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Research Article

Hearing Assessment of School Going Children of Various Schools in Jaipur, Rajasthan

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Abstract: Hearing impairment substantially affects child's ability to normally acquire the spoken language. It creates problems for the child in terms of communication, achievement in school as well as social and emotional growth. The aim of this research is to study the prevalence of hearing disorders and its causes among various school students of Jaipur, Rajasthan. In this cross-sectional and descriptive analytical study, 1500 students from various schools of age 6 – 12 years were screened for complete E.N.T. examination and hearing loss by pure tone audiometry and tympanometry. Of the 1500 school children, 821 children were found to have various ENT related problems. Hearing assessment revealed a hearing loss on one or both sides in 249 cases (16.60%), out of which 241cases (96.79%) were of conductive hearing loss. Various ear pathologies were detected in these children, out of which Wax was the most common, followed by chronic suppurative otitis media "Tubotympanic type", otitis media with effusion and otomycosis respectively. Regular E.N.T. check up and primary ear care education to teachers, students and guardians can prevent these vulnerable children from developing hearing impairment.
Keywords: School screening, Hearing impairment.

INTRODUCTION

Hearing loss is the most common sensory deficit in humans today. As per WHO estimates in India, there are approximately 63 million people, who are suffering from significant auditory impairment; this places the estimated prevalence at 6.3% in Indian population. As per NSSO survey, currently there are 291 persons per one lack population who are suffering from severe to profound hearing loss (NSSO, 2001). Of these, a large percentage is children between the ages of 0 to 14 years. An even larger percentage of children population suffers from milder degrees of hearing loss and unilateral (one sided) hearing loss (NPPCD) [1].

To be deaf or "hard of hearing" is probably one of the most emotionally disabling conditions suffered by human race. The baby who is deaf at birth learns to speak only with the most intensive training and remains six to eight years behind his fellows, regardless of the amount of effort devoted to his training and education.

The person who later becomes deaf or "hard of hearing" lives in the world of subdued or distorted sound or even silence. Thus deprived of his primary means of communication, he tends to withdraw from the world and live within himself.

If these consequences of hearing loss are to be avoided, early diagnosis is essential before rather than after e.g. the infant is treated as though feeble-minded, the child fails in school work or the older person losses his job or become a partial recluse.

Children grow, develop and mould themselves in their schools and other institutions of learning, deafness affects adversely on their mental development, social adjustability and participation in day to day activities and deprive them of attaining knowledge, skill, personality, character and physique.

It is only if we consider deafness as a whole, in all its degrees, that we can begin to reach something approaching an accurate idea of its incidence [2]. In this study deafness means impairment of hearing and not total deafness.

World over, hearing impairment is the second leading cause for "Years Lived with Disabilities" (YLD), first being depression. There are large number

of hearing impaired young people in India which account for severe loss of productivity, both physical and economic. An even larger percentage of population suffers from milder degree of hearing loss. Against the above background, the Ministry of Health and Family welfare, Govt. of India launched a pilot phase of National Programme for Prevention and Control of Deafness (NPPCD) (July 2006-June 2008) in 10 States and 1 Union Territory.

The Programme was a 100% Centrally Sponsored Scheme during 11thFive Year Plan. However, in as per the 12thFive Year Plan, the Centre and the States will have to pool in resources financial norms of NRHM mutas mutandis. The Programme was initiated in year 2007 on pilot mode in 25 districts of 11 State/UTs. The Programme has been expanded to192 districts of 20 States/UTs. In the 12thPlan, it is proposed to expand the Programme to additional 200 districts in a phased manner probably covering all the States and Union territories by March, 2017 (NPPCD) [1].

The majority of pediatric patients attending the E.N.T. Out-patients Department are of wax, ear discharge, nasopharyngitis, tonsillitis and adenoiditis. The negligence on the part of parents, teachers and medical professionals leads to adverse affect on hearing and make the child handicapped.

Good hearing is very important for everyday life and for acquisition of education and its preservation is our responsibility. It is with this background the present study was undertaken in school going children to find out the incidence of hearing impairment and various E.N.T. defects which predispose to defective hearing in children with special emphasis on audiometric studies.

MATERIALS AND METHODS

The school selected for screening was NIMS International School, Vardhaman Public School, KPS Udaan, Adarsh Vidhya Mandir, Jai Durga Public School and Candlewick Public School, Jaipur.

1500 students from different schools between the ages of 6 and 12 years were examined for assessment of hearing.

