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Clinical and epidemiological profile and outcome of meningoencephalitis in children of one month to 12 years - A hospital based descriptive observational study.

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Abstract

Background: Meningoencephalitis in children is an important cause of morbidity and mortality around the globe. The present study was undertaken to evaluate the clinico epidemio logical profile and outcome of men in go encephalitis in children aged 1 month to 12 years.

Methods: Total 76 children who got admitted in the PICU with symptoms of meningitis and encephalitis were enrolled and evaluated for clinical and epidemiological profile and outcome of meningoencephalitis.

Results: The prevalence of meningoencephalitis in present study was 2.47%. The most common symptom was fever (100%). AVPU (93. 36%) and GCS score (97.36%) were the commonest abnormal symptoms at PICU presentation. 5.26% had bacterial growth. 14.47% and 19.73% of children had abnormal CT and EEG pattern respectively. 3 (3.94%) children were died during the study period. After one month of discharge, only 4% children had abnormal sensory neural hearing loss evaluated by BERA. In children whose CSF appearance was cloudy at the time of initial examination (23%) and whose CSF cell count were predominantly PMN (30%) highly correlated with mortality. When bacterial growth in CSF and mortality association was 100%. CSF cell count who had increased polymorph predominate at initial CSF examination and abnormal hearing im pair ment by BERA was 14.28%, shows highly correlated with morbidity, ($p< 0.05$). Conclusion: Predominant age group involved was between 1 month to 3 years, which indicates the immaturity of Blood Brain Barrier. Viral infections were most common etiology. Poor AVPU and GCS score and resistant seizures indicated the grave

prognosis and acts as an important prognostic indicator for outcome in children with acute CNS infection.

Keywords: Meningoencephalitis; Epidemiology; AVPU; GCS score; E. coli; BERA; CSF; Mortality.

Introduction

Infection of the central nervous system (CNS) is a significant cause of morbidity and mortality in children in the developing countries due to poor immunization and poor socioeconomic status [1]. Acute CNS infection is diagnosed by clinical signs and symptoms like fever, altered sensorium, seizures, neck pain, photophobia and abnormal CSF finding [2]. Depending on the tissues affected, infection could result in meningitis, ence phalitis, men in go encephalitis, or a brain abscess [1].

Meningitis is a condition that involves inflammation or infection of the meninges (protective tissues and fluid surrounding the brain and spinal cord) [2]. However, encephalitis is defined as inflammation of the brain parenchyma associated with neurologic dysfunction [3]. Because of these anatomic boundaries (brain parenchyma and meninges) are often not distinct, many patients have evidence of both meningeal and parenchymal involve ment. Although, the men in go encephalitis is an in flam matory process involving both the brain parenchyma and meninges. Men in go encephalitis primarily affects infants and children. Leading to increase in morbidity and adverse outcome like neurological damage, hearing impairments and poor school performance. Typically, meningoencephalitis presents acutely with fever, Headache, vomiting, altered sensorium, stiff neck, seizures photo phobia [2]. However, the etiology of childhood men in go encephalitis has changed significantly over the past decades with the introduction of national immuniza tion programs against previous common causes of child hood men in go encephalitis [4, 5].

Meningoencephalitis is a diagnosis to be made from clinical symptoms and signs along with CSF Analysis [2].

The early recognition of childhood meningoencephalitis remains challenging because of the non-specific clinical presentation, such as fever, headache, irritability, vomiting and diarrhea [6, 7]. Additional diagnostic tools to recognize (the etiology of) men in go encephalitis such as blood inflammation markers, cerebrospinal fluid (CSF) chara cteristics and neuroimaging abnormalities have been used to aid clinical decision-making. Previous studies on the use of these diagnostic techniques were mostly performed for specific pathogens or in small study populations, making it difficult to evaluate their current value as accurate predictors for diagnosing a specific cause of meningoencephalitis in children [8, 9] Hence, the present study was aims to evaluate the clinico-epidemiological profile and outcome of men i n go encephalitis in children aged 1 month to 12 years.

Materials and Methods

After obtaining Institutional Ethical Committee approval and written informed consent from parents/ legal guardian of patient, this hospital based descriptive observ ational study was conducted in the Department of Pediatrics, at Tertiary Care Hospital during a period of 2 years from January 2021 to December 2023.

A total of 76 children who got admitted in the PICU under the age group of one month to 12 years, with symptoms of meningitis (fever of any duration, headache, vomiting, nuchal rigidity, irritability, refusal to feed) and with symptoms of encephalitis like altered sensorium, seizures, focal neuro logical deficit were included.

