

HEARING DEFICIT AMONG HOSPITALIZED CHILDREN WITH ACUTE BACTERIAL MENINGITIS

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ABSTRACT

Background: Acute bacterial meningitis among children may result in hearing deficit. **Objective:** To determine the frequency of hearing deficit in hospitalized children with bacterial meningitis. **Methodology:** Study Design: Cross sectional study. Setting: Department of Pediatric Medicine, Services Institute of Medical Sciences / Services Hospital, Lahore. Duration: From 1st February to 30th July 2010. Patients diagnosed as bacterial meningitis were admitted in Paediatric Medicine Department of Services Hospital Lahore and included in the study. After informed consent, auditory brain stem evoked response (BERA) test was performed on all patients by a single audiologist. In this test patients were sedated and electrodes placed on patient's vertex, ear lobes and forehead. The wave forms of impulses generated at the level of brain stem (cochlear nerves, cochlear nucleus, superior olivary complex, nuclei of lateral lemniscus, inferior colliculus) were recorded and numbered in Roman numerals respectively. The outcome whether patient is deaf or not was noted and entered in pre-designed proforma. All patients received standard care for bacterial meningitis. **Results:** Two hundred and ten consecutively admitted cases of bacterial meningitis were enrolled in the study, 134(63.8%) cases were male and 76 (36.2%) were female. Out of 76 cases of hearing loss, 45 (59.3%) cases has bilateral hearing deficit and 31 (40.7%) has unilateral hearing loss. **Conclusion:** Hearing deficit developed in one third of cases. It is worth performing BERA in all patients with acute bacterial meningitis since there is a significant risk of developing sensorineural hearing loss.

Key Words: Acute Bacterial Meningitis, Sensorineural, Hearing deficit, BERA

INTRODUCTION

Meningitis is an inflammation of the leptomeninges, mainly caused by an infection.^{1,2} Acute bacterial meningitis is one of the severe infectious diseases in the childhood with significant incidence and hospital admissions.^{3,4} In neonatal age group common pathogens includes group B Streptococci and gram -ve bacilli. Beyond neonatal period it is caused by Neisseria meningitides, Streptococcus pneumonia and Hemophilus influenzae type b.⁵ Clinical features includes fever, poor feeding, headache, irritability and signs of meningeal irritation / bulging fontanel. Diagnosis is made by clinical examination and with positive findings of cerebrospinal fluid (CSF) analysis.^{6,7} The management includes antibiotics, dexamethasone and the intensive care.⁸ Complications of bacterial meningitis includes sensorineural hearing loss, recurrent seizures and mental retardation.^{9,10} This results in delayed speech, language and development so all the patients with bacterial meningitis should undergo careful audio logical assessment. Auditory brain stem evoked response or brainstem evoked response audiometry (BERA) test is a valuable test for assessing severity of hearing deficit in children with hearing impairment.¹¹

This study was conducted to determine the frequency of hearing deficit in cases of bacterial meningitis.

METHODOLOGY

This cross-sectional study was carried out in Department of Pediatric Medicine, Services Hospital & Services Institute of Medical Sciences (SIMS), Lahore, Pakistan. Patients between 2 months and 12 years of age with bacterial meningitis were enrolled in the study. These patients were diagnosed as having meningitis based on the case definition fulfilling both clinical (fever > 98.6F, convulsions, vomiting, headache, photophobia, drowsiness, neck stiffness, bulging fontanel) and laboratory (CFS profile demonstrating leucocytes >5/mm³, glucose <40 mg/dl, proteins > 80 mg/dl) criteria. Patients who were already deaf, those who were taking ototoxic drugs (aminoglycosides, chloroquin, furosemide, quinine) and those with congenital anomalies of external ear, based on clinical history and physical examination, were excluded from the study. Two hundred and ten patients were selected by non-probability, purposive sampling and informed consent was taken from the guardians after detailed explanation of the purpose of study. Brainstem evoked response audiometry (BERA) test was performed on all of the selected children by single audiologist after clinical stabilization. In this

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test, patients were sedated and electrodes were placed on patient's vertex, ear lobes and forehead. The stimulus was transmitted in the form of a click to the ear via a transducer placed in the insert earphone. The waveforms of impulses generated at the various levels of auditory pathway were recorded through electrodes over the scalp. These impulses when recorded, contain a series of peaks & troughs. The positive peaks were referred to by the Roman numeral I-VII. These peaks were labeled on basis of anatomical sites from where they originated as follows:

1. Cochlear nerves wave I&II.
2. Cochlear nucleus wave III.
3. Superior olivary complex wave IV.
4. Nuclei of lateral lemniscus wave V.
5. Inferior colliculus wave VI&VII.

These peaks occurred in the most readable form in response to click stimulus over a period of 1-10 milliseconds. Following findings suggestive of hearing deficit / deafness were recorded:

- a) Absent auditory brainstem response in the involved ear.
- b) Prolonged latency period and inter peak interval between waves.