The screening was done in three stages

I. Identity, detailed history and general examination including nourishment, built, speech defect, I. Q. and examination of other system.
II. Examination of ear, nose and throat including cervical lymph nodes.
III. Hearing assessment – Audiometry and Tympanometry (wherever needed)

A standard printed Performa was prepared to collect the desired information from various age groups of children. Parents were informed of the proposed study by the principals of schools.

This survey of audiometric examination is to find out the incidence and causes of hearing – impairment in school going age children's was carried out in Jaipur in 2013. Various procedures were adopted and the survey was carried out on the following lines.

School premises were selected for carrying out the survey. For screening the children of schools all the students of age 6-12 of class 1st to 6th who brought the consent form filled were examined.

School authorities were informed about the date and timing of the examination of children and their cooperation was sought. Prior to examination the history were gathered from the children. This consisted of socio-economic data, family size, and medical history with an emphasis on hearing problems within the family.

During the examination the every child was examined in detail for general physical examination, hearing and other ENT disorder and findings pertaining to E.N.T. diseases were noted in Performa.

RESULTS

This study was based on 1500 school children of 6 different schools of Jaipur who underwent Hearing assessment and routine ENT check up in their respective schools during a period of Sept. 2012 to July 2014. The percentage of male children was 61.93 percent (929 children) while the percentage of female children was 38.07 percent (571 children) of total children screened.

Students were further categorized on the basis of socio-economic status with the help of B.G. Prasad's Classification of 1961 revised for 2013. Which showed the majority of children belong to Category II and Category III (24.53% and 31.73%), Category I and Category IV both the groups have almost equal number of children and the percentage is 21.40 per cent and 19.47 per cent respectively ,while only 2.87per cent children belong to Category V of socio-economic status. The findings which were seen are as follows:

Table 1: Percentage of children which are normal in all respects and those with any pathology

	Number	Percentage
Total number of student examined	1500	100
Number of students normal in all respects	680	45.33
Number of students with one or more defects	820	54.67

The above table shows that out of total number of children examined i.e. 1500, 45.33 % (680) children were Normal in all respects and 54.67 % (820) had one or more Pathology or Defects.

Table 2: Showing the findings of E.N.T examination in total number of cases

Examination	Number of Cases	Percentage
External Auditory Canal		
Wax	506	33.73
Otomycosis	43	2.87
Tympanic Membrane		
Acute Otitis Media	21	1.40
Secretory Otitis Media (Retraction)	150	10.00
Adhessive Otitis Media	7	0.46
Tympanosclerosis	5	0.33
Gromet	1	0.07
Perforations	73	4.87
Cental	67	4.47
Marginal		
Attic	3	0.20
Post. Sup.	3	0.20
Nose		
DNS	64	4.26
Rhinosinusitis	178	11.86
Throat		
URTI + Tonsil & Adenoids	282	18.80
Caries Teeth	8	0.53
Cervical Lymphadinitis	28	1.86

From the above table we can see wax, retraction of tympanic membrane and perforation were the common findings with 33.73, 10 and 4.87 percent in ear, while in throat, upper respiratory tract infections including tonsilloadenoiditis with 18.80 percent were prevalent. In nose rhinosinusitis and deviated nasal septum with 11.86 and 4.26 percent were main findings.

These students were further divided in different socio-economic groups. In ear the findings included wax, perforations, secretory otitis media and adhesive otitis media. The low socio-economic group was most affected followed by middle socio-economic group. The high socio-economic group had the least involvement of ear diseases.

It was observed that nose and throat diseases were more prevalent in low socio-economic group along with middle socio-economic group. The important finding was chronic rhinosinusitis, deviated nasal septum and upper respiratory tract infections including tonsillitis.

Table 3: Percentage of children with hearing loss and their distribution according to type and nature

		Percentage out of 249	**Percentage out of 1500**
Total number of children examined	1500	--	--
Number of children with normal hearing	1251	--	83.40
Number of children with hearing loss	249	--	16.60
Number of children with conductive hearing loss	241	96.79	16.07
Number of children with sensory neural hearing loss	6	2.41	0.40
Number of children with mixed hearing loss	2	0.80	0.13
Number of person having unilateral hearing loss	80	32.13	5.33
Number of person having bilateral hearing loss	169	67.87	11.27
Number of person having mild deafness	223	89.57	14.87
Number of person having mild to moderate deafness	8	3.21	0.53
Number of person having moderate deafness	13	5.22	0.87
Number of person having moderately severe deafness	5	2.01	0.33

Table 3 shows that out of 1500 school children examined 83.40 percent had normal hearing while 16.60 percent had impaired hearing. Out of hearing impaired children 96.79 percent had conductive deafness, 2.41 percent had sensory neural deafness and 0.80 percent had mixed deafness. The unilateral deafness was found out to be in 32.13 percent of cases while bilateral in 67.87 percent of total number of deaf children.

