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A Critical Analysis of Cerebro Spinal Fluid in Pediatric Population with Severe Falciparum Malaria

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Abstract—*Cerebral malaria is one of the most dreadful complication. The children are particularly more vulnerable to have this complication.*

Objective*: To study the CSF profile in children.*

Material and Methods*:- This study was carried out on 43 patients of cerebral malaria in the DTR Hospital, Kurnool from April 2015 to Sep 2016. Thick and thin smear were prepared to examine the speciation of malarial parasites and their infective stages.*

Results*: Out of 43 cases 23(53%) were male children and 20(47%) were female children. The age of the children from 1-12 years. Patients with cerebral malaria had significantly lower CSF glucose, and higher protein and higher LDH levels.*

Conclusion*: Cerebral malaria is the most severe neurological complication with plasmodium falciparum. This study focused on the CSF analysis in children with severe falciparum malaria.*

Keywords*: Cerebral malaria, CSF glucose, CSF pressure, protein, lactate concentrations.*

1. INTRODUCTION

Severe malaria occurs when P-falciparum infections are complicated by serious organ failures or abnormalties. It is usually manifests in children growing up in malarious endemic area like Kurnool. In paediatric patients convulsions are frequent, few patients have status epilepticus. In these patients small cerebral vessels are packed with parasitized red blood cells. Electron dense knobs are present on the surface of parasitized red blood cells, close to their point contract with endothelial cells [1-2] Cerebral malaria can occur in the absence of a localized inflammatory cell response, direct tissue invasion, a breakdown in the blood brain barrier, cerebral edema, disseminated intravascular coagulation and hypoglycemia. The cerebrospinal fluid in cerebral malaria shows no increase in cell number or protein concentration but show a raised lactate levels. The adherent erythrocytes may also interefere with gas and substrate exchange throughout the brain cytokines induce nitric oxide synthesis in leukocytes, smooth muscle cells microglia and endothelium and nitrous oxide (No) is a potent inhibits of neurotransmission. [3].

This study was carried out with an aim to find out the CSF cell count, glucose, pressure and protein levels together with CSF and serum lactate dehydrogenase, adenosine deaminase. LDH is an intracellular enzyme that is released from damaged cells. Its level in the CSF reflects the degree of damage of cells in the CNS. CSF–adenosine deaminase, an enzyme mainly produced by developing in mature T-lymphocytes, is increased in the body fluids of patients with stimulation of cellular immunity and was evaluated in this study, for its use in differentiation of parasitic and viral infection of the brain.[4-5].

2. MATERIALS AND METHODS

This study was carried out in the DTR Hospital, Kurnool from April 2015 to Sept 2016. Data consisted of age and sex distribution, children age between 1-12 years were included confirmed diagnosis of falciparum malaria by peripheral blood smear microscopy and had clinical and laboratory findings of severe malaria. CSF pressure was recorded in all the patients by simple method of estimating CSF pressure during Lumbar puncture (LP). In this method it was done by inserting needle into the spinal canal and number of drops were counted to measure the pressure of CSF in Cm water. CSF biochemistry was done for protein, sugar, chloride and cell count in all the subjects were determined by standard methods.

3. RESULTS

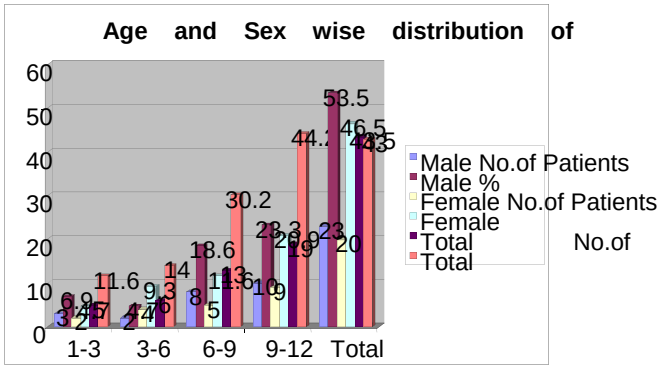
A Total 43 patients aged 1-12 years were enrolled for study. Out of 43 cases 23(53%) were male children and 20(47%)

were female children. The ratio of male and female is 1.15:1. 19(44.2%) patients were below the age of 12 years (Table 1). Out of 43 cases below 3 were 5(11.6%) less in number, below 6 were 6(14%) and below 9 years were 13(30.2%) were recorded.

