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CSF lactic acid estimation in meningitis

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ABSTRACT

Aims: The aim of present study was to determine the association of cerebrospinal fluid lactic acid estimation among patients of meningitis.

Materials and Methods: This cross sectional, observational study consisted of 32 patients of pyogenic meningitis, 30 patients of viral meningitis and 30 control patients without meningitis patients, assessed with CSF cytology and biochemistry specifically CSF sugar, protein and lactic acid estimation on day 1 and day 8.

Results: Overall meningitis was characterized by higher CSF cell counts and lactic acid but lower sugar and protein measurements. While differentiating between pyogenic and viral meningitis low sugar and high cell counts and lactic acid characterized pyogenic in day one estimations, however lactate remained most relevant in differentiations on day 8.

Conclusions: The study found that CSF lactic acid estimation differentiates the viral and pyogenic meningitis over eight days, more effectively then CSF sugar and protein measurements.

KEYWORDS CSF, Meningitis, Lactate estimation.

INTRODUCTION

The diagnosis of Meningitis is a serious medical condition, the diagnosis is based upon the history, clinical features (Symptoms and signs) and relevant laboratory investigations. Differential diagnosis of meningitis is vital for the management and difference between bacterial meningitis and aseptic meningitis is a critical clinical question.

In a recent systemic review and meta analysis Huy et al [1] reviewed 25 studies and concluded that CSF lactate is better marker compared to other conventional markers and a good single indicator to distinguish bacterial meningitis from aseptic meningitis.

However CSF lactate can also be elevated in several others disorders, such as subarachnoidal hemorrhage, bacterial meningitis [2], cerebral hypoxia [3], status epilepticus [4], and inborn errors of metabolism [5]. A decreasing lactic acid level in purulent meningitis is indicative of effective therapy and resolution of infection [6]. These factors are complicated by partial or ongoing antimicrobial treatment of bacterial meningitis, where raised CSF lactic acid gradually comes down. This poses great difficulty in clear diagnosis of patients, who comes to tertiary care centre with ongoing antimicrobial treatment from primary care centres. We plan this study to measure CSF estimation to differentiate bacterial and viral meningitis at early contact with therapeutic facility. We further measured CSF parameters and lactic acid estimation after one week with full antimicrobial treatment.

MATEIALS AND METHOD

The aim of the present study of cerebrospinal fluid lactic acid estimation in cases of meningitis is to find out the variations of lactic acid level in different types of Meningitis, to observe its diagnostic and prognostic value and to corroborate or contradict the findings of previous workers and reach at a conclusive state if possible. This was a cross-sectional hospital-based study, conducted at a tertiary care medical college hospital, RIMS Ranchi, Jharkhand, India during June 2005 to October 2006. The study protocol was approved by the institutional review board of RIMS, Ranchi. Data were collected with consenting patients or their guardians.

Subjects

Patients of Meningitis of both sexes, within age group 14 to 70 years admitted in different wards and units of the Medicine department in RIMS were selected for the estimation of cerebrospinal fluid lactic acid in addition to other relevant conventional tests on blood and CSF. These patients were thoroughly examined clinically after taking detailed history about the disease from the patients themselves or from the attendants, in case the patients were unconscious.

A total of 60 cases were included for the study, those with clinical diagnosis of tubercular meningitis, any concurrent medical illness and other disabilities were excluded.

Control:

30 patients were selected as control to serve as comparison for patients suffering from meningitis. These patients were free from any neurological disorder. The CSF of these patients were collected during spinal anesthesia for surgical procedure including obstetric operations, and few patients were of Enteric fever.

Tools

Socio-demographic Data Sheet: The socio demographic data

sheet included age, gender and religion of the patients, it also recorded clinical information like consciousness level.

Procedure : It was a cross sectional observational study. All subjects were assessed for inclusion – exclusion criteria, and on qualification they were requested to fill up Socio-demographic data sheet. Cerebrospinal fluid was collected by lumbar puncture performed on these patients. Lactic acid levels in cerebrospinal fluid of these patients was studied as complete routine biochemically and microbiologically. The laboratory people were blind to the clinical diagnosis of the CSF samples. The level of lactic acid for all samples was measured by calorimetric method through proper steps described for its estimation. The CSF collection and analysis was repeated after 8 days for experimental group only.

Statistical Analysis: The collected data of all students was statistically analyzed, using Statistical Package for Social Sciences (SPSS, Inc., Chicago, Illinois) version 10.0.

Data analysis included means, standard deviations and median scores for each gender. The parametric t-test was used to determine if differences existed between the groups. Statistically significant levels are reported for p values less than or equal to 0.05. Highly significant levels are p values less than .001.

RESULTS

The present study is a comparative study involving 32 cases of pyogenic meningitis and 30 cases of viral meningitis consisting a experimental group of total 62 patients. Another control group of 30 non meningitis cases were selected. Their age group varied from 14 to 70 years and there were 45 males and 15 females.

Table 1 summarizes the sample characteristics. The mean age of the experimental group was 33.77 (±15.55) years with gender distribution of 43 males and 19 females, whereas for the control group the mean age was 29.36 (±14.36) years and gender distribution of 19 males and 11 females. Within experimental group there were 32 cases of pyogenic meningitis with mean age 27.65 (± 13.67) years and 30 cases of viral meningitis with mean age of 28.93 (± 8.94) years. The two main experimental group ie patients of pyogenic and viral meningitis were not significantly different on socio demographic variables like age, sex and religion (table 1).

