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Study of Biochemical Profile in Viral Meningitis

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Abstract:
Aim: *Meningitis is referred to as an inflammatory process of the leptomeninges and cerebrospinal fluid (CSF) within the sub-arachnoid space of the brain. globally distributed as either sporadic or epidemic forms. Meningitis can be caused by many infectious agents like bacteria, viruses and fungi, and non-infectious factors (like trauma The aim of the present study is to look for a simple, rapid, cost effective, non-invasive and fairly specific test in differentiating viral from other causes.*
Material and Methods: *The present study was carried to evaluate the changes in biochemical parameters including glucose, protein, C-reactive proteins (CRP), electrolytes (sodium, potassium and chloride) and enzymes (ALT, AST, ALP, CK and LDH) in the CSF and serum samples of the viral meningitis patients (n=25) and compared with control subjects (n=25).*
Results: *Our study shown that significant ($p<0.001$) increase in CSF glucose and protein levels in viral meningitis patients. The C-reactive protein was negative in all the cases of viral meningitis, as it is the diagnostic test to differentiate between viral and bacterial meningitis. Significant decrease ($p<0.001$) was observed in the CSF electrolytes concentration particularly in case of sodium and potassium levels while insignificant decrease was observed in the concentration of chloride. We observed extremely significant ($p<0.001$) high levels of all the enzymes (ALT, AST, ALP, CK and LDH in the CSF samples of viral meningitis as compared to their respective normal controls.*
Conclusion: *It can be concluded that CSF CRP, CSF protein, glucose, electrolytes and enzyme profiles is not only simple, inexpensive and rapid but also fairly specificmethod for making a diagnosis, viral meningitis and also in differentiating it with other types of meningitis*
Keywords: *Biochemical profile Cerebrospinal Fluids (CSF), viral meningitis*

I. Introduction

Meningitis is defined as inflammation of the membranes surrounding the brain and spinal cord, including the dura, arachnoid and pia mater meningitis can pose a serious public health problem especially during out breaks.(1) These infections are associated with significant morbidity and mortality despite advances in a treatment..A rapid and accurate diagnosis is important for effective earlier treatment of serious infections. (2) Meningitis can be caused by a wide range of bacteria, viruses, fungi, protozoa, chemical agents and drugs. Viruses play a major role in meningitis. In the annual number of central nervous system infections that occur as a result of viral agents far exceeds that of infections caused by bacteria, yeast, molds and protozoa combined.(3) Viral meningitis is generally less severe and clears up without specific treatment. Viral("aseptic") meningitis is serious but rarely fatal in people with normal immune systems. **Table 1** (1)

Acute Meningitis

Common	Less Common
Enteroviruses (coxsackieviruses, echoviruses, and human enteroviruses 68–71	Varicella-zoster virus
Herpes simplex virus 2	Epstein-Barr virus
Arthropod-borne viruses HIV	Lymphocytic choriomeningitis virus

The clinical symptoms in acute meningitis include fever, malaise, vomiting, and in some cases, petechial rashes. Among younger children's the signs of meningeal irritation are rare including neck stiffness, Kernig's sign, (an infection of the knee when the limb is placed at a certain degree of relative inflection to the trunk), and Brudzinski's sign, (an involuntary inflection of the limb following a head inflection). Moreover, an inability to feed, vomiting, drowsiness, and convulsions was observed in small children's (4).. The diagnostic criteria conventionally used for aseptic meningitis includes: the Cerebro-spinal fluid (CSF) analysis, Gram stain and cultureThe CSF analysis in case of enterovirus meningitis is practically identical to those of bacterial

meningitis while other assays, like Gram stain, latex agglutination, and polymerase chain reaction-based assays shows lack in the sensitivity (5). The present study was undertaken to evaluate the biochemical changes in the cerebrospinal fluid of viral meningitis patients and the possible role of CRP in designing strategy for more accurate diagnosis and treatment in these patients

II. Material And Methods

The present study was based on the biochemical analysis of CSF in viral meningitis patients. The CSF samples were taken from different Hospitals and Institutes all over kurnool. from 2013-2014.The samples included were already confirmed as viral meningitis cases as negative result was observed on gram staining and/or bacterial culture - the common tools used for the diagnosis of meningitis. A separate consent form has been filled for each case including the demographic and clinical features as well as the laboratory results of the patients. The CSF analysis was done on the first spinal tap and it included protein, glucose and the Enzyme profile (Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Alkaline Phosphatase (ALP) Creatine Kinase (CK) and Lactate Dehydrogenase (LDH) were measured using chemistry analyzer (automated analyzer) while the quantitative determination of C-reactive protein (CRP) was made by a latex agglutination method (CRP-latex Bio-System Kit). The serum electrolytes (Sodium, Potassium and Chloride) were estimated by a Flame photometer for all the patients and controls. The CSF samples taken as a control group comprises on the patients whose clinical finding and CSF examination exclude the presence of meningitis, they may suffer from high grade fever with electrolyte disturbances etc. We also used serum samples of normal individuals in order to compare our results. Statistical analysis was performed using standard statistical software (SPSS version 16.0). All data are expressed as mean ± S.D. The data were also tested using student's t-tests; the significance level was set as $p < 0.05$.

