

Significance of Cerebrospinal Fluid Lactate Level in Diagnosing Septic Meningitis

Cerebrospinal Fluid
Lactate Level in
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Meningitis

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ABSTRACT

Objective: To evaluate the significance of lactate in CSF in differentiating between the cases of septic and aseptic meningitis in our setup.

Study Design:

Place and Duration of Study: This study was conducted at the Department of Pediatric Medicine, Peoples University of Medical and Health Sciences, Nawabshah from January 2018 to June 2018

Materials and Methods: Patients were collected from Out Patient's Department of Peoples Medical College Hospital as well as private clinics. Clinical diagnosis of septic (SM) and aseptic meningitis (ASM) was the standard of diagnosis. Neonates to 12 years old patients were included. CSF and blood samples were collected immediately after admission. CSF chemical analysis including lactate level was done on first spinal tap.

Results: A total of 144 patients were included in this study. The average age of patients was 4.2 +/- 6 months. 95 (66%) were males, 49 (34%) were females. Of these 144 patients 86 (59.7%) were in SM group and 58 (40.27%) were in ASM group. Most frequent symptom in either group was fever, followed by neck rigidity in SM group and vomiting in ASM group. The value of lactate in bacterial meningitis was 5.73 mmol/L (ranging from 5.17-6.73) and in aseptic meningitis patients it was 1.72 mmol/L (1.63-1.94).

Conclusion: The best method to confirm the diagnosis of bacterial meningitis is culture and sensitivity tests but as these C/S reports take quite a longer time to help in accurate diagnosis so the lactate level in CSF could be a safe and timely alternate for this delay. But the limitation of lactate level of CSF is that it does not help in establishing the exact pathogen species.

Key Words: CSF Lactate, septic meningitis, aseptic meningitis.

Citation of articles: Siyal AA, Shaikh S, Memon NA, Naqvi SQH. Significance of Cerebrospinal Fluid Lactate Level in Diagnosing Septic Meningitis. Med Forum 2018;29(12):68-71.

INTRODUCTION

The septic meningitis requires immediate intervention due to high morbidity and mortality, so its diagnosis should be accurate and immediate^{1, 2}, as the prognosis becomes guarded if there is a delay in the commencement of suitable antimicrobial therapy³. The culture of cerebrospinal fluid (CSF) is considered as gold standard for the diagnosis of septic meningitis, but this takes few days to complete the culture report⁴.

markers of CSF like protein, sugar, leukocyte count and gram staining⁵. To specify the diagnosis of septic meningitis other investigative tools like latex agglutination and PCR are used but they lack sensitivity, other tests like C- reactive protein (CRP), and procalcitonin can be helpful but are not used in routine practice⁶⁻⁹. Sometimes atypical CSF findings are given in reports or culture reports may be negative due to so many reasons, again making it quite desirable to have another test or marker to at least guide if its septic or aseptic meningitis¹⁰.

In routine it is generally observed that the clinical findings in septic and aseptic meningitis are overlapping but treatment in both is quite different as in cases of aseptic meningitis only supportive management is needed¹⁰.

Bacteria produce lactate through anaerobic metabolism¹¹, its level increases in any condition that results in decreased oxygen supply to brain and it is not related to lactate level of blood, thus lactate has an advantage over CSF glucose because glucose level in CSF correlates with blood level^{1, 12}. It is documented that the serum lactate level is not affected by contamination of blood in CSF^{13,14}. Many studies has mentioned that the CSF lactate concentration is not related to the neutrophil count in the CSF^{15,16,17}.

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Received by: July, 2018

Accepted by: October, 2018

Printed by: December 2018

For immediate management, the attending physician relies on clinical features and on the conventional

So it can be understood that beside CSF lactate can be used as a quick diagnostic tool to differentiate between septic and aseptic meningitis¹¹, but there is a great variation documented in literature^{18, 19}. So we designed this study to evaluate the significance of CSF lactate level in differentiating between septic and aseptic meningitis in our setup.

MATERIALS AND METHODS

The current study was conducted in the Department of Pediatric Medicine, Peoples University of medical and health sciences for women, Nawabshah, patients were also collected from out patient’s department of Peoples Medical College Hospital as well as private clinics, from January 2018 to June 2018. Clinical diagnosis of septic (SM) and aseptic meningitis (ASM) was the standard of diagnosis. All children of age 0-12 years with mentioned criteria and suspicion of meningitis were scrutinized and included in study after formal consent.

The cases included in the SM group were patients having leucocyte count >5 cells/microlit (all cells should not be lymphocytes) in the CSF, with one of the following three criteria:

1. Clinical signs and symptoms favoring bacterial meningitis²⁰
2. CSF glucose less than 1/3rd of plasma glucose
3. CSF protein more than 50 mg/dl

The patients included in the ASM group were having the following two criteria.

1. CSF having less than or equal to 4 cells/microlit
2. Absence of all criteria of SM group.

CSF and blood samples were collected immediately after admission. CSF chemical analysis including lactate level was done on first spinal tap.

All the data collected was tabulated and results were statistically analyzed.

