Prevalence of Hearing Loss among Primary School Children in El-Mahalla El-Kubra District, Egypt

Original Article

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ABSTRACT

Objectives: Hearing is a critical sense that affects the ability of persons especially children to communicate with others, share their thoughts and opinions, and participate in activities. In this descriptive cross-sectional study, school age children aged 6-12 years old in El-Mahalla El-Kubra district of Egypt were screened for hearing loss.

Patients and Methods: Three hundred children were involved in this study from one rural and another urban primary school in El-Mahalla El-Kubra district of Egypt. All children were screened for hearing loss at their schools during the academic year 2017/2018. The positive cases were referred for basic audiological evaluation at El-Mahalla El-Kubra general hospital. All children were submitted to history taking through questionnaire, otoscopic examination, tympanometry and pure tone audiometry.

Results: In this study, the prevalence of hearing loss was (9.2%) of the studied children. The most common type of hearing impairment was conductive hearing loss due to Eustachian tube dysfunction (4.7%) and secretory otitis media (3.3%).

Conclusion: Recurrent ear infection is the commonest cause of hearing loss in children and hearing evaluation of school children is useful to avoid the impact of permanent hearing loss on scholastic achievements.

Key Words: Hearing loss in children, otitis media in children, prevalence of hearing loss, scholastic underachievement.

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INTRODUCTION

Hearing loss has a significant impact on the individual and the society. The problem is even greater for children, since normal hearing is the main source for the acquisition of language, speech and cognitive abilities[1]. Undetected hearing loss in infants and young children compromises optimal language development and personal achievement. Without appropriate opportunities to learn language, children fall behind their hearing peers in language, cognition, social-emotional development, and academic achievement[2,3].

The worldwide statistics by World health organization (WHO) showed that Over 5% of the world's population (466 million person) have hearing loss, 432 million of them are adults and 34 million are children. Most of them live in low- and middle-income countries. Sixty percent of hearing loss in children is due to avoidable causes. Almost one billion People whose age between 12–35 years old are at risk of hearing loss as a result of noise exposure[4].

In Egypt, a national house held survey was done about the prevalence and causes of hearing impairment among 6 randomly selected governorates (Alexandria, Marsa-Matrouh, Dakahlia, Minia, Luxor and North Sinai). Screening of 4000 person for hearing loss was done. The prevalence of hearing impairment was 16.0% of the population of Egypt. This means more than 13 million people across all age groups. The prevalence was high in children up to 4 years old (22.4%). The commonest cause was Otitis media with effusion (30.8%)[1]. A study about the prevalence and risk factors of hearing impairment among primary-school children in Shebin El-Kom district, Egypt showed that the prevalence of hearing loss was 20.9%. The rate of hearing loss did not differ across the schools. The most common type was conductive hearing loss of minimal to mild severity[5].

The present study is cross-sectional prospective study for estimation of the prevalence of hearing loss among children in urban and rural primary schools in El-Mahalla El-Kubra district.

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PATIENTS AND METHODS:

This is a descriptive cross-sectional study that was performed in the urban and rural primary schools in El-Mahalla El-Kubra district during the academic year 2017/2018.

2.1- Subjects:

300 male and female children were randomly selected with age between 6-12 years from one rural and another urban primary school in El-Mahalla El-Kubra district of Egypt were screened for hearing loss at their schools during the academic year 2017/2018. The positive cases who failed screening (28 child) were referred for basic audiological evaluation at El-Mahalla El-Kubra general hospital.

Inclusion criteria: 1. Primary school children aged 6–12 years old. 2. Male and female children.

Exclusion criteria: Uncooperative children

This study was performed after fulfilling the requirements of the ethical committee at the ENT Department and the approval of the Institutional Research Board of the Faculty of Medicine in our University. Written informed consent was also obtained from parents of all the children who participated in this study. All parents of children in study presented written informed consent in accordance with the Declaration of Helsinki.

2.2- Equipment:

A. All the included children were screened by: • Audiometer, Madsen Xeta EN60645 in a suitable classroom. • Immittance measures, AT235 Interacoustics.

B. The referred cases were tested by audiometer, AD 629 Interacoustics in a sound treated room.

C. Screening environment: The screening classroom was chosen based on: It was reasonably quiet. It had limited visual distractions. It was away from stairs, street noise, cafeterias, and play areas. It had 3' x 4' table, two chairs and an electrical outlet. The child was seated in a way not facing the examiner or the audiometer.

