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Characteristics and Factors Associated with Hearing loss (Deafness) in Children Attending the Medical City Hospital, Baghdad, Iraq

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Abstract

Background Hearing loss (HL) is one of the commonest and neglected childhood disabilities. According to the World Health Organization (WHO), most of childhood hearing impairment is preventable. Studies showed that 31% of hearing impairment cases are caused by prenatal and postnatal infections, 17% are birth-related causes, 4% are ototoxic medications and about 8% related to other causes such as maternal substance abuse.

Objective To review factors associated with HL in a sample of children attending the Medical City Hospital in the Pediatrics Outpatient Clinic and Auditory Clinic; including congenital, early, or late onset and to investigate risk factors associated with HL.

Methods A cross sectional study, included children <15 years with hearing loss attending the Medical City Hospital in the Pediatrics Outpatient Clinic and Auditory Clinic during the period from the 1st of July 2021 till the 30th of October 2021.

Results One hundred and one children with HL; 65.3% of them were males, 71.3% were preschoolers, 60.4% of them had family history of deafness, Severe deafness was found among 45.5% of children. Management was by Cochlear implantation for 60.4% of them and hearing aid for the rest. Causes of deafness were unknown in 39.6% of children, congenital among in 37.6%, acquired in 15.8% and mixed causes in 6.9%.

Conclusion Hearing impairment is severe deafness in most of the children included in this study. Family history, congenital infections and otitis media were the major causes of hearing impairment. Finally, cochlear implant was the management of choice in the majority of these children.

Keywords Hearing loss, cochlear implant, otitis media

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List of abbreviations: CDC = Center of Disease Control /Atlanta/USA, CMV = Cytomegalovirus, HL = Hearing loss, PTA = Pure tone audiometry, TORCH = Toxoplasma gondii, other agents, such as Treponema pallidum, Varicella zoster virus, Parvovirus B19, and human immunodeficiency virus, Rubella, Cytomegalovirus

Introduction

Childhood hearing loss (HL) is a significant cause of disability worldwide, 466-million persons are living with HL and about 34 million of them are children. It is estimated that by the year 2050, over 900 million persons will suffer from hearing impairment if the current trend continues [(1)].

A child is said to have HL if he/she was not able to hear. HL could be mild, moderate, severe, or profound. It can affect one ear or both ears, and leads in the future to difficulty in hearing, speech or loud sounds. Hard of hearing refers to patients complaining of HL ranging from mild to severe [(2)]. Children who are hard of

hearing are usually able to communicate through spoken language and later on can benefit from hearing aids, cochlear implants, and/or other assistive devices. 'Deaf' children mostly suffer profound hearing impairment, which implies very little or no hearing. They often get benefit from sign language for communication [2,3].

HL is one of the commonest and neglected childhood disabilities because of its gradual onset, often painless and physically hidden nature. The parents usually complain only of behavioral problems, like frequent requests, carelessness, improper responses to instruction, talking too loud and confusion [4]. However, these behavioral complaints are subjective, and are usually ignored by teachers and parents, who consider that these children have no hearing problems [5].

According to the World Health Organization (WHO), most of childhood hearing impairment is preventable; studies showed that 31% of hearing impairment cases caused by prenatal and postnatal infections, 17% are birth-related causes, 4% are ototoxic medications and about 8% related other causes such as maternal substance abuse [6,7].

In children, disabling hearing impairment affects speech and language development and affects children's educational and vocational performance. Furthermore, it causes difficulty in obtaining, performing, and keeping a job, also, stigma, feelings of isolation, and depression, coupled with the poverty, and poor health that create a huge social and economic burden on society worldwide. Without suitable interventions, hearing impairment is a barrier to both education and social integration. These consequences can be reduced by early detection with appropriate audiological and speech interventions [8,9].

Many studies have been done among children and adolescents to assess the prevalence of hearing problems and its associated factors [10], nevertheless, there are great variations in these studies' findings. This demonstrates the demand for a comprehensive investigation of the burden of hearing problems to inform policymakers, program planners, care providers, in addition to stakeholders to serve more efforts on childhood hearing problem especially in developing countries [11,12].

