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A DESCRIPTIVE RESEARCH ON BACTERIAL MENINGITIS AND IMPAIRMENT IN HEARING IN THE PERSPECTIVE OF ASSOCIATED RISK FACTORS

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Abstract:

Objective: *To evaluate the occurrence of loss of hearing in the aftermath of serious meningitis episode amongst the children.*

Methods: *From Jan 2016 to Jul 2017, we completed this research at Mayo Hospital, Lahore (Paediatric Medicine Department). Total strength of the included children suffering from meningitis was 175, aged between one month and 13 years. Biochemistry, CSF cytology, culture sensitivity and complete blood count were recorded. CT scan brain was carried out when required. After two weeks of admission, assessment of hearing faculty was executed by utilising otoacoustic emissions in the subject possessing normal tympanogram. If otoacoustic emissions were found absent, hearing disability was categorised as sensorineural. However, tympanometry was considered as normal.*

Results:

For the total strength of 175 children, forty-two (42) percent were females while fifty-eight (58) percent were of male gender. 2.1 years was the mean age. Glasgow comma scale (GCS) was utilised for the assessment of orientation. It was normal in sixty-three percent of the cases whereas five percent possessed less than eight GCS. GCS was observed between 8 and 15 in thirty-two percent of the cases. In fifty-eight percent of the cases, signs of meningeal irritation were noted whereas four percent had focal signs. CT scan was performed in fifteen percent of the cases in which abnormal investigations were observed in 73 percent of the subjects. In twenty two percent of the cases, Otoacoustic emissions were not present.

Conclusion:

Results concluded twenty two percent cases of hearing loss in the aftermath of serious episode of meningitis. In Pakistan, it thus, calls for the demand of screening assessment implementation in the post-meningitis trouble. Risk factors for hearing disability are inadequate GCS, complicated meningitis and prolonged stay.

Keywords: *Sensorineural hearing loss, Otoacoustic emissions, Tympanogram.*

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INTRODUCTION:

Hearing loss has been one of the main complications amongst children [1]. The estimated hearing loss in developed nations is 10 percent. Meningitis accounts for more than half of the collected cases of deafness [2]. The occurrence of this problem is estimated to commence during the initial stage of the ailment [3]. Presence of comorbidity and acuteness of meningitis are significant factors of risk [4]. Timely audiological testing is highly recommended since children suffering from meningitis are more susceptible to sensorineural hearing loss [1].

Studies on the assessment of hearing loss amongst the children in Pakistan are occasionally carried out. One such research brought out 18.5 percent occurrences of hearing loss [5]. Bacterial meningitis is considered to be the most prevalent and acute form of diseases amongst children at ICU's of paediatric centres in our country. We decided to undertake the task of investigating the spectrum of hearing loss in the children who suffered from severe meningitis and its relationship with sex, age, cerebrospinal fluid findings, complications, altered sensorium and treatment and stay duration.

METHODS:

Our descriptive research was carried out from Jan 2016 to Jul 2017, we completed this research at Mayo Hospital, Lahore (Paediatric Medicine Department). Total strength of the included children suffering from meningitis was 175, aged between one month and 13 years. Definition of Positive CSF was as white blood cell greater than 10/ ul in CSF. Those children who were victims of seizure disorder, history of recurrent meningitis, meningomyelocele, acute head trauma and prior central nervous system pathology were not included in the study.

A comprehensive medical examination and elaborated history of each subject were ensured. Documentation of various clinical traits such as total hospital stays, gender, age, examination findings, complications, presenting symptoms, duration of illness before presentation and outcomes etc was carried out. In children who were aged less than 2 years the examination of fontanelle was carried out. Necessary laboratory data such as complete blood count, CSF cell count with differential, glucose, protein, gram staining with CSF culture sensitivity was executed. Intravenous antibiotics were administered to all the patients. The dose of Dexamethasone was administered as 0.6 mg/kilogram per day in the beginning within half hour of the first dose of antibiotic more than 04 months of age in accordance with hospital protocol. The parents of the included children were asked for the informed willingness for the proposed study. Local hospital committee granted the ethical approval. The dose of antibiotics was administered for ten days at least. After four days of treatment, each subject was medically examined especially neurological complications which included motor and sensory loss, seizures and cranial nerve palsy were paid special attention. CT scan was carried out when deemed necessary and results were jotted down accordingly.