III. Results

The biochemical profile of cerebrospinal fluid and serum samples of viral meningitis patients and controls is summarized in **Table 2**. Our analysis revealed statistically significant increase in the concentration of glucose in both serum and CSF samples, with marked increase in CSF/Serum glucose ratio in viral meningitis patients as compared to the control group ($p<0.001$). While total protein concentration was also significantly increased in CSF samples of viral meningitis patients but was insignificant in case of serum samples as compared to control group. C-reactive protein (CRP) depicts negative results in both viral meningitis patients and control groups. However, CRP is routinely used as a diagnostic marker in differentiating viral and bacterial meningitis cases (**Table-2**). **Table-3** shows the electrolyte levels in the CSF of patients with viral meningitis. The following results differ significantly from the control group as the concentration of sodium and potassium were observed to be significantly decreased ($p<0.001$) with a slight insignificant decrease in the chloride level in the viral meningitis patients.

Table 2.Biochemical Profile Of CSF In Viral Meningitis

Csf-variables	Normal range	controls	Viral meningitis MEAN+SD	p value
CSF –glucose mg/dl	**40-80**	**68.2±12.2**	**136±7.32**	**<0.001**
SERUM GLUCOSE mg/dl	**80-120**	**92.32±4.53**	**105±15.5**	
CSF/SERUM GLUCOSE RATIO	**0-0.6**	**0.8**	**1.87**	**<0.001**
SERUM PROTEIN g/dl	**5-9**	**7.206±0.06**	**10.2±7.99**	
CSF PROTEIN g/dl	**0.08-0.1**	**0.84±2.35**	**2.51±0.091**	**<0.001**
CRP	**6.0**	**<6.0(-VE)**	**<6(-VE)**	

Table 3. CSF Electrolytes Profile In Viral Meningitis

Csf-variables	Normal range	controls	Viral meningitis mean+sd	p value
SODIUM mEq/L	144-154	148±0.8	123.5±1.24	**<0.001**
POTASSIUM mEq/L	2-3.5	5.21±0.09	2.56±0.8	**<0.001**
CHLORIDE mEq/L	90-130	94.23±3.91	98.751±.34	

Table.4 Enzymatic Profile In Viral Meningitis

Csf-variables	Normal range IN CSF	controls	Viral meningitis mean +sd	p value
ALT U/L	5-11	8.32±1.47	49.65±3.12	**<0.001**
AST U/L	7.5-25	8.3±2.65	39.52±3.01	**<0.001**
ALP U/L	<5	3.54±1.62	12.45±4.20	**<0.001**
CK U/L	<18	13.2±2.43	46.2±3.52	**<0.001**

IV. Discussion

Viral meningitis leads to considerable morbidity and mortality in childrens. In order to differentiate aseptic meningitis to the bacterial meningitis, numbers of studies have shown the effectiveness of rapid and definite tests using CSF variables and markers of peripheral blood for various common and uncommon laboratory measurements (6-8). The main aim of study was to evaluate biochemical profile of CSF and to find out whether above parameters could be useful and differentiate viral meningitis from bacterial meningitis.

CSF glucose concentrations depend on serum concentrations and should always be tested on paired samples. A CSF/serum ratio cut-off of <0.4 is helpful in distinguishing between bacterial and aseptic meningitis .(Genton & Berger 1990) The glucose level in meningitis may be altered due to the changes in metabolizing glucose by the cells, white blood cells or bacteria due to inflammation.Marked increase was observed in CSF protein levels , consistent with the findings of other studies suggesting 50-100 mg/dl protein concentration in CSF samples of viral meningitis. However this increase in protein level is due to the increased membrane permeability may lead to increase CSF enzymes proportionately, helping in the differential diagnosis of meningitis (9).. Ejrances et al., have reported the concentration of glucose might normal with elevated protein level in cases of meningitis.(10). Jadali F has reported the negative correlation between CSF glucose and serum CRP revealed the important role of reduced CSF-glucose levels.(11) Marked significant decrease ($p<0.0001$) in electrolyte concentration was observed in the CSF samples of viral meningitis. The changes in electrolyte levels play a significant role in the diagnosis of viral/ bacterial meningitis as, the inflammation of meninges may cause damage to the blood brain barriers which leads to alter brain homeostasis. Moreover, the patients with fatal outcome of bacterial meningitis showed significantly higher CSF-acidosis and K+ level with lower levels of bicarbonate in CSF (12). Our study revealed a significant increase in the CSF enzyme activities (ALT, AST, ALP, CK and LDH) in viral meningitis patients as compared to controls. Many research reports suggest that the prognosis for meningitis patients could not establish on the basis of enzymatic activity alone, but depends on several factors.We conclude that biochemical profile of CSF variables have shown the effectiveness of rapid and definite tests for viral meningitis and treatment.

V. Conclusion

The present study was designed to evaluate the biochemical changes in the CSF samples, in order to differentiate viral and bacterial meningitis, as laboratory investigations play a major role in early diagnosis of this disease.significant increase in the concentration of glucose in both serum and CSF samples, with marked increase in CSF/Serum glucose ratio in viral meningitis patients.While total protein concentration was also significantly increased in CSF samples of viral meningitis patients but was insignificant in case of serum samples as compared to control group.C-reactive protein (CRP) depicts negative results in both viral meningitis patients and control groups.significant increase in the CSF enzyme activities (ALT, AST, ALP, CK and LDH) in viral meningitis patients as compared to controls.This study may play an important role in the diagnosis and more accurate treatment for the patients suffering from viral meningitis.

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