This study aimed to describe risk factors associated with HL in children attending Medical City Hospital in Baghdad, Iraq during the period from 1st of July 2021 to 30th of October 2021, including congenital, early, or late onset hearing loss. Risk factors associated with hearing impairment will be investigated as a secondary aim.

Methods

Study design and sampling

A cross sectional study, included 101 children <15 years old with HL who attended Pediatrics Outpatients Clinic and Auditory Clinic in the Medical City Hospital during the period from 1st of July to 30th of October 2021. The inclusion criteria included those with hearing/deafness problems; for 2 consecutive months, 2 days/week, 5 hours/ day. While exclusion criteria: children admitted to the wards or emergency units for other reasons.

Data collection and instrument

A questionnaire paper was filled by the researcher. It includes the following data:

1- Sociodemographic and clinical features: (Age, gender, parents' job, parents' education, family history, consanguinity, degree of kinship.
2- Diagnosis: First and current chief complaints, time of onset of the illness, current management.
3- Causes of HL (congenital and/or acquired).

Ethical approval

This study was approved by Ministry of Health, Medical City Directorate, and Medical city Hospital Ethics Committee and the requirement for informed consent was waived by the Ethics Commission due to the observational nature of the study. Informed consents were taken from parents.

Statistical analysis

Microsoft Excel 2010 and IBM statistical package for social sciences (SPSS) version 24 were used for data entry, management, and analysis. Descriptive analyses of the variables were expressed as frequencies and percentage for categorical data. While mean of standard deviation was used for quantitative data that is normally distributed, represented by figures and tables. To compare qualitative variables, we utilized the chi-square test, and we used $P<0.05$ to determine statistical significance.

Results

This study included 101 children with hearing loss. Males formed 65.3% of patients while females formed 34.7%. Preschool children (3-5 years) formed 71.3%, while school age children (6-12 years) formed 18.8%, Employed fathers formed 53.5%, 78.2% of them with secondary school education or less. Employed mothers formed 12.9%, and 80.2% of them with secondary school education or less. Parents' consanguinity formed about 86.1% with family history of deafness among 60.4%. Diagnosis of hearing problem was done at 1st year of life among 64.4%. Severe deafness was founded among 45.5% of children while profound deafness was among 43.6%. Deaf children were managed at diagnosis for first time by Cochlear implantation for 60.4% of them, hearing aid for the rest, 39.6%. Reasons behind current children's visit were for programming Cochlear Implants, 40.6%; for cochlear implant maintenance, 7.9%; for pure tone audiometry PTA, 19.8%; and for rehabilitation of hearing aid, 31.7%. Causes of deafness were unknown among 39.6%, congenital among 37.6%, acquired among 15.8%, and mixed causes (congenital and acquired causes) among 6.9%. Other features are shown in table 1.

Table 1. Sociodemographic features of children with hearing loss

Sociodemographic features		N	%
Gender	Male	66	65.3
	Female	35	34.7
Age/ Years	< 3 years	10	9.9
	Preschool age (3-5 years)	72	71.3
	school age (6-12 years)	19	18.8
Father Occupation	Employed	54	53.5
	Not employed	47	46.5
Father Education	> 2ndary school	22	21.8
	=<2ndary school	79	78.2
Mother Occupation	Employed	13	12.9
	Not employed	88	87.1
Mother Education	> 2ndary school	20	19.8
	=<2ndary school	81	80.2
Consanguinity	Positive	87	86.1
	Negative	14	13.9
Family History	Positive	61	60.4
	Negative	40	39.6
Age at diagnosis	< 1 year old	16	15.8
	1st year	65	64.4
	2nd year	11	10.9
	≥3rd year	9	9.0

Figure 1 shows that severe deafness was found among 45.5% of children while profound deafness was among 43.6%. Deaf children were managed at diagnosis for first time by Cochlear implantation for 60.4% of them, hearing aid for the rest, 39.6%.