After two weeks of admission, assessment of hearing faculty was executed by utilising otoacoustic emissions in the subject suffering from meningitis. To rule out any conductive deafness, tympanometry was executed at first. otoacoustic test was not performed on the subjects who possessed abnormal tympanogram. Such patients were dispatched for ENT evaluation and were planned to follow up afterwards. If otoacoustic emissions were not found in the company of normal tympanometry, hearing deficit was categorised as sensorineural.

For categorical variables, frequency percentages were utilised whereas standard deviation was used for continuous variables. Whenever applicable, application of the Chi Square was ensured. P less than 0.05 were considered the level of significance.

RESULTS:

Analysis of total 175 cases who were admitted to a hospital and were suffering from acute bacterial meningitis, was carried out. From the total subjects, females were 73 (forty two percent) whereas male were 102(fifty eight percent). 138 children (seventy nine percent) were aged less than 05 years, however, thirty-seven (twenty one percent) children were aged more than 10 years. 2.1 years was the mean age. In sixty-six (thirty-eight) cases, total duration of stay was greater than 10 days whereas one hundred and nine (62 percent) cases were stayed less than 10 days.

Fever was found in 173 cases (ninety nine percent). Seizure affected cases were 155(eighty nine percent). GCS less than 8 was found in nine children. Fifty-six children were found with the GCS between 8-15. Normal score was observed in 110 cases. In 101 subjects, the symptoms of meningeal irritation were observed. However, in only seven cases focal signs were noticed. In about thirty eight percent of the cases, irritability was observed. In forty-five subjects, rise of CSF count was greater than one hundred cells. In ninety-two cases, CSF count was between 50 to100 cells. However, thirty-seven cases possessed CSF count between 10 to 50 cells. In ninety three percent of the cases, Neutrophil predominance in CSF was observed. CSF protein was enhanced in seventy-six

subjects. In 123 cases, Abnormal glucose was observed.

Positivity of CSF culture was noticed in eleven children whereas sixteen patients were detected with complications. Focal deficit was present in seven cases as it was noted as the most common initial clinical complication. Similarly, seven cases were having hydrocephalus. Visual loss and nervy palsy was seen in one patient each. In about half of the children, the maximum time span of sickness before presentation was < 02 days. Sickness lasted for greater than 05 days in twenty-one patients. Sixty-six patients had been under the shadow of disease between 02 -05 days.

Assessment of clinical parameters frequency. is exhibited in Table – III. Twenty-six subjects had undergone CT scan test in which abnormal cases were nineteen subjects as in Table – I. During CT investigations, twelve cases were detected with subdural effusion. Four subjects were seen with hydrocephalus whereas two cases of haemorrhagic infarcts were found. Focal changes were noted in only one patient.

Table – I: Relationship of risk factors with hearing loss

Variables		Number	Percentage	p-values
Fever	**Yes**	173	99	0.4
	No	2	1	
Gender	**Male**	102	73	0.9
	Female	73	42	
Duration (Stay)	**<10days**	109	62	0.04
	>10 days	66	32	
Seizures	**Yes**	155	89	0.9
	No	20	11	
Complications	**Yes**	17	9	0.008
	No	158	91	
Brain CT Scan	**Normal**	19	75	0.2
	Abnormal	7	25	
GCS	**<8**	12	7	0.009
	8-15	56	32	