All children involved in this study were submitted to:

a. History taking through a questionnaire. The questionnaire fulfilled by parents of children in study included questions that covers child name, age, gender, child residence and school grade, parent occupation and education, average family income, family number, if the family has TV, computer or internet, consanguinity, family history of hearing loss, prenatal, natal, postnatal history and developmental history.

b. Otoscopic examination.

c. Immittance measures including: tympanometry using probe Tone of frequency 226 Hz done at varying pressures that ranging from +200 to –400 mmH2O with determination of presence of ipsilateral acoustic reflex using pure tones of frequency 1000Hz and intensity 100dB. Tympanometry referral criteria are: 250 daPa, tympanometric width, 0.2 mmhos static compliance or negative pressure of >-200 daPa to -400 daPa[6].

d. Pure tone audiometry: presence or absence of air conduction sensation at 25 dB HL for an octave frequency ranging from 500 to 4000 Hz. A sweep at 500, 1000, 2000, and 4000 Hz at 25 dB HL. Each tone is presented for 1 to 3 seconds. Three tones of each frequency are given per ear. A "Pass" means a response to 2 out of 3 tones. A "Refer" means no response at any single frequency in either ear.[7].

The referred cases were submitted to: 1. Otoscopic examination. 2. Immittance measures (AT235 Interacoustics) including: tympanometry using probe Tone of frequency 226 Hz done at varying pressures that ranging from +200 to –400 mmH2O with determination of presence of ipsilateral acoustic reflex using pure tones of frequency 1000Hz and intensity 100dB. 5. Pure tone audiometry (AD 629 Interacoustics) in a sound treated room: air conduction threshold for an octave frequency ranging from 250 to 8000 Hz and bone conduction threshold for an octave frequency ranging from 500 to 4000 Hz. 6. Speech audiometry including: speech reception threshold by using Arabic bisyllabic words and word discrimination score by using Arabic phonetically balanced words[8].

3.4 Statistical analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 22.0. • Quantitative data were described using mean, standard deviation for parametric data after testing normality using Kolmogrov-Smirnov test. • Qualitative data were showed by number and percent. Chi-Square test for comparing 2 or more groups with each other. • Binary logistic stepwise regression analysis was applied for prediction of independent variables of binary outcome. Predictors of significant importance in the Univariate analysis were applied into regression model using forward Wald method /Enter in addition to calculation of the adjusted odds ratios and their 95% confidence interval. • Significance of the obtained results was judged at the (0.05) level. R.

RESULTS:

This was descriptive cross-sectional study included 300 randomly selected children from one rural (140 child) and another urban (160) primary schools in El-Mahalla El-Kubra district of Egypt. The calculated sample size of the study was 245 participants, using the following formula[9]: n = Z2 * P* (1-P)/ d2, where Z = 1.96 for 95% confidence level, p = expected prevalence (main outcome of your study), d = precision (Margin of error) = 0.05. The sample size was increased to 300 participants to compensate for drop outs or protocol failures with incomplete data.

4.1 Socio-demographic data:

Socio-demographic characteristics of the studied children according to the data of questionnaire was mentioned in (Table 1). The mean age of the studied group is 8.79 years with standard deviation 1.7 years. Socio-economic status was classified according to the family income (sufficient or not), size (more or less than 5) and their possession of television and computer. Children with low socioeconomic status have risk of hearing impairment 3.42 more times than those with average socioeconomic status. Children whose fathers are professional workers have risk of hearing impairment 6.29 more times than children whose fathers are employees. Children whose mothers are housewives have risk of hearing impairment 1.32 more times than children whose mothers are manual workers. Children who were delivered by vaginal method have risk of hearing impairment 4.16 more times than those who were delivered by cesarean section surgery.

4.2 Medical history of the studied children:

Seventy-six of the studied children were delivered by cesarean section surgery, 99.7% of them were delivered of average body weight. 15% of the studied group have history of neonatal jaundice. 0.7% of studied children have history of postnatal fever that required hospitalization. 2.3% of the studied children have history of delayed language development. 5% of the studied group have positive family history of consanguinity and hearing loss. 7% of the studied children have recurrent ear infections.