Reasons behind current children's visit were for programming cochlear implants, 40.6%; for cochlear implant maintenance, 7.9%; for pure tune audiometry (PTA), 19.8%; and for rehabilitation of hearing aid, 31.7%. Causes of deafness were unknown among 39.6%, congenital among 37.6%, acquired among 15.8%, and mixed causes (congenital and acquired causes) among 6.9%.

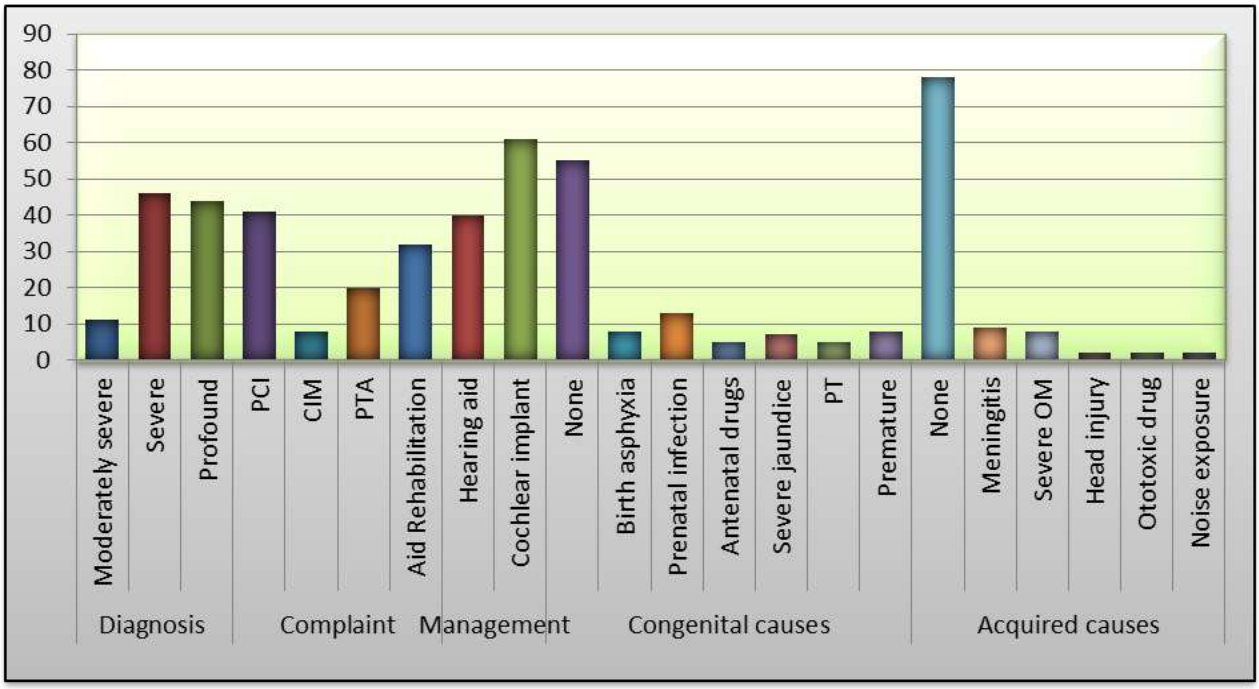

Figure 1. Clinical features of children with hearing loss

Table 2 shows sociodemographic association with different diagnosis. A significant association was founded between severe deafness with preschool age (P<0.05).

Table 3 shows association of causes and management with different diagnosis. A significant association was founded between severe deafness and management with cochlear implant (P<0.05), and between profound deafness with otitis media and noise exposure, P=0.032.

Distribution of studied groups according to different causes was shown in table 4. There was a significant difference between unknown cause of deafness and positive family history, P<0.001.