Detailed history in all cases were taken with emphasis on the onset of symptoms, presence of meningeal signs, history of convulsion if any. Clinical diagnosis of men in go encephalitis was made in the presence symptom such

as fever, altered sensorium with (or) without motor/ sensory defect, convulsion, headache, and vomiting. Child who presented with other cause like cerebral malaria, dyseletrolytemia, ICSOL (Intra Cranial space occupying lesion), Reyes syndrome, enteric fever, Hepatic Encephalopathy are excluded from this study.

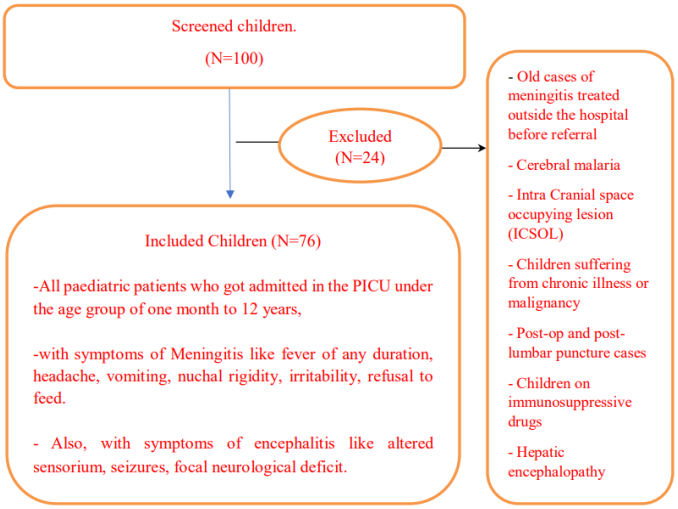
All peadiatric patients who were presented with the feature of meningoencephalitis were registered and clinical data such as age, sex, resident address, develop mental history, immunization status, exanthema Tous fever, prehospital treatment, contact history of TB, migration history were enter in the pre structural profoma. All symptoms like fever, headache, vomiting, seizure, altered sensorium, focal neurological deficit (FND) and prehospital treatment like, Oxygen, IV. Fluids, Anti biotics, anti-Viral were documented. Con dition of the child arrival at the PICU, CMCH like AVPU Scale, ICP, GCS and seizure were recorded. Routine investigation such as CBC, blood-sugar, serum electrolytes, renal function test, liver function test, peripheral smear for malarial parasite was done.

After full clinical examination and fundus examination, any contra indications for L.P (Lumbar Puncture) like increased ICP features, AF Bulg, 3rd or 6th nerve palsy, hyper tension, bradycardia, severe cardio pulmonary com plications like shock, local skin infections were ruled out. Lumbar Puncture was done and CSF analysis like appea rance, opening pressure, cell count, protein and sugar, culture, sensitivity. Outcome complication like any hydrocephalus and other changes and hearing impairment (BERA) were recorded.

Statistical Analysis

The collected data were entered in the profoma for statistical analysis. Frequency was expressed in per centage. The difference in quantities variables groups were assessed by means of the unpaired test. The chi-square test was used to asses' differences in categorical variables between groups. A 'p' value of <0.05 using a two –tailed test was taken significant for all statistical tests. All data were analyzed with a statistical software package (SPSS. Version 21.0 for windows).

Flow chart showing screened children and included and excluded from the study



Observations and Results

During the study period, 3071 children were admitted to the paediatric ward. Among the total cases, 76 children were diagnosed as a case of meningoencephalitis. Thus, the prevalence of meningoencephalitis in our tertiary care hospital was 2.47%. Table 1 show the socio-demographic data of patients.

Table 1: Socio-demographic data of patients.

Socio-demographic data		No. of patients	Percentage
Age group	1 month to 3 years	31	40.78
	3 to 5 years	23	30.26
	5 to 12 years	22	28.94
	Total	76	100.0
Gender	Male	44	57.89
	Female	32	42.10
Resident	Urban	22	28.94
	Semi-urban	17	22.36
	Rural	37	48.68
Socioeconomic status	Lower middle	25	32.89
	Upper Lower	28	36.84
	Lower class	23	30.26

The most common symptom in present study was fever (100%) and altered sensorium (93.42%). Among fever,

