years had  
84 more hearing loss. It was 14% at the age of two years , 5 % in four years olds  
85 and 4.9% was observed at the age of five years.<sup>(17)</sup>

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

97

#### 98 **Patients/Methods and Results**

99 The study design was a cross-sectional survey, conducted for the duration of six  
100 months from August 2018 to January 2019 to find out the prevalence of hearing  
101 impairment caused due to middle ear infection. Study was conducted in Riphah  
102 University Lahore and Data was collected from ENT Department of Children's  
103 Hospital Lahore. Convenient sampling technique was used for this study.  
104 Sample size calculated was 41 on the basis of prevalence of unilateral hearing  
105 impaired 5.4% in chronic otitis media <sup>(20)</sup> by using 95% confidence interval and  
106 7% confidence level through online sample size calculator.<sup>(21)</sup> Fifty-two  
107 children, aged two to 10 years, both male and female, with middle ear infections  
108 were included in this study. Co-morbidities such as cerebral palsy, cleft palate,  
109 congenital diseases and any other structural deformity with ear infections were  
110 excluded. The Performa was developed from literature review and expert  
111 opinion was used for data collection. Content validity index was used for  
112 validation of content. Cronbach Alpha was used for internal reliability of the  
113 questionnaire. The questionnaire consisted of four sections: demography,  
114 reviews of systems, medical/family/social history, past surgery and medications.

115 After approval from the research ethical committee of Riphah International  
116 University, Lahore, and taking consent from the parents, the researcher himself  
117 filled the Performa to collect the data. Visual reinforcement audiometry was  
118 used in patients below the age of four years, Play Audiometry was used in  
119 patients between age of four and five years, in those above the age of five years  
120 audiometer was used to test hearing impairment. Tympanometry was used to  
121 assess the mobility of tympanic membrane. The data was analysed in Statistical  
122 Package for Social Sciences, SPSS 20.0. The qualitative variables were  
123 analysed for frequency/percentage.

124

## 125 **Results**

126 The table 1 shows that one patient had throat infection for the first time, 19  
127 (36.5%) patients had it twice a month and 32(61.5%) patients had it off and on.  
128 Moreover, 15(28.8%) had ear infection once a month and 37 (71.2%) had it off  
129 and on. It was also noted that 35 (67.3%) patients had mild hearing, 13(25%)  
130 had moderate, 2(3.8%) severe and 2(3.8%) had normal hearing loss.

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

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

137 The table 3 shows that 3(20%) participants who had ear infection once a month  
138 had type A Tympanogram and 12(80%) had type B Tympanogram, 10(27%)  
139 participants who had ear infection off and on had type A Tympanogram and  
140 37(73%) had type B Tympanogram.

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## 144 **Conclusion**

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

152 Thus, it was concluded that most of the participants having middle ear  
153 infections experience hearing loss. Most of the participants have type B  
154 Tympanogram. It is recommended that the participants should consult ENT  
155 surgeons and audiologists for hearing assessment.

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237 **Table 1: Frequency of throat & Ear infection and Hearing Impairment**

Variables	Frequency		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	2 (3.8%)	52 (100%)
	Mild	35 (67.3%)	
	Moderate	13 (25.0%)	
	Severe	2 (3.8%)	

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241 **Table 2: Frequency of Ear Infection and Degree of Hearing loss**

Frequency of Ear Infection	Degree of Hearing Loss	Results
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%)

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245 **Table 3: Tympanometry and Ear Infection**

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

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