The result whether the patient is deaf or not was recorded in a pre-designed proforma. Data was entered and analyzed by using SPSS 10. Frequencies and percentages of hearing deficit were calculated for hearing loss and risk factors.

RESULTS

Two hundred and ten cases of bacterial meningitis were included in the study, 134 (63.8%) cases were male and 76(36.2%) were female. Overall 76 (36%) cases were found to have hearing deficit. (Table I) Two age group were defined based on age, group 1(<2years = 67) and Group 2(>2years=143). In group 1, 25 cases (37.3%) were having hearing deficit while in group 2, 51(35.6%) cases showed hearing deficit. Out of total 76 cases of hearing loss in both groups, 45(59%) cases has bilateral hearing deficit (59.2%) and 31 (40.7%) has unilateral hearing loss. (Table I) Among 210 patients 93 has persistent fever after start of antibiotics and 25 (26.8%) of them develop hearing loss. 101 patients developed convulsions which were difficult to control and 50 (49.5%) among them has hearing loss. 96 patients had hypoglycorrhachia and 46 (47.9%) showed hearing deficit. (Table I)

Table I: Frequency of Hearing Loss

| Variables | No. of Patients n = 210 | Percentage |
|---|----------------------------|------------|
| Hearing deficit | | |
| Hearing deficit | 76 | 36.1% |
| No hearing deficit | 134 | 63.8% |
| Type of Loss | | |
| Bilateral hearing loss | 45 | 59.2% |
| Unilateral hearing loss | 31 | 40.7% |
| Risk Factors | | |
| Convulsions | 101 | 49.5 % |
| CSF Hypoglycorrhachia (CSF glucose < 20mg/dl) | 96 | 47.9 % |
| Prolonged fever | 93 | 26.8 % |
| CSF Cultures findings (Hearing deficit patients) | | |
| CSF Culture Positive | 42 | 55.3% |
| H. Influenza | 18 | 23.6% |
| Pneumococcus | 17 | 22.3% |
| Meningococcus | 5 | 6.5% |
| E. Coli | 2 | 2.6% |
| CSF Culture Negative | 34 | 44.7% |

However other characteristics like male gender, deep coma, raised intracranial pressure, need for prolonged antibiotic therapy, hydrocephalus, raised CSF proteins(>150mg/dl) and polymorphic count >250/mm were not significantly associated with hearing deficit. CSF cultures were positive in 87(41.6%) patients. Among 76 patients with hearing deficit, CSF cultures were positive in 42(55.2%) patients, 18(23.6%) cases of Hemophilus influenzae, 17(22.3%) cases of Streptococcus pneumoniae, 5(6.5%) cases of meningococcus and 2 (2.6%) cases of E.coli. (Table I)

DISCUSSION

Hearing loss in early life may cause inspired development impaired and lead to learning problems due to deficient language acquisition and communication skills. Acute bacterial meningitis is the most common cause of acquired hearing loss.

In this study, two hundred and ten patients of bacterial meningitis, who were managed in the department of Pediatric medicine, were included. Sensorineural hearing loss was observed in 76 (36.1%) of cases and this is comparable a study by J. Walter Kutz et al¹² who reported 5-35% of post meningitis children, having varied degree of sensorineural hearing impairment. Similarly Mencia et al¹³ showed that 28% patients suffered deafness as a result of meningitis caused by Stococustrep pneumoniae.

In another study by B. Cherian T et al,¹⁴ 28.1% developed sensorineural hearing loss, approximately close to our results, bilateral in 21.9% and unilateral in 6.2%. In addition, the hearing loss may be reversible if treated early,¹⁵ In this study, 77.6% of patients who did not develop hearing loss were treated with preadmission antibiotics. In contrast, only 22.4% of patients who developed hearing loss received preadmission antibiotics, but it is not confirmed in humans. Between two groups identified, hearing loss was more common in younger age groups (37% versus 31%). Other studies supported these findings as well.¹⁴ As observed, hearing loss was mostly bilateral (58% versus 41%), as supported by other researchers.^{14,16} Risk factors identified were prolonged fever <4 days, persistent convulsion and CSF hypoglycorrhachia. Potential sequelae of meningitis and low CSF glucose are direct damage to the cochlear neuro-epithelium.¹⁷ The development of seizures is multi factorial and may be due to high fevers, metabolic disturbances, or focal cerebral irritation and infarction. Kaplan,¹⁸ had noted that abnormal hearing results were correlated significantly with the presence of seizures prior to admission ($P<0.04$) and prolonged fever after therapy with antibiotics ($p<0.03$) in conformity with our study.

CONCLUSION

Hearing impairment develops in a significant number of cases after an episode of meningitis. Specific therapy can be implemented early to halt and treat progression of speech and development delay. Immunization against *Hemophilus influenzae*, *streptococcus pneumoniae* and *nisseria meningitidis* is an applicable solution to prevent this problem.

Conflict of interest

The authors have declared no conflict of interest.

RESULTS

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