



Frequency of Sensorineural Hearing Loss among Children with Pyogenic Meningitis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To find out the frequency of sensorineural hearing loss among children with pyogenic meningitis.

Study Design: Cross-sectional.

Place and Duration of Study: Study was conducted at Ziauddin university hospital during the period of July 2019 to February 2020.

Methodology: About 96 participants were enrolled in the study between the age group of one month up to 12 years. Patients were included on the basis of clinical presentation and laboratory findings of pyogenic meningitis. An expert audiologist performed the brainstem evoked response audiometry test before discharging the patient from the hospital. For data analysis SPSS version-20 was used. All the quantitative variables were calculated as mean with standard deviation while qualitative data were presented as frequency and percentages. To find out association between variables, the Mann Whitney U-test and chi-square test was applied while P-value ≤ 0.05 was considered as significant.

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Results: Mean age with standard deviation was 6.8 ± 2.3 . Majority of the study participants were boys (57%). The frequency of sensorineural hearing loss was 17%. It was more among females than their male counter parts that was 64.7% and 35.3% respectively but no significant association was reported. The younger age group was having higher frequency of sensorineural hearing loss (47.1%), followed by the age group of 6-8 years (29.4%) and the very small number of participants were affected from the age group of 9-12 years (23.5%) but all the age groups were having no significant association with frequency of hearing loss.

Conclusion: It can be concluded that sensorineural hearing loss is the most common complication reported among the children with pyogenic meningitis in current setup so there is a need of early evaluation of hearing problems in all patients diagnosed with pyogenic meningitis.

Keywords: Sensorineural hearing loss; pyogenic meningitis; BERA test.

1. INTRODUCTION

Meningitis is a clinical syndrome characterized by inflamed meninges. It may be caused by bacteria, virus or fungal infection [1]. Risk of pyogenic meningitis is higher among infants and about 95% of cases present during the first month of life up to 5 years of age. Pyogenic meningitis is a life threatening condition while survivors having increased risk of long term complications. Developing countries are more prone to have pyogenic meningitis with poor outcomes in comparison with the developed ones [2,3].

The most common pathogenic organisms involved in pyogenic meningitis are *group-B Streptococci* and *E.Coli* among neonates after that the *Neisseria meningitides*, *Streptococcus pneumoniae* and *Hemophilus influenza* are the most common causative organisms [4,5]. Children with meningitis having signs and symptoms including fever, poor feeding history, irritability, lethargy, headache, signs of meningeal irritation and bulging fontanell [5,6]. It is diagnosed by clinical presentation and testing the cerebrospinal fluid (CSF) of the patient that shows increased intracranial pressure, serum glucose level less than 40mg/dl, proteins more than 80mg/dl and increased leukocytes count mainly there is increase in neutrophil count [7].

There are many complication as a result of pyogenic meningitis including neurological disturbances like seizures, hydrocephalus, motor abnormalities, sensorineural hearing loss, visual problems, coma and even death in severe cases [8,9]. Among all complications the sensorineural hearing loss is the most common one and can lead to permanent deafness. Sensorineural hearing loss is the common complication of

meningitis caused by pneumococcus infection. Among children it is the leading cause of behavioral issues and inappropriate development of language learning skills as hearing is an important component to develop language and speech [10]. The aim of current study is to find out the frequency of sensorineural hearing loss among children with pyogenic meningitis so that an awareness can be spread for early detection of hearing problems soon after recovery from the infection.

2. METHODOLOGY

A cross-sectional study was conducted at Ziauddin university hospital during the period of July 2019 to February 2020. Consecutive sampling technique was used. Sample size was calculated by using the OpenEpi software. About 96 participants were enrolled in the study between the age group of one month up to 12 years. Patients were included on the basis of clinical presentation and laboratory findings of pyogenic meningitis. Patients who were either having age more than 12 years or whose parents refused to give consent or having history of cerebral palsy, congenital heart disease and already diagnosed case of deafness were excluded from the study.

After taking detailed history and relevant clinical examination, patient's samples were sent for relevant investigations i.e. Blood culture and CSF examination and their results were recorded. An expert audiologist performed the brainstem evoked response audiometry (BERA) test before discharging the patient from the hospital. Same device was used on all the study participants to avoid the risk of bias.

For data analysis Statistical Package for Social Science (SPSS) version 20 was used. All the quantitative variables were calculated as mean

with standard deviation while qualitative data were presented as frequency and percentages. To find out the association between variables, the Mann Whitney U-test and chi-square test was applied while P-value ≤ 0.05 was considered as significant.