RESULTS

A total of 144 patients were included in this study. The average age of patients was 2.5years +/- 6 months. 95 (66%) were males, 49 (34%) were females (fig-1), the

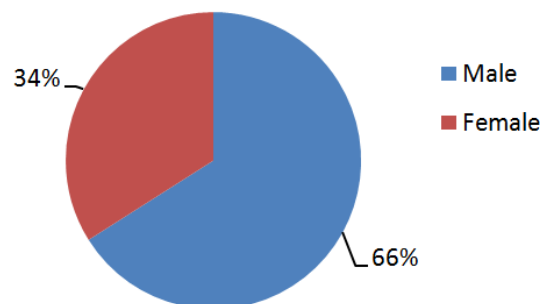


Figure No.1: Gender Distribution

Table No.1: Age distribution

Group	Age	Total	Male/Female	Bacterial Meningitis	Non-Bacterial Meningitis
Neonate	0-4 weeks	38	26/12	22	16
Infant	1-12 months	46	31/15	26	20
Toddler	1-3 years	16	10/6	10	06
Pre-School	3-5 years	32	21/11	20	12
School child	5-12 years	12	7/5	08	04
Total		144	95/49	86	58

Table No.2: Clinical Signs and Symptoms:

Clinical features	Bacterial Meningitis (n=86)	Non-bacterial meningitis (n=58)	p-value
Fever n(%)	86 (100)	46(79.3)	0.000
Seizuresn(%)	71 (82.55)	40(68.9)	0.057
Vomiting n(%)	34(39.6)	42(72.4)	0.000
Headache n(%)	12(14)	06(10.3)	0.521
Nuchal rigidity n(%)	49(57)	38(65.5)	0.304
Kernig’s sign n(%)	22(25.6)	10(17.2)	0.238
Brudzinsky’s sign n(%)	16(20.3)	07(14.9)	0.294
Mental status changes n(%)	24(30.4)	05(10.6)	0.005
Photophobia n(%)	05(6.3)	02(4.3)	0.517
Irritability/excessive cryn(%)	24(30.4)	10(17.2)	0.139
Lethargy n(%)	20(25.3)	05(10.6)	0.023

Table No.3: CSF characteristics

Parameter	Bacterial meningitis n-86	Non-bacterial meningitis n-58
Lactate mmol/L	5.73(5.17-6.73)	1.72(1.63-1.94)
TLC/cmm	11300(9800-16200)	8400(7300-11200)
Leukocyte count of CSF %	98(74-220)	76(68-84)
Protein %	250(134-330)	62(30-110)
Sugar %	18(9-24)	58(54-62)

majority of patients (46 cases) were infants. Out of these 144 patients 86 (59.7%) were in SM group and 58 (40.27%) were in ASM group (Table-1). Most frequent symptom in either group was fever, followed by seizures in SM group and vomiting in ASM group (Table-2). The value of lactate in bacterial meningitis

was 5.73 mmol/L (ranging from 5.17-6.73) and in aseptic meningitis patients it was 1.72 mmol/L (1.63-1.94).

DISCUSSION

If patients with bacterial meningitis are not treated promptly, the mortality rate can reach 20 to 50 %^{15,20}, an early and accurate diagnosis bacterial meningitis can be possible by examining the CSF lactate concentration¹⁵. The test can be performed at bedside, and the results can be received within 15 min. additionally, a rapid decrease in the CSF lactate level following antibiotic treatment could suggest a relatively good prognosis²¹. In our current study a total of 144 patients were evaluated. The frequency of septic meningitis among these patients was 86 (59.7%), which is quite high in comparison with the documented frequency in a study of Nazir et al (15.8%)²² and 39.68% in another study from Nepal²². This discrepancy is because they have calculated the frequency among all pediatric admissions of their center but we have only calculated the frequency among suspected cases of meningitis. Fever was one of the most common symptoms among both groups, over all the spectrum of symptoms matches with like studies on bacterial meningitis^{22,23}. In our study there is a major difference in the value of lactate in SM and ASM group, which was actually the main objective for this study and this finding is also seen in similar studies^{23,24}. So the purpose of finding a quick test that can differentiate between the cases of bacterial and aseptic meningitis while the treating physician waits for culture report is served by the findings of our study, lactate values do help in this regard. Although the gold standard for diagnosis of meningitis is CSF culture and even our study patients were later on treated according to their CSF culture and sensitivity reports. The findings in support of lactate values in CSF were assessed in two different meta-analyses, both of these studies showed quite different population but their results in term of sensitivity and specificity of CSF lactate for differentiation between septic and aseptic meningitis²⁵. Although our study was one of the first study in our setup studying the effectiveness of CSF lactate as a marker of bacterial infection, there is a high need of studying in large cohorts of patients in similar condition, age and setup so that one can reliably label the CSF Lactate as a quick diagnostic marker.

CONCLUSION

CSF lactate level is a quick, simple and economical marker as compared to other markers used to differentiate between septic and aseptic meningitis, but careful interpretation as always needed which should include a close eye on the clinical symptoms progression or improvement in the patient.

Author's Contribution:

Concept & Design of Study: Ali Akbar Siyal
 Drafting: Shamsuddin Shaikh
 Data Analysis: Naseer Ahmed Memon, Syed Qaiser Husain Naqvi
 Revisiting Critically: Ali Akbar Siyal, Shamsuddin Shaikh
 Final Approval of version: Ali Akbar Siyal

Conflict of Interest: The study has no conflict of interest to declare by any author.

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