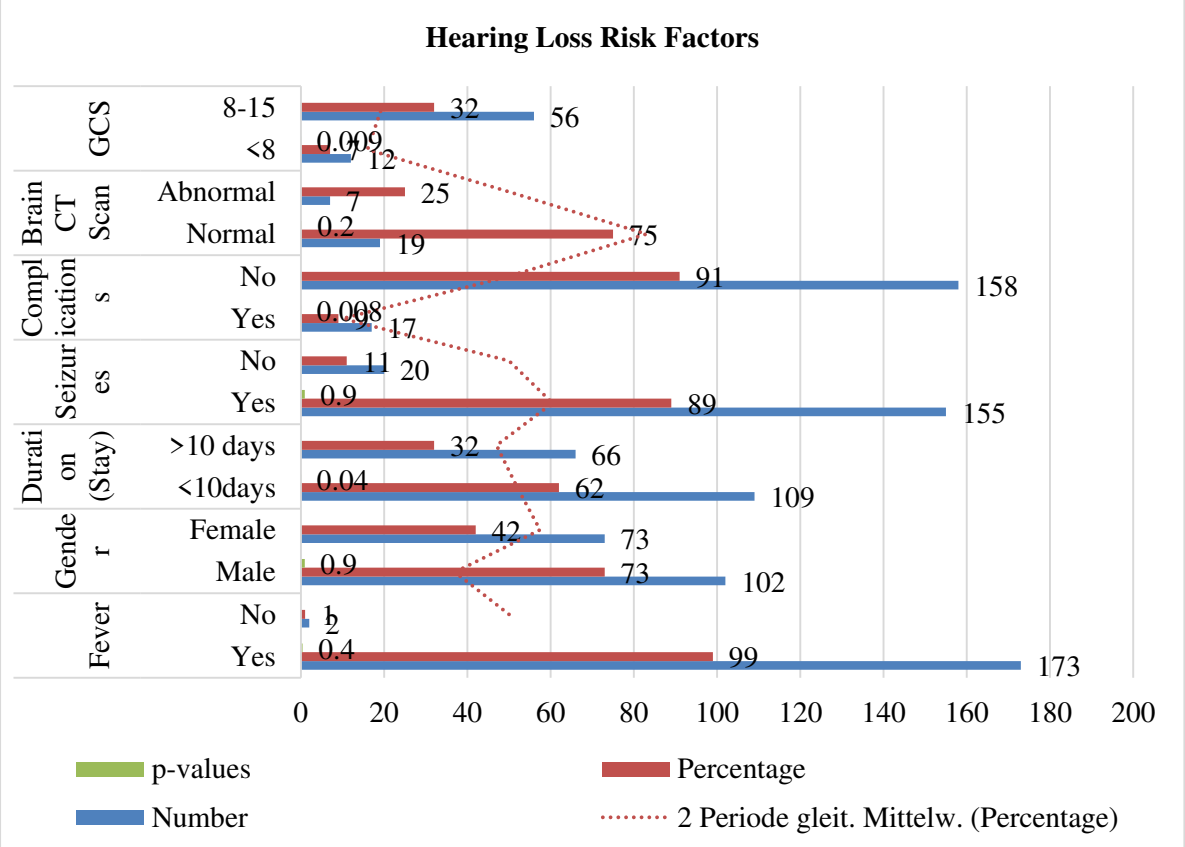


Table – II: Hearing Loss after Meningitis

Hearing	Percentage
Normal	22
Hearing Loss	78

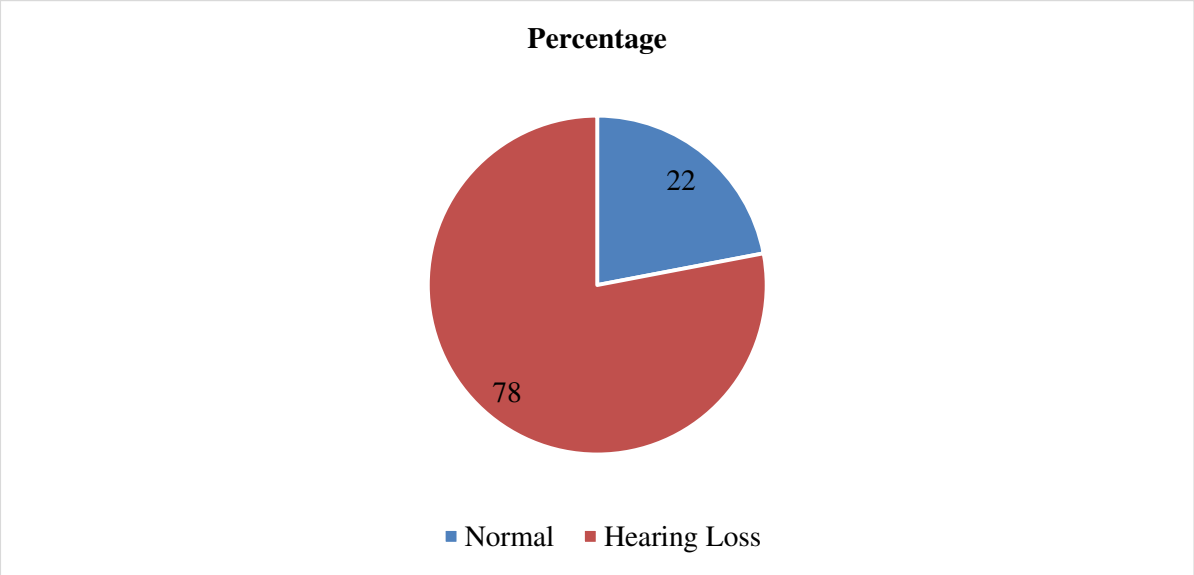
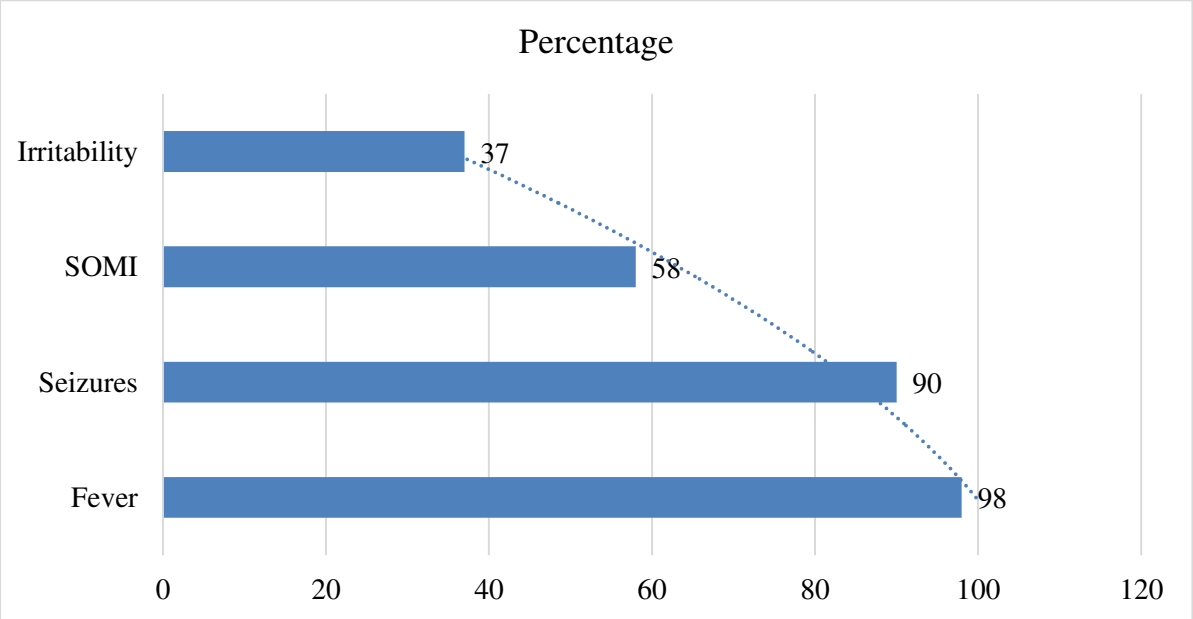


Table – III: Clinical Presentation

Clinical Presentation	Percentage
Fever	98
Seizures	90
SOMI	58
Irritability	37



Positivity of CSF culture was observed in eleven patients who demonstrated Klebsiella in eight cases. Streptococcus pneumonia was seen in two cases whereas one case was noted to have coagulase negative staphylococcus. In thirty-eight cases, abnormality of hearing test was detected as in Table – II.