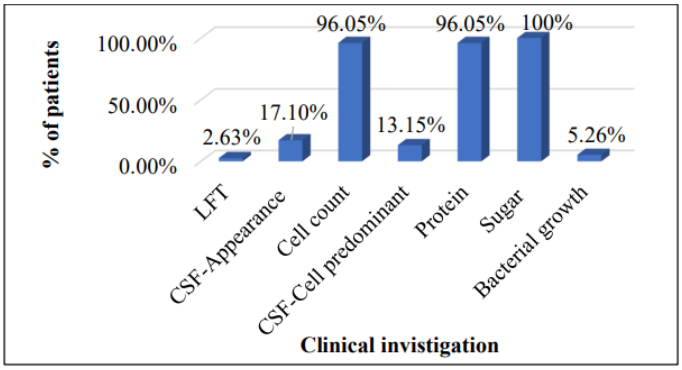
sustained/continuous fever was the most common pattern (31.57%) followed by Intermittent (26.31%), Remittent fever (21.05%) and hectic, and relapsing fever (21.05%). AVPU and GCS score were the most common abnormal symptoms at the PICU presentation, (Table 2). The most common prehospital treatment was IV fluids (60; 78.94%) and oxygen therapy (59; 77.63%) followed by antibiotic therapy (53; 69.73%) and only 15.78% (12 children) antiviral therapy.

Table 2: Clinical profile of the children's

Parameters		No. of patients	Percentage
Clinical history	ANC issues	10	13.15
	Developmental History	05	6.57
	Immunization Status - Fully	74	97.36
	Immunization Status - Parital	02	2.63
	Previous Hospital Admission	14	18.42
	Contact History	12	15.78
	History of Trauma	02	2.63
	Recent travel	03	3.94
	Migration History	01	1.31
Clinical symptoms	Fever	76	100.0
	Headach	28	36.84
	Vomiting	66	86.84
	Seizure	65	85.52
	Altered Sensorium	71	93.42
	Focal Neurological Deficit	06	7.89
At PICU Admission-abnormalities status	AVPU SCALE	74	97.36
	GCS SCORE	74	97.36
	ABC	61	80.26
	ICT	06	7.89
	Seizure	17	22.36

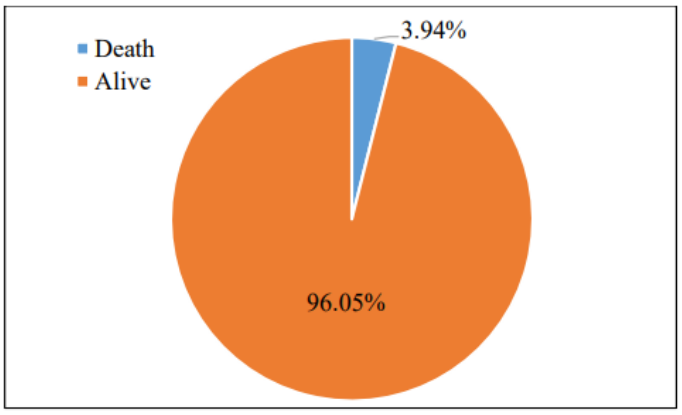
From the figure 1 it was observed that the maximum cases i.e., 96.05% (73 children) have increased cell count and elevated CSF protein as depicted in figure 1. 5.26% (4) had bacterial growth. The most common organism found in culture growth was E. coli (50%) followed by Streptococcus (25%) and Klebseilla (25%).

Figure 1: Prevalence of clinical investigation



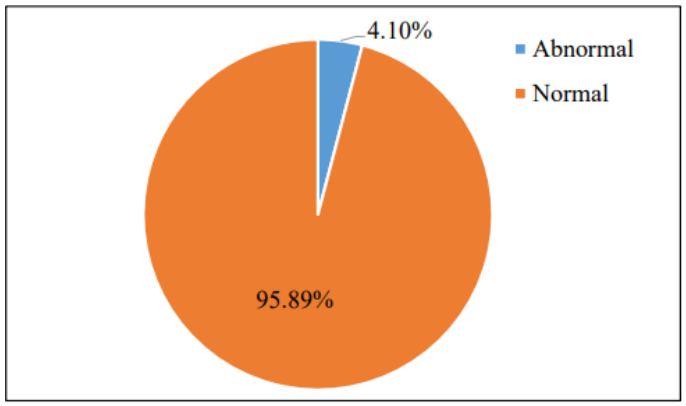
Out of 76 children, 14.47% had (11 children) abnormal CT and 19.73% (15 children) had abnormal EEG pattern. Out of 76 children, 96% have alive and 3.94% (3 children) were died, (Figure 2).

Figure 2: Outcome of the study.



After one month of discharge, we do a hearing evolution by BERA only 4% (3 children had abnormal sensory neural hearing loss and 95.89% (70 children) normal hearing, (Figure 3).