When findings of CSF routine examination of meningitis patients and control was compared, there was significantly higher mean CSF cells count (mean 5817/cmm), CSF protein and lactic acid, but significantly lower CSF sugar level (table – 2)

When cytology and biochemical parameters in day one cerebrospinal fluid were compared between pyogenic and viral meningitis for day one, there was significant higher lactic acid measure (p value = .000) and significantly lower sugar (p value = .001) in group of pyogenic meningitis. There was no difference in CSF cell counts and protein measurements between two types of meningitis (table – 3). When same CSF measurements were repeated on day 8, all measures were almost same for both the group, except mildly higher cell count (p value= .004) and persistence of significantly higher lactic acid value (p value = .000) for pyogenic meningitis (table -4).

Discussion:

Cerebrospinal fluid cytology and biochemical parameters estimation is of special importance in differential diagnosis of meningitis. CSF examination difference between normal (patients without meningitis) and patient of meningitis is very clearcut and most of the parameters showed significant difference in their parameters (table-2). Finding low CSF sugar is considered as hallmark of bacterial meningitis, but there may be other possible nonbacterial CNS infections like tuberculosis, amebic infections, brain abscess with ventricular leak and fungal infections which may cause low CSF glucose levels. Davis et al. [7] . similarly finding of high CSF sugar implicates viral meningitis and the differential diagnosis includes mycoplasma meningoencephalitis, neuroborreliosis, legionnaires' disease, rickettsial infection, hepatic encephalopathy and drug-induced meningitis/encephalitis [8–10]. Another important differential diagnosis are the viral infections that presents with decreased CSF glucose level like mumps virus, enteroviruses, and lymphocytic choriomeningitis virus [9]. Hence CSF lactic acid levels are a useful way to differentiating bacterial versus viral CNS infections, with decreased CSF glucose levels [10–14]. In pyogenic meningitis the CSF lactic acid level varied inversely with sugar while in viral meningitis there was no correlation between CSF sugar and lactic acid.

Another strength of this study is addressing the effect of treatment on 8th day, when CSF lactic acid level in pyogenic meningitis there was a fall with treatment, but it remained significantly higher then viral meningitis. Where as other parameters were settling to undifferentiated with viral meningitis, except CSF cell counts. This is clinically important finding as at tertiary care centre patients do come with few days of antimicrobial treatment from peripheral centers without confirmatory diagnosis or CSF examination. At this situation the CSF lactate estimation remain valid for differentiating between viral and pyogenic meningitis.

CONCLUSION

The study found that CSF lactic acid estimation differentiates between the viral and pyogenic meningitis over eight days, more effectively then CSF sugar and protein measurements.

Table 1. Age and sex of the sample and distribution according to diagnosis of bacterial and viral menongitis.

Variable		Pyogenic (n=32)	Viral (n = 30)	t / Chi – Square	df	p
Age (Years)		27.65 ± 13.65	28.93 ± 8.94	-.432	60	.667
Sex	Male (n)	23	20	.198	1	.657
	Female (n)	9	10			
Religion	Hindu	29	26	.299	4	.984
	Others	03	04			
Clinically	conscious	15	17	1.894	3	.595
	unconscious	17	13			

Table 2. Comparison of important CSF examination findings of cases of meningitis and control.

	Meningitis (n=60)	Control (n=30)	t	df	Sig. (2-tailed)
CSF Cells	5,817 ± 1175	3,466 ± 1,105	3.87	61	.000*
CSF Protein	244 ± 82.07	325 ± 6.73	15.18	61.95	.000*
CSF Sugar	29.56 ± 13.33	66.70 ± 10.68	-13.31	90	.000*
CSFLacticacid 1	44.73 ± 25.80	13.89 ± 2.70	9.30	63.74	.000*
CSFLacticacid 8		NA			

Table 3: comparison among subtypes of Meningitis for day 1 of hospitalization

	Pyogenic Meningitis (n=32)	Viral Meningitis (n=30)	t	df	Sig. (2-tailed)
CSF Cells	8,954 ± 1483	2471 ± 584	2.29	40.95	.027
CSF Protein	232 ± 68.19	256 ± 141	-.838	60	.405
CSF Sugar	24.18 ± 10.35	35.30 ± 13.90	-3.58	60	.001*
CSFLactic acid 1	57.53 ± 22.79	31.09 ± 21.72	4.669	60	.000**

Table 4: comparison among subtypes of Meningitis for day 8 of hospitalization

	Pyogenic Meningitis (n=32)	Viral Meningitis (n=30)	t	df	Sig. (2-tailed)
CSF Cells 8	4198 ± 519	1190 ± 212	3.01	41.64	.004
CSF Protein 8	235.8 ± 68.88	235.9 ± 69.05	-.990	60	.993
CSF Sugar 8	36.12 ± 14.09	31.23 ± 8.82	1.64	52.54	.105
CSFLactic acid 8	37.07 ± 14.20	15.58 ± 4.93	8.056	38.82	.000**

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