4.3 Pure tone audiometry:

From total studied children (300), 28 child failed screening and referred for diagnostic audiometry. 272 child showed normal PTA results and 28 child was abnormal. Of the 28 child who showed abnormal PTA, 14 child (50%) was abnormal at 500 Hz, 15 child (53.6%) at 1 KHz, 12 child (42.9%) at 2 KHz, 11 child (39.3%) at 4 KHz and finally 15 child (53.6%) has more frequency affected.

4.4 Immittance measurements:

Ninety two percent of the studied children showed type (A) tympanograms, 3.3% showed type (B) and 4.7% showed type (C). 53.7% of the studied group have preserved acoustic reflex at 1000 Hz.

According to the results of PTA and immittancemetry, out of the 28 children with abnormal results, 14 child (4.7%) diagnosed as Eustachian tube dysfunction, 10 children diagnosed as otitis media with effusion and 4 children diagnosed as SNHL.

Table (2) showed history distribution according to hearing impairment among studied children. (Table 3) predictors of hearing impairment among studied children.

Table 1: Socio-demographic characteristics according to hearing impairment among studied children.

	N =300	Hearing impairment N=28	test of significance	OR (95% CI)
Age/years				
6-<9 years (R)	161	12(42.9)	$\chi2$=1.45	1
9 years or more	139	16(57.1)	p=0.23	1.62 (0.74-3.54)
Sex				
Male(R)	128	15(53.6)	$\chi2$=1.50	1
Female	172	13(46.4)	p=0.22	1.62 (0.74-3.54)
Socio economic status				
Low	68	13 (46.4)	$\chi2$=9.95	3.42 (1.53-7.60)
Average(R)	232	15 (53.6)	p=0.002*	1
Residence				
Rural	140	17 (60.7)	$\chi2$=2.45	1.87 (0.85-4.15)
Urban (R)	160	11 (39.3)	p=0.12	1
Father education				
Illiterate	0	0		

Primary or secondary education	31	1 (3.2)	χ2=1.52	3.35
University or higher education (R)	269	27 (10.0)	P=0.22	(0.44-25.53)
Father occupation				
Manual worker	9	0(0.0)		Undefined
Professional worker	62	16(57.1)	χ2=25.34	6.29(2.79-14.19)
Employee (R)	229	12(42.9)	*p<0.001**	1
Mother education				
Illiterate	0	0		
Primary or secondary education	40	7(17.5)	χ2=3.64	2.41(0.95-6.12)
University or higher education (R)	260	21(8.1)	*P=0.06*	
Mother occupation				
Manual worker (R)	11	1(3.6)		1
Professional worker	25	6(21.4)		3.16(0.33-29.99)
Employee	127	5(17.9)	χ2=11.62	0.41(0.04-3.86)
Housewife	137	16(57.1)	*p=0.009**	1.32(1.16-11.02)
Family size				
≤5	158	17(60.7)	χ2=0.80	1.44(0.65-3.18)
>5(R)	142	11(39.3)	*p=0.37*	1
Labor				
Cs (R)	228	14(50.0)	χ2=11.45	1
Vaginal	72	14(50.0)	*p=0.001**	4.16(1.88-9.19)

Table 2: History distribution according to hearing impairment among studied children.

	n=300	Normal n=272	Hearing impairment n=28	test of significance	OR (95% CI)
Birth weight					
LBW	1	0(0.0)	1(3.6)	χ2=9.74	Undefined
Average	299	272(100.0)	27(96.4)	*p=0.002**	
Positive Neonatal Jaundice	45	31(11.4)	14(50.0)	χ2=29.67 *p<0.001**	7.77(3.39-17.82)
Positive post-natal history	2	1(0.4)	1(3.6)	FET *P=0.18*	10.04(0.61-165.05)
Delayed Language development	7	3(1.1)	4(14.3)	FET *P=0.002**	14.9(3.2-70.7)
History					
Positive family hx of consanguinity	15	10(3.7)	5(17.9)	χ2=10.75 *p=0.001**	5.69(1.79-18.08)
Positive family history of hearing loss	15	10(3.7)	5(17.9)	χ2=10.75 *p=0.001**	5.69(1.79-18.08)
Recurrent ear Infection	21	5(1.8)	16(57.1)	χ2=119.3 *p<0.001**	71.2(22.35-226.86)

Table 3: predictors of hearing impairment among studied children.