Table 4: Frequency Average of Hearing Loss [3]

Hearing Loss in Decibel (dB)	Number of Children	Percentage
21-40	231	92.77
41-55	13	5.22
56-70	5	2.01
70-90	--	Nil
>90	--	Nil
Total	249	100

By averaging the hearing losses of the impaired children at the four frequencies 500, 1000, 2000, and 4000 Hz, we found that 231 (92.77 percent) of the impaired children had hearing losses ranging between 21-40 dB, and 13 (5.22 percent) between 41-55dB, 5 (2.01percent) had a hearing loss between 56-70 dB and no children were having Hearing Loss above 70 dB.

Table 5: Deafness due to various causes

	Number	Percentage
Mild Deafness		
External Auditory Canal		
Wax	118	47.39
Otomycosis	18	7.23
Tympanic membrane		
Perforations	62	24.90
Central	60	24.10
Marginal		
Attic	Nil	
Postero-superior	2	0.80
Secretory Otitis Media	18	7.23
Chronic Adhessive Otitis Media	6	2.41
Tympanosclerosis	1	0.40
Acute Otitis Media	2	0.80
Sensory Neural Hearing Loss	4	1.61
Moderate Deafness		
Wax	3	1.21
Otomycosis	1	0.40
Perforations	11	4.42
Central	7	2.81
Marginal		
Attic	3	1.21
Postero-Superior	1	0.40
Secretory Otitis Media	2	0.80
Chronic Adhessive Otitis Media	1	0.40
Sensory Neural Hearing Loss	2	0.80

Table 5 shows the causes which were responsible of Decreased Hearing in the children for both Mild as well as Moderate and their percentage calculated. According to the findings wax (47.39 %) was the major cause responsible for mild hearing loss in children of school going age followed by Chronic Suppurative Otitis Media (24.90 %), Secreatory Otitis Media (7.23 %) and Otomycosis (7.23 %). Perforation (4.42%) was the major cause responsible for Moderate Hearing loss.

When the students were divided on the basis of sex and age it showed that there was a higher rate of hearing impairment in the lower age group and mild deafness is these children. This has no significance to their sex. In older age group of children mild deafness is more prevalent among males i.e. 21.71 percent in

comparison 15.05 percent in males. Over all percentage of mild deafness was found to be more in females as compared to males, but the incidence was equal in moderate deafness. In total, incidence of hearing in 6 – 8years group, 9 – 10 years group and 11 – 12 years group was 43.37 percent, 33.74 percent and 22.89 percent respectively. This shows incidence of decreased hearing was greater in lower age group and decreases as the age increases.

DISCUSSION

In our study we randomly selected six Schools of Jaipur and all the students of age 6 – 12 who brought back the written consent were examined. The students examined in this survey were 61.93 percent males and 38.07 percent females which was in accordance with the population of male and female children of the group of 6-12 years in this study.

Table 6: Original and revised classification of the per capita income (in Rs./month)

Social class	Original classification of the per capita income (in Rs./month)	Revised for 2013 (in Rs./month)
I	100 and above	5113 and above
II	50-99	2557-5112
III	30-49	1533-2556
IV	15-29	767-1532
V	Below 15	Below 767

In present study The BG Prasad's Classification of 1961 revised for 2013 was adopted according to Monthly Per Capita income in Rupees for socio-economic status [4].

Sharma [5] adopted a criterion for classifying the population socio-economically. He classified in 3 classes upper class (Rs. 401and above in a month), middle (Rs. 181 – 400) and lower class (Rs. 1 – 180). Same criterion was also adopted by Lodha [6] for their study.

In present study the students of Category I of socio-economic group were 21.40 percent, Category II of socio – economic group were 24.53 percent, Category III had 31.73 percent, Category IV had 19.47 Percent and 2.87 percent belonged to Category V of socio-economic group.

The deafness among the school children during the present study was 16.60 percent, out of which mild degree of deafness was present in 15.40percent of cases while 1.20 percent cases had moderate degree of deafness. In the present study the mild degree of deafness was the major contributor for deafness which tallies with the findings of Sharma [5], Ashroor [7], Narendra Lodha [6], G. Yamamah [8], Nogueira [9], Tahir Hussain [10] and S. L. Chishti [11].