Figure 3: Sequelae Auditory brainstem response (BERA).



From the table 3 it was observed that in children whose CSF appearance was cloudy at the time of Initial examination highly correlated with mortality in current study (23%), (p=0.047). The children whose CSF cell count were predominantly PMN (30%) highly correlated with the mortality (p=0.023). When Bacterial growth in CSF and mortality association was100%. It was highly correlated with bacteria growth in CSF culture with very high mortality, (p=0.033).

Table 3: Association of clinical variables with outcome [N=73]

Clinical investigation		Outcome		Total	P value
		Death	Alive		
CSF-Appearance	Normal	00 (0.0%)	63 (100%)	63	0.047*
	Cloudy	03 (23%)	10 (76.92%)	13	
Cell count	Increased	03 (4.10%)	70 (95.89%)	73	0.134
	Normal	00 (0.0%)	03 (100%)	03	
CSF-Cell predominant	Increased	03 (30%)	07 (70%)	10	0.023*
	Normal	00 (0.0%)	66 (100%)	66	
Protein	Increased	03 (4.10%)	70 (95.89%)	73	0.153
	Normal	00 (0.0%)	03 (100%)	03	
Sugar	Increased	03 (3.94%)	73 (96.05%)	76	-
Bacterial growth	No	02 (2.66%)	73 (97.33%)	75	0.033*
	Yes	04 (100%)	00 (0.0%)	04	

CSF cell count who had increased polymorph pre dominate initial CSF examination and abnormal hearing impairment by BERA was 14.28%% shows highly correlated with morbidity in our study statistically significant 'p' value of < 0.05 and polymorphic lymphocytes early damage to the inner hair cells and produce the significant abnormality, (Table 4).

Table 4: Comparison of clinical variables with sequelae BERA [N=73]

Clinical investigation		SEQUELAE BERE		Total	P value
		Abnormal	Normal		
CSF-Appearance	Normal	01 (1.58%)	62 (98.41%)	63	0.084
	Cloudy	02 (20.0%)	08 (80.0%)	10	
Cell count	Increased	03 (4.28%)	67 (95.71%)	70	0.091
	Normal	00 (0.0%)	03 (100.0%)	03	
CSF-Cell predominant	Increased	01 (14.28%)	06 (85.71%)	07	0.011*
	Normal	02 (3.03%)	64 (96.96%)	66	
Protein	Increased	03 (4.28%)	67 (95.71%)	70	0.125
	Normal	00 (0.0%)	03 (100.0%)	03	
Sugar	Increased	03 (4.10%)	70 (95.89%)	73	-
Bacterial growth	No	03 (4.10%)	70 (95.89%)	73	-

Discussion

In the present study, the most common age group involved was 1 month to 3 years (40.78%) followed by 3 to 5 years (30.26%). Young children, particularly infants were more commonly affected with males' predominance (57.89%). The male predominance may be due to outdoor life activity and playing. However, rural children (48.68%) belonging to lower socio-economic class were more affected in men in go encephalitis. These findings are comparable with the study conducted by Sasikumar N [2], Rasul CH et al [10] and Roy A et al [11].

Clinical history about ANC issue was 13.15% (10 children), developmental delay 6.57% (5 children), parti ally immunized 2.63% (2 children), previous hospital admission 18.42% (14 children), previous conduct history 15.78% (12 children), trauma history 2.63% (2 children) and recent travel history 3.94% (3 children), migration history 1.31% (1 children). These results are in accordance with the study done by Sasikumar N, [2]. The most common symptom at the time admission fever (100%) and alter sensorium (93.42%). Sustained/ continu ous fever was the most common pattern (31. 57%) followed by Intermittent (26.31%), Remittent fever (21.05%) and hectic, and relapsing fever (21.05%). Similar findings are reported in previous studies [2, 10-12]

Before arrival at our hospital 77.63% (59 Children) were treated with oxygen therapy, 78.94% (60 children) had IV fluids and 69.73% (53 children) had been treated with antibiotics and only 15.78% (12 children) treated with antivirals. So prehospital treatment with IV fluid therapy and oxygen therapy was received by most of the children. Antiviral therapy was the least that was given to the children. Most common etiological organisms are viral but most of the children had not received early antiviral coverage. These findings are comparable with the study done by Sasikumar N [2]. The most common abnormal finding when get in PICU admission was low GCS and AVPU Scale abnormality (97.36% each). Least was ICP seizure. Regarding clinical investigation, the maximum cases i.e., 96.05% (73 children) have increased cell count and elevated CSF protein, 17.10% (13 children) cloudy CSF appearance, 13.15% (10 children) had CSF PMN predominate, 5.26% (4 children) bacterial growth. Sasikumar N [2] and Sonowal R et al [13] had similar value.