Table 2. Distribution of patients according to sociodemographic features and different diagnosis

Parameter		Moderately severe deafness		Severe deafness		Profound deafness		P value
		N	%	N	%	N	%	
Gender	Male	7	10.6	27	40.9	32	48.5	0.38
	Female	4	11.4	19	54.3	12	34.3	
Age Group	< 3 years	3	30.0	4	40.0	3	30.0	0.001
	Preschool age (3-5 years)	2	2.8	38	52.8	32	44.4	
	school age (6-12 years)	6	31.6	4	21.1	9	47.4	
Consanguinity	Positive	11	12.6	40	46.0	36	41.4	0.29
	Negative	0	0.0	6	42.9	8	57.1	
Family History	Positive	8	13.1	27	44.3	26	42.6	0.67
	Negative	3	7.5	19	47.5	18	45.0	

Table 3. Distribution of studied group according to different diagnosis

Parameter		Moderately severe deafness		Severe deafness		Profound deafness		P value
		N	%	N	%	N	%	
Management	Hearing aid	11	27.5	13	32.5	16	40.0	<0.001
	Cochlear implant	0	0.0	33	54.1	28	45.9	
Congenital history	None	6	10.9	28	50.9	21	38.2	0.56
	Birth asphyxia	1	12.5	5	62.5	2	25.0	
	Prenatal infection	2	15.4	4	30.8	7	53.8	
	Antenatal use of drugs	0	0.0	3	60.0	2	40.0	
	Severe jaundice during 1st 24 hours of birth	2	28.6	2	28.6	3	42.9	
	Toxemia during pregnancy	0	0.0	2	40.0	3	60.0	
	Premature/low birth weight	0	0.0	2	25.0	6	75.0	
Acquired causes (diseases-disorders)	None	11	14.1	30	38.5	37	47.4	0.032
	Meningitis	0	0.0	8	88.9	1	11.1	
	Severe OM	0	0.0	7	87.5	1	12.5	
	Head injury	0	0.0	1	50.0	1	50.0	
	Ototoxic drug	0	0.0	0	0.0	2	100	
	Noise exposure	0	0.0	0	0.0	2	100	

Table 4. Distribution of studied group according to different causes

Parameter		Unknown		Congenital		Acquired		Congenital and acquired		P value
		N	%	N	%	N	%	N	%	
Gender	Male	25	37.9	27	40.9	9	13.6	5	7.6	0.71
	Female	15	42.9	11	31.4	7	20.0	2	5.7	
Age Group	< 3 years	5	50.0	4	40.0	0	0.0	1	10.0	0.27
	Preschool age (3-5 years)	24	33.3	30	41.7	14	19.4	4	5.6	
	school age (6-12 years)	11	57.9	4	21.1	2	10.5	2	10.5	
Consanguinity	Positive	37	42.5	33	37.9	11	12.6	6	6.9	0.14
	Negative	3	21.4	5	35.7	5	35.7	1	7.1	
Family History	Positive	34	55.7	20	32.8	2	3.3	5	8.2	<0.001
	Negative	6	15.0	18	45.0	14	35.0	2	5.0	

Discussion

Early childhood relationships and interactions with the environment influence social acceptance and a child's ability and skills to form social relationships later in life [13]. These skills are mainly acquired through hearing and talking, the negative consequences of delayed diagnosis for children with HL will affect language, cognitive, and social-emotional skills particularly impaired, also it will delay access to early intervention programs [14].

According to the Center of Disease Control /Atlanta/USA (CDC), about 2 to 3 out of every 1,000 children in the United States are born with a detectable level of hearing impairment in one or both ears [15]. The current study included 101 children with HL, the majority were males, preschoolers, parents' consanguinity formed about 86.1% with family history of deafness among 60.4%, our figure is much higher than the CDC numbers, this is maybe by due to the type of our society with high consanguineous marriages, and the fact that our study was held in a specialized center for cochlear implant.

This is agreed with a retrospective, observational study of newborns in 2010 in Spain that found the percentage of children with a family history and HL was (3.2%), which is higher than expected in the general population [16].