	B	P	AOR (95% CI)
Socio economic status			
Average(R)	1.26	0.28	3.5(0.35-36.12)
Low			
Father occupation			
Employee (R)			Underfined
Manual worker	21.62	0.99	
Professional worker	20.02	0.99	
Mother occupation			
Manual worker (R)			
Professional worker	2.86	0.13	17.4(0.43-711.99)
Employee	1.001	0.59	2.71(0.07-106.38)
Unemployed	0.59	0.72	1.81(0.07-45.01)
Labor			
Cs (R)			
Vagina	1.98	0.01*	7.3(1.39-38.15)
low birth weight			
LBW			
Average	22.68	0.99	Underfined
Positive neonatal jaundice	1.58	0.07	4.88(0.91-26.27)
Delayed language development History	3.20	0.02*	24.62(1.51-402.51)
Positive Family hx of Consanguinity	2.57	0.08	13.13(0.72-239.23)
Positive family history of hearing loss	2.85	<0.001*	17.35(4.27-70.45)
Recurrent ear infection	6.64	<0.001*	62.9(22.32-216.24)

DISCUSSION

The results of this study proved that the commonest type of hearing loss was conductive hearing loss and we agreed in this point with Taha *et al*.[5] who found that conductive hearing loss was the most common type of hearing loss among the tested group in Shebin El-Kom district of Egypt. But they differ from the present study about the prevalence of hearing loss which was in their study (20.9%) versus (9.2%) of the sample group in the current study.

Abdel Rahman *et al*.[10] found that otitis media and history of ear disease treatment are risk factors for hearing impairment as the present study proved. They also found that history of fever hospital admission, history of ear surgery and intramuscular injection of antibiotics are significant risk factors of hearing loss.

The current study also agreed with Yamamah *et al*.[11] who achieved that the commonest cause of hearing loss was secretory otitis media and the commonest type of hearing loss was conductive hearing loss among the screened group in South Sinai of Egypt.

Abdel Rahman *et al*.[10] found that the prevalence of hearing loss was (22.2%), mostly sensorineural hearing loss in Ismailia city of Egypt while the present study varied from them as it proved that the prevalence of hearing loss was (9.2%) and the commonest type was conductive hearing loss.

In this study, positive history of consanguinity was significant predictor of hearing impairment. It agreed in that point with Zakzouk *et al*.[12] who showed that positive family history of consanguinity demonstrated a marked adverse effect on the incidence of hereditary hearing loss and also proved that the incidence of hereditary hearing loss is higher in developing countries than developed countries.

Taha *et al*.[5] agreed with the present study in some points. They proved that the most important predictors for hearing loss were otitis media and low socioeconomic status as this study found. But they varied from the current study in other points. They found that household smoking and postnatal jaundice were important predictors for hearing loss while this study found that delayed language development

and family history of hearing loss were significant predictors of hearing impairment. In addition, parent's occupations which reflected on socioeconomic status and vaginal mode of delivery associated with complication during labor may play as predictors for hearing loss

This study also agreed with Abdel Hamid *et al*.[1] who found that otitis media with effusion was the commonest cause of hearing loss. They also showed that there are no significant sex differences as the present study proved.

In the present study, positive history of neonatal jaundice represented an important risk factor of hearing impairment in 50% of the studied children. This study agreed with Cándido Corujo-Santana *et al*.[13] in this point as they proved that hyperbilirubinemia at birth was a risk factor associated with hearing loss that is usually linked to other factors that might have an effect on hearing synergistically.

Olds and Oghalai[14] agreed with the present study as they showed that the auditory pathway is very sensitive to hyperbilirubinemia which causes damage primarily within the brainstem and cranial nerve VIII. Permanent hearing loss could result from only moderately elevated serum bilirubin levels.

CONCLUSION

Recurrent ear infection is the commonest cause of hearing loss in children and hearing evaluation of school children is useful to avoid the impact of permanent hearing loss on scholastic achievements.

RECOMMENDATIONS

1- Regular scholar screening especially at the start of each stage (primary, preparatory and secondary stages) to identify children with genetic late onset hearing loss.

2- Screening programs should provide a family approach to encourage families to make responsible choices for their hearing-impaired children.

3- Evaluation of the effect of hearing loss on the scholastic achievements of the hearing-impaired children.

CONFLICT OF INTEREST

There are no conflicts of interest.

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