Fever was present in all cases 39(91%) patients had high grade fever with chills, vomiting and headache was observed in 35(81%) and 29(67%) respectively. Convulsions were seen in 32(74%) patients. Coma was observed in 2 patients. Other clinical observations were noted in Table 2.

Table 1 : Age and Sex wise distribution of patients

Age Years	Male		Female		Total	
	No.of Patients	%	No.of Patents	%	No. of Patients	%
1-3	3	6.9	2	4.7	5	11.6
3-6	2	4.7	4	9.3	6	14
6-9	8	18.6	5	11.6	13	30.2
9-12	10	23.3	9	20.9	19	44.2
Total	23	53.5	20	46.5	43	100



(Fig-1)

Table-2: Clinical manifestations of cerebral malaria.

Sign	No.of Patients	Percentage
Fever	43	100
Chills	39	91
Vomiting	35	81
Headache	29	67
Convulsions	32	74
Repeated Seizures	26	60
Pallor	18	42
Anemia	32	74
Loss of Consciousness	5	11.6
Coma	2	4.6

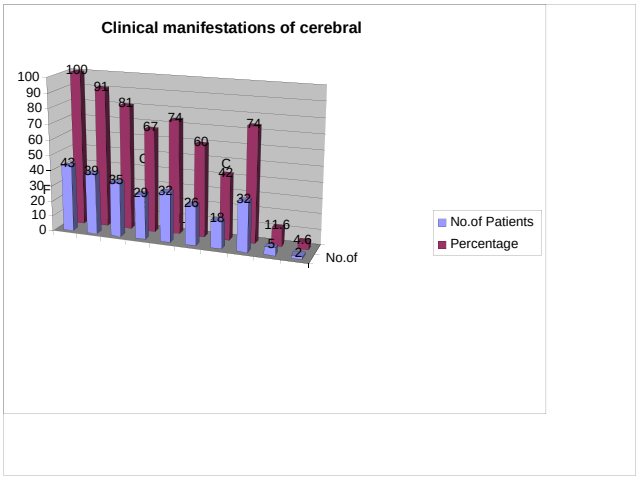


Fig: 2

Table : 3 – CerebroSpinal Fluid in Cerebral malaria

CSE Indices	No. of Patients n=43	Percentage
Glucose (mg/dl)		
<30	17	39.5
<35	14	32.6
<40	12	27.9
Protein (mg /100ml)		
15-30		
>40	9	21
>45	21	48.8
	13	30.2
Cell Count (Cells/cmm)		
0-5		
>5	24	56
	19	44
LDH(mm/dl)		
39-4.3	17	39.5
>4.5	24	55.8
>5	2	4.7
ADA 1U/L		
>6	24	56
>6.5	19	44
Pressure (mm of water)		
15-16		
>16	13	30.2
>20	19	44.2
	11	25.6

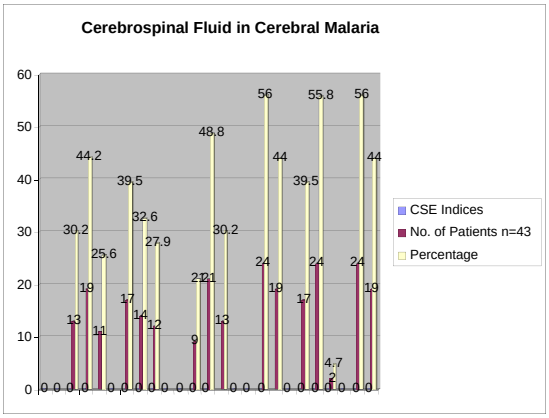


Fig-3

Patients had significantly lower CSF glucose, increased CSF pressure, higher protein, LDH and ADA and higher CSF white cell (leucocytes) count. 13(30.2%) children had pressure between 15-16cm of H_2O and 19(44.2%) had above 16 and more than 20cm of H_2O was seen in 11(25.6%) patients. (Table 3). Out of these 11 patients, 2 Patients underwent coma.