Severe deafness in this study was found among less than half of children while profound deafness was among lesser percentage (43.6%). Cochlear implantation was the management of choice for 60.4% of them, hearing aid for the rest. So, and as a result, visiting for programming cochlear implants and maintenance where the major cause for visit to the hospital. This is reported also by The Non Communicable Disease Control approximately 736,900 cochlear implants have been implanted worldwide by December 2019. In the United States, roughly, 65,000 devices had been implanted in children [17].

This could be understood as management of HL is mainly influenced by the nature, the bilaterally, the severity, the onset and age at diagnosis. Severe to profound bilateral Sensorineural hearing loss can be managed by cochlear implantation weather unilateral or bilateral if picked up at early age of the child, while mild to moderate bilateral hearing loss are easier to manage with conventional hearing aids [18].

In our study, causes of deafness were unknown in the largest percentage, one third of them had mixed cases congenital and acquired, 6.9% of them had prenatal infection (TORCH) (*Toxoplasma gondii*, other agents, such as *Treponema pallidum*, *Varicella zoster* virus (VZV), Parvovirus B19, and human immunodeficiency virus (HIV), Rubella,

Cytomegalovirus (CMV)), *Herpes simplex* virus (HSV)) and birth asphyxia were common congenital causes of deafness, while meningitis and severe otitis media were most common acquired causes among same age group. This high percentage of unknown causes are probably due to the cost of the genetic analyses required, lack of awareness about many prenatal infections.

A recent survey by CDC reported that genes are attributed for hearing impairment among 50% to 60% of children presented with HL. About 20% of infants with genetic HL come with accompanied "syndrome" (Down syndrome or Usher syndrome) [15]. on the other hand, maternal infections during pregnancy, environmental causes, and some events after birth are responsible for hearing problems among about 30% of children with HL. It is also found that congenital CMV infection during pregnancy is a common preventable risk factor among children. Unfortunately, 14% of those exposed to CMV during pregnancy develop sensorineural HL. A health styles survey by CDC in 2005 reported that only 14% of female participants had heard of CMV and had knowledge regarding other TORCH infections [19].

Concerning acquired causes, another study included reports of registered hearing aids devices of the United States Food and Drug Administration in December 2019 demonstrated that five out of six children experience ear infection (otitis media) by the time they are 3 years old. In many developing regions, middle ear disease abounds and often is of the dangerous suppurative type. Certain populations had intermediate, with acute suppurative and chronic otitis media being almost endemic, yet rarely cholesteatomatous [20].

The present study found that preschool age (3-5 years) shows a significant association with severe deafness and cochlear implant as management, another significant association was founded between severe deafness with preschool age and management with cochlear implant, and between profound deafness with otitis media and noise exposure.

This is disagreed with the results of a study involving a population-based data that collected children with HL from 2003 to 2013, in which the multivariate analysis showed no statistically significant relationship between risk factors examined by the researchers (TORCH, family history, syndromes, and postnatal infections) and the probability of the presence of progressive HL. However, the presence of congenital anomalies was inversely associated with progressive hearing impairment [21]. Providing that this study was held in a specialized center of hearing problems and cochlear implants, comparison to population studies may not provide a full picture of the variability among those studies worldwide.

Without population-based screening, it is difficult to diagnose whether HL occurred congenitally, in neonatal period, or during early childhood [23]. In our country, accurate information and registration on the progression of HL is also difficult to obtain due to limited data on hearing loss onset. In addition to newborn screening for HL, there is a vital need to monitor under five children who are at risk of developing HL beyond the neonatal period. Also, using that data in many countries in early hearing detection and Intervention programs, campaigns and care had provided essential services to these children in need and their families during COVID-19 [22,24].

In conclusion, hearing impairment in children in this study is of the sever deafness in most of them and cochlear implant was the management of choice in the majority. Family history, congenital infections and otitis media were the major causes of hearing impairment.

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Author contribution

Dr. Qasim: study design, data collection. Dr. AbdulKareem: writing, data-analysis, Dr. Issa: review and editing.

Conflict of interest
None.

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