The correlation of hearing loss was with low GCS at presentation, meningitis with complications and stay duration of more than 10 days as in Table – I. Factors such as CSF cell counts, culture, age and sickness before presentation did not have statistical bearing on hearing deficit. None of the case of fatality was seen.

DISCUSSION:

The most frequent reason for the loss of hearing in childhood is bacterial meningitis [2]. The accurate mechanism is yet to be known so far. The most favourable tests are tympanometry, otoacoustic emissions and auditory brainstem response [6]. Variations of rates of sensorineural hearing loss were noted from five to thirty five percent in an American research in which four percent were suffering from acute deafness. Loss of hearing could have a considerable influence on children so this type of complication should be considered as soon as possible.

Studies on hearing impairment are few and far between in Pakistan. A study which was conducted in the year 2008 had exhibited the same frequency of twenty percent as was shown in case of our study [7]. Thirty percent of incidence was reported in some other studies [8]. 7.4 percent meningitis cases with hearing deficit was confirmed by a UK based study [9]. Insufficient vaccination can be a reason of ever increasing cases of hearing loss in developing nations. A six-year study conducted in Netherland reported thirteen percent of cases of hearing impairment [10]. Hearing loss which was previously reported was found in less than one-year cases [11].

In the published literature fifty percent of the typical trio of fits, fever and signs of meningeal irritation are found while thirty three percent focal signs and fourteen percent unconsciousness were also present [12]. As far as our study is concerned, 64 cases have altered sensorium, seven cases have focal signs and 102 cases have signs of meningeal irritation (SOMI). A study conducted somewhere have found 69 percent cases had altered sensorium and 83 percent cases were affected with neck stiffness [13, 14].

Two days was the duration of illness before presentation in case of our study which is akin to other such researches. Many studies have validated the point that hearing impairment is on the rise in the children who appeared to be weak and ill [14].

We observed the similar connection in case of complicated meningitis.

The cases which were caused by Haemophilus influenza B were eradicated by the use of Hib immunization. General pathogens responsible for meningitis are Neisseria meningitis and Streptococcus Pneumonia. Our study confirmed six percent CSF culture positivity in which 4.5 percent were gram negative having Klebsiella. One percent of Streptococcus pneumonia followed Klebsiella. 0.5 percent coagulase negative staph aureus was recorded. A latest study conducted about hearing impairment in UK, isolation of meningococcal was noted in seventy five percent of the cases which was followed by fifteen percent of the cases of streptococcus pneumonia [14]. Defective culture techniques and initial undocumented antibiotic exposures could be potential cause of low yield in case of our study. CSF culture positivity was noted as twelve percent in a conducted research on 199 children [15].

Otoacoustic emission is known to be a non-invasive test. It produces flection of functioning of inner ear status. It is commonly used for a screening purpose. Middle ear infections can influence it. Otoacoustic emission test was employed to those cases which were having normal tympanogram. Function reflection of auditory pathways is not reflected by it. Resultantly, hearing impairment cannot be ruled out by its presence [16]. It cannot ensure classification either. As a result, we are unable to classify our cases into severe, mild or moderate loss [17].

In our study, robust correlation was seen between hearing impairment and low GCS, prolonged stay more than 10 days and complicated meningitis as in Table-I. In other studies, prolonged stay and cranial nerve palsy were considered risk factors [8]. Complications are indicated via poor GCS. It is connected to complications of neurology of hearing impairment [18, 19]. As in previous researches, our study indicated that type of treatment and sickness presence duration before presenting to health care facility was ineffective on the loss of hearing [20].

CONCLUSION:

By summing up the findings and considering the ever-increasing cases of hearing impairment, the universal hearing screening protocol after meningitis is highly recommended for its implementation in the countries such as Pakistan. We can thus avert educational and social difficulties of the affected children who are the victims of hearing loss by rendering timely detection and prompt response.

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