CSF glucose was <30mg/d1 in 17(39.5%) patients and <35mg/d1 in 14(32.6%) cases, 12(27.9%) patients had <40mg/dl. Maximum number of patients had lower sugar lever in our study.

CSF protein between 15-30mg/100ml was recorded in 9(21%) patients whilst 21 patients (48.8%) had >40mg/100ml and in 13(30.2%) had CSF protein level above 45mg/100ml. Above 45mg/100ml patients had developed severe manifestation. CSF cell count was increased >5(cells/cmm) in 19(44%) and 0-5(cells/cmm) was seen in 24(56%) patients. Chloride values were normal 110-125(mEq/L) in all the children.

In the study CSF LDH levels were higher, above >4.5 mm/d1 was seen in 24(55.8%) and above >5mm/d1 was noted in 2(47%) cases. In case of CSF ADA levels, were 6.1 IU/L is seen in 24(56%) patients whilst >6.1 IU/L in 19(44%) patients.

4. DISCUSSION

Asymptomatic parasitaemia with plasmodium falciparum is common in regions hyper endemic for this parasite. In present study CSF parameters in cerebral malaria was reported.

CSF glucose: In our study CSF-glucose levels were below normal range. Low CSF glucose is a significant change in patients with fatal cerebral malaria as compared to survivors. The low CSF glucose may be partly due to low plasma glucose levels.

CSF Protein: CSF protein was increased >45mg/100ml in 30.2% of cases. It was associated with increased multiorgan dysfunctions lead to mortality in the present study increased concentration in CSF may be due to increase serum albumin and serum IgG in severe falciparum infections.

CSF Pressure: In our study, observed increased CSF pressure >16cm of water in 69.7% of cases. Almost all children with cerebral malaria who have lumber puncture have elevated CSF opening pressure raised CSF pressure is an important aspect of cerebral malaria in children. Intracranial pressure is thought to be important in the pathogenesis of cerebral malaria, thereby contributing to a poor outcome in patients and can reduce the risk factors include repeated seizures deep and prolonged coma in children.

CSF – Cell Count: In the present study cell count increased >5cells/cmm in 44% of cases. It might be due to increased number of parasites in the cells, it has been used an index of severity of the pathogens in patients.

CSF LDH: CSF is characteristically elevated in cerebral malaria. It is an important parameter for future studies looking at discriminating features between cerebral malaria and other CNS infections. Lactase concentrations were closely associated with glycaemic status in patients. LDH is an intracellular enzyme that is released from damaged cells. Its level in the CSF reflects the degree of damage of cells in the CNS.

CSF ADA: CSF Adenosine deaminase levels were measured in patients with severe falciparum malaria. 44% of children hard above 6.5 IU/|L, slightly higher than the normal range. ADA has been considered as a marker of cell mediated immunity and its activity has been observed in various infections including cerebral malaria. CSF-adenosine deaminase is an enzyme mainly produced by developing immature. T-lymphocytes, is increased in the body fluids of patients with stimulation of cellular immunity and was elevated in this study for its use in differentiation of parasitic and viral infection of the brain of the patients.

5. CONCLUSION

Cerebral malaria is the most severe neurological complication of infection with P.falciparum. Children in this endemic area(Kurnool district) are the most affected. This study highlighted the increased CSF pressure, elevated LDH levels, lower CSF glucose and higher protein levels were the best discriminator of cerebral malaria from other pathogen infection.CSF testing can provide valuable information for diagnosis of severity of falciparum infection in the patients. Early detection of CSF values can reduce the neurological sequelae and morbidity in children.

6. ACKNOWLEDGEMENT

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