In the present study, the most common organism found in culture growth was E. coli (50%) followed by Strept ococcus (25%) and Klebseilla (25%). These findings are correlated with the study done by Rasul et al [10] and Mazed et al [14]. Regarding imaging abnormity CT had 14.47% (11 children), EEG abnormality 19.73% (15 children) in children of meningoencephalitis. Sasikumar N [2] and Roy A et al [11] support the finding of present study.

Out of 76 children, 96% have alive and 3.94% (3 children) were died. Similarly, in Sasikumar N study out of 63 children 2 children died (3% death), 61 children (97%) were alive. Death rate is decreased compared to Roy A et al study conducted in west Bengal [11] and Farzana KB study conducted at Uttar Pradesh [12]. This is due to early referral to higher tertiary centres and appropriate antibiotic, antiviral and antiedema measures given to reduce mortality.

After one month of discharge, we do a hearing evolution by BERA only 4% (3 children had abnormal sensory neural hearing loss and 95.89% (70 children) normal hearing which is comparable with the study conducted by Sasikumar N [2].

In children whose CSF appearance was cloudy at the time of Initial examination highly correlated with mortality in current study (23%). Only in 4% of the babies had increased cell count which was not statistic ally associated with mortality. The children whose CSF cell count were predominantly PMN (30%) highly correlated with the mortality. Regarding CSF protein in current study shows only 4% were increase the mortality associate with increased protein in the CSF. It was not statistically significant p value >0.05. When Bacterial growth in CSF and mortality association was100%. It was highly correlated with bacteria growth in CSF culture with very high mortality.

We compare the initial CSF analysis and abnormal changes in hearing evolution by BERA after one month of discharge of the Children. CSF who has cloudy BERA was abnormal at the end of one month by 20% which was not statistically significant. Increase CSF protein in the initial CSF examination and abnormal BERA shows only 4.28% which was not statistically significant with p value >0.05. CSF cell count who had increased polymorph predominate initial CSF examination and abnormal hearing impairment by BERA was 14.28%% shows highly correlated with morbidity in our study statistically significant ‘p’ value of < 0.05 and polymorphic lymphocytes early damage to the inner hair cells and produce the significant abnormality. Increase CSF protein in the initial CSF examination and abnormal BERA shows only 4.28% which was not statistically significant with p value >0.05. Even though stating of antibacterial and antiviral therapy organism enter and damage to the inner hair cells earlier. It is highly correlated with morbidity statistically significant, (p< 0.05).

Being a hospital-based study done in a tertiary care center; the incidence observed in this study may not reflect the actual incidence of meningoencephalitis of the entire population. Due to financial constraints of the families and non-availability of all investigations within the hospital, some important investigations could not be performed like Viral marker, viral panel studies on CSF, Auto-immune encephalitis panel, etc. An estimate of the cost of the care could better explain the burden of the problem. Most common etiology of men in go ence phalitis is viral in origin. But for detection of the viruses IgM ELISA, Nuclear Method and PCR are the investigations of choice; that has a high yielding power. CSF culture technique that has been used in this study has a comparatively low yield for detecting viruses. Auto

immune encephalitis is one of the most common etiology of acute meningoencephalitis, which is not included in this study due to resource limitations. However, in this study patients had been under follow up for a period of one month after which hearing evaluation and neuro imaging has been done. But for detecting men in go ence phalitic sequelae like neuro logical defects, hearing defects, visual abnormalities, and psychosocial behave oral disorders a long term follow up is needed.

Conclusion

Predominant age group involved was between 1 month to 3 years, which indicates the immaturity of Blood Brain Barrier. Viral infections were the most common etiology. Poor AVPU and GCS score and resistant seizures indicated the grave prognosis and acts as an important prognostic indicator for outcome in children with acute CNS infection. Meningoencephalitis remains as an important cause of emergency hospitalization of children, particularly infants. It is difficult to differentiate bacterial and viral causes of meningoencephalitis by clinical features alone, but altered mental status is frequently associated with the non-pyogenic form of men in go encephalitis. Limited investigation of the a etio logical agent revealed that E. coli and S. pneumoniae tops the list of bacteria present in our patients.

However, meningoencephalitis was diagnosed in a small proportion of children with a suspected central nervous system infection. Further large-scale studies are required to explore the national picture of men in go encephalitis in India.

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