The Conductive deafness constituted 96,79 percent cases while 2.41 percent were due to Sensory Neural hearing loss and 0.80 percent cases were of mixed Hearing Loss. These results coincide with the results by various authors like Kapoor [12] 95.97 percent, Sharma [5] 98.98 percent, Ashoor [7] 92.98 percent, Lodha [6] 97.62 percent, R.S. Rao [13] 81.60 percent, Maharjan and Bhandari [14] 87 percent, Tahir Hussain [10] 88.20 percent and S. L. Chishty [11] 87.10 percent.

Ashoor [7], Lodha [6] and Tahir Hussain [10] reported incidence of sensory neural loss as 0.1 percent, 3.5 percent, 2.38percent and 8.3 percent respectively in their study, whereas the percentage was 2.41 in the present study.

The analysis of hearing loss of impaired children at different frequencies showed that 231 cases (92.77 percent) had a hearing loss ranging between 26-40 dB and 13 cases (5.22 percent) hearing loss 41-55 dB , and only 5 cases (2.01 percent) were having hearing loss between 56-70dB. The proportion of children (92.77 percent) with hearing loss 21-40 dB is similar to that reported by Ashoor [7], Lodha [6], Tahir Hussain [10] and S.L. Chisti [11]. However, many children of this group of 249 have some form of ear pathology which if not treated, could cause a permanent hearing loss.

In this study it was observed that the Wax, Chronic Suppurative Otitis Media and Secretary Otitis Media (retracted tympanic membrane) were major attributors of mild deafness. These observations are in conformity with those recorded by Sharma [5], R.S.Rao [13], Nogueira [9], Tahir Hussain [10], G. Yamamah [8], Reeje Ebenezer R [15] and S. L. Chishti [11]. Chandra and Mishra [16], Kapoor [12], Ashoor [7], Lodha [6], R. Kalpana [17] and Maharjan and Bhandari [14] concluded the Chronic Suppurative Otitis Media and Secretary Otitis Media (retracted tympanic membrane) are the major causes of mild deafness. However tympanic membrane and its retraction, which were due to tonsilloadenitis and rhinosinusitis also caused deafness. There was no case of congenital or traumatic deafness.

The wax occludes the external auditory canal completely creating obstruction to sound waves in reaching the tympanic membrane. In this study 47.39 percent cases out of 504 cases of wax lead to impaired

hearing. The impacted wax was noticed in these cases occluding whole meatus leading to deafness. Wax causing defective hearing was noticed by Sharma [5] in 56.04 percent of cases, Lodha [6] in 14.28 percent, R. S. Rao [13] in 86.30 percent, Tahir Hussain [10] in 61.20 percent, G. Yamamah [8] in 9.5 percent, Reeje Ebenezer R [15] in 40.76 percent and S. L. Chishti [11] in 41.94 percent.

The perforation forms the major cause (4.42 percent - 11 cases) of moderate deafness, which are in conformity with that reported by Lodha [6].

The degree of hearing loss was considerably depending on the size and the position of perforation and also on the degree of Fixation of drum and Ossicles. The large posterior perforation may cause greater degree of hearing loss (Paperella and Shumrik, 1973). In our study out of the 73 perforation 71.79 percent were discharging while 28.21 percent were dry. The central perforations and marginal (posterosuperior and attic) perforations were 67 and 6 respectively. The audiograms were performed and out of 73 cases 62 cases were having mild degree of hearing loss and 11 had moderate hearing loss. The site of perforations and condition of ossicles, affected the areal ratio, lever ratio and preferential sound conduction mechanism leading to a mild to moderate grade of deafness.

In present study the incidence of chronic suppurative otitis media was 4.87 percent, while Chandra and Mishra [16] reported it to be 53.80 percent of cases. While R. Kalpana [17] observed incidence of Chronic Suppurative Otitis Media in 4.75 percent, Maharjan and Bhandari [14] in 12.47 percent, Tahir Hussain [10] in 12.70 percent of cases which is in confirmatory with incidence reported in the present study.

It was observed that younger age group is more affected which due to horizontal level of Eustachian tube, low resistance and prevalence of nose and throat infections the unhygienic and insanitary conditions of the low socioeconomic groups may also be the predisposing factors.

The Retraction of Tympanic Members was the next prevalent cause which is favored by the observations of Hoople [18], Armstrong [29], Nogueira [9] and Reeje Abenezer R [15]. They reported that negative pressure gives rise to hearing loss. Holborn [20] mentioned the critical period of tubal insufficiency is relatively short and extends from birth to 7 years of age. The Tensor Palati muscle is much weaker than at a later age. And longer tubal cartilage contributes to insufficiency of Eustachian tube.