3. RESULTS

About 96 children were enrolled in the study who were having high grade fever with fits and were diagnosed as a case of meningitis on the basis of signs and symptoms as well as laboratory findings. Participants were classified into three groups on the basis of age including under 5 year-age group (33.3%), between 6-8 years of age (36.5%) and between 9-12 years of age (30.2%) but the age groups have no significant association with pyogenic meningitis. Mean age with standard deviation was 6.8 ± 2.3 . The majority of the study participants were boys (57%) and no significant association was found with the gender. On the other hand, some of the presenting symptoms reported a very strong association with the occurrence of pyogenic meningitis including fever and headache as mentioned in Table 1.

The frequency of sensorineural hearing loss was 17.7%. It was higher among females than their

male counter parts that were 64.7% and 35.3% respectively, but no significant association was reported with the occurrence of sensorineural hearing loss. Looking over the different age groups affected with pyogenic meningitis, the younger age group was having a higher frequency of sensorineural hearing loss (47.1%), followed by the age group of 6-8 years (29.4%) and a tiny number of participants were affected from the age group of 9-12 years (23.5%) but the age groups were having no significant association with frequency of sensorineural hearing loss as mentioned in Table 2.

4. DISCUSSION

Pyogenic meningitis is one of the leading cause of mortality and disability [11] so it is important to timely identify the patients who are expecting poor outcome and to plan a good management strategy for them. Pyogenic meningitis is more common among younger age group of children as is reported by number of studies [12,13] also favored by the current study. A study conducted in India reported that pyogenic meningitis is more prevalent among males as compare to females [14] and the finding is also supported by a study done in Nigeria [15]. Current study also favored this finding.

Table 1. Demographic variables of study participants and their association with pyogenic meningitis

Variables	Pyogenic Meningitis		p-value
	Yes	No	
Age groups	≤ 5 years	20	0.42
	6-8 years	16	
	9-12 years	14	
Gender	Male	31	0.32
	Female	19	
Presenting Symptoms	Fever	50	0.001
	Headache	47	0.004
	Vomiting	22	0.821
	Fits	16	0.412

Table 2. Frequency of sensorineural hearing loss and their association with demographic variables among children

Variables	Sensorineural hearing loss		p-value
	Yes n=17	No n=79	
Gender	Male	6 (35.3%)	0.357
	Female	11 (64.7%)	
Age groups	≤ 5 years	8 (47.1%)	0.628
	6-8 years	5 (29.4%)	
	9-12 years	4 (23.5%)	

There are many complications occurring as a result of pyogenic meningitis mainly affecting the central nervous system including mental retardation, developmental delay, sensorineural hearing loss, eyesight problems and motor deficit. It is noticed that sensorineural hearing loss is the most common complication of pyogenic meningitis among all other complications. Its exact mechanism among the cases of pyogenic mechanism is unknown but it is hypothesized that there is damage to the cochlea and labyrinthine system resulting in sensorineural hearing loss [16].

Looking over the frequency of sensorineural hearing loss among the cases of pyogenic meningitis it has been found that about 43% of children in Kenya with pyogenic meningitis have been reported with sensorineural hearing loss [17] while a retrospective study from United Kingdom collected data of 10 years and manifested that only 7.4% of cases underwent for audiological assessment and having sensorineural hearing loss [18], on the other hand it is about 13% prevalent among the children of pyogenic meningitis in Neherlands [19]. Reviewing the local data, a study conducted in Lahore collected samples of 175 patients with pyogenic meningitis, out of which 22% were having sensorineural hearing loss [20] while another study reported 20% children were affected with sensorineural hearing loss [21]. Current study found that about 17.7% of the children with pyogenic meningitis were reported with sensorineural hearing loss. Multiple studies reported that sensorineural hearing loss is more prevalent in developing countries because of the poor history of vaccination and increased rate of complication in cases with pyogenic meningitis.

Literature review revealed that male were predominant but found non-significant association of gender with occurrence of sensorineural hearing loss among the cases of meningitis [7,20,22]. The current study found that more females were affected but no significant association. It is also noticed that the younger age groups of children were more affected but no significant association was found between age and frequency of sensorineural hearing loss among children of pyogenic meningitis [7] and the current study favored this finding.

Higher prevalence of sensorineural hearing loss among children with pyogenic meningitis in developing countries enforce the need of an

early audiological assessment along with repeated testing when once hearing loss is detected [23]. The limitation of the study is small sample size so it is recommended to study on large scale and also to identify the organism of pyogenic meningitis which is responsible for sensorineural hearing loss.

5. CONCLUSION

It can be concluded that sensorineural hearing loss is the most common complication reported among the children with pyogenic meningitis in current setup so there is a need of early evaluation of hearing problems in all patients diagnosed with pyogenic meningitis.

ETHICAL APPROVAL AND CONSENT

The study got approval from the Ethical Review Committee of concerned hospital. An informed consent was obtained from the patient's relative or next of kin.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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