In our study the incidence of Secretary Otitis Media as a cause of partial deafness is 8.03 percent. The major factors which were noted for this condition were mechanical obstruction and inflammation in nose and paranasal sinuses, tonsillitis, adenoiditis and rhinosinusitis. The other factors which act as the nidus of infection were caries of teeth. The Eustachian tube blockage due to mechanical obstruction is produced by hyperplasia of adenoids and short horizontal Eustachian tube. The resultant Eustachian obstruction leads to creation of vacuum in middle ear cavity by absorption of nitrogen and oxygen by blood vessels leading to retraction of tympanic membrane. If the condition persists then the transudation gradually develops and the space of middle ear cavity again lessens causing retraction of tympanic membrane. The retraction of tympanic membrane may lead to the formation of cholesteatoma.

Secretary Otitis Media are doubtlessly the most prevalent cause of conductive hearing impairment in children; it is especially common in allergic children and those with hypoimmune conditions, enlarged adenoids, and cleft palates. Language retardation and poor learning ability are definitely more prevalent in these children. The incidence of Secretary Otitis Media was commoner in younger age group of children and those of the low socioeconomic group because of prevalence of nose and throat problems.

In our study 7.63 percent cases of Otomycosis were the factors causing defective hearing as it occludes the auditory canal. However, Kohli [21] reported 18.2 percent, Lodha [6] in 3.57 percent and Tahir Hussain [10] in 1.60 percent cases of otomycosis causing defective hearing.

The Chronic Adhesive Otitis Media was the causative factor of partial deafness in 2.81 percent cases. Caw throne [22] found Conductive Type of deafness in similar cases.

There were 6 cases (2.41 percent) having mild to moderate grade of sensory neural deafness. 2 cases had Ototoxicity with streptomycin during treatment of tuberculosis; while 2 had a past history of mumps and in 2 cases had history of recurrent viral infection. Ashoor [7] reported the incidence of Sensory Neural Hearing Loss in 3.5 percent.

The other factor which gave rise to Conductive Deafness in 2 cases (0.80 percent) was Acute Otitis Media. This can be explained on lines of process of inflammation in middle ear cavity resulting in edema and effusion.

In the present study the younger age group (6-9 years) of children observed to have more defective hearing. Similar results were observed by Kapoor [12] and Sharma [5]

There were 28 cases having Cervical Lymphadenopathy. Of them, 13 were associated with

other chronic infection. The chronic infection included upper respiratory infections, tonsillitis, tuberculosis etc.

In present study the prevalence of upper respiratory tract infection including tonsilloadenoiditis was 18.80 percent. The prevalence of upper respiratory tract infections has also been reported by Reeje Abenezer R [15].

The other nose and throat findings like Deviated Nasal Septum (DNS) and rhinosinuitis, were more common in low socio-economic and in young age Group. The incidence of Deviated Nasal Septum and rhinosinusitis was 4.26 percent and 11.86 percent in the present observations.

In our survey the number of students who were found normal in all respects, were 680 (45.33 percent) while 820 (54.67 percent) had one or more defects. This indicated that more than 50 per cent of children examined had some sort of ear, nose and throat infections.

The variability of the problem of deafness among school going children was 31.91 percent. This shows incidence of hearing impairment vary 31.91 percent for different ages but is not much, therefore it can be said that deafness prevail in all ages of school children equally.

CONCLUSION

In our study of 1500 school children, all the students of 6 years to 12 years of age in class 1st to 6th were examined for hearing and other E.N.T diseases from 6 different schools of Jaipur. The most prevalent external ear disease was impacted wax, present in 33.73 % of children. Eustachian tube dysfunction without middle ear effusion was the most common middle ear disease (10 %), followed by chronic suppurative otitis media (4.87%), acute otitis media (1.40%). Hearing impairment was detected in 16.60 percent of cases. Majority of cases were of mild deafness (15.40 percent), out of which majority of cases (96.79 percent) had conductive hearing loss. In older age group (11 – 12 years) of children mild deafness is more prevalent among males (21.71 percent) and (15.05 percent) in females. Over all percentage of mild deafness is found more in females as compared to males, but the incidence is equal in moderate deafness. In total, incidence of hearing in 6 – 8years group, 9 – 10 years group and 11 – 12 years group was 43.37 percent, 33.74 percent and 22.89 percent respectively. This shows incidence of deafness decreased as child grows up. Other E.N.T. findings were deviated nasal septum in 4.26 % of cases, rhinosinusitis in 11.86 %, upper respiratory tract infection with tonsil and adenoids in 18.80% and cervical lymphadenitis in 1.86 % of cases respectively. Thus regular E.N.T. check up and Hearing assessment should be added in school health programme and primary ear care education should be given to teachers, students and parents, which can prevent these vulnerable children from developing hearing impairment.

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