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# An Epidemiological Study of Meningitis in a Tertiary Care Centre and Role of Serum and CSF Creatine Kinase and Lactate Dehydrogenase in Its Diagnosis

Dr. Subhasish Chakraborty[1], Dr. Manabendra Sau[2], Dr J Agarwal[3]
*[1] RMO, Dept. of General Medicine, NRS MCH*
*[2] Assistant Professor, Dept. of Community Medicine. Midnapore Medical College, West Bengal*
*3. MD Medicine*
*Corresponding author: Dr. Manabendra Sau2*

***Abstract***
***Introduction :*** *Meningitis is a life threatening infection of protective membranes covering the brain and the spinal cord, known as meninges. It is a common disease worldwide with high mortality and morbidity and remains a major international health problem. It is one of the common cause of hospital admission. It can present with fever, headache, neck rigidity, seizures, lethargy, drowsiness or coma in varied combinations.* ***Objective :*** *To study the epidemiology of meningitis in adults and role of Creatine kinase and lactate Dehydrogenase in its diagnosis.* ***Methodology :*** *A observational, cross sectional and institution based study conducted among* ***50*** *patients above 12 years of age admitted in a tertiary care centre with features suggestive of meningitis. 25 individuals were taken as control as per guidelines. Study was conducted from the month of January 2017 to September 2017. Patients were selected presenting signs and symptoms of meningitis after satisfying inclusion and exclusion criteria. Parameters like detailed history, through clinical examination, ECG and imaging studies were taken.* ***Result :*** *Majority of the patients 44% (44 patients) belonged to the adult age group 26-40 years. In the study 98% patients with meningitis presented with fever. All patients with pyogenic, viral and tubercular meningitis had headache. Seizures was present in 16.66% of tubercular meningitis and 37.5% of pyogenic meningitis. Clinical presentation of the disease is similar to features documented by other studies. Patients with clinical diagnosis of meningitis had increased LDH and CK in serum*
***Conclusion :*** *Inspite of many advents of sophisticated methods of investigations, diagnosis of meningitis remains a puzzle for physicians. In present study CSF enzymes like LDH and CK which remain significantly high compared to controls, hence their estimation gives an important clue to the diagnosis of meningitis.*
***Keywords:*** *Meningitis, Cerebrospinal fluid, Creatine Kinase, and Lactate Dehydrogenase*

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## I. Introduction

Acute infections of the nervous system are among the most important problems in medicine because early recognition, efficient decision-making, and rapid institution of therapy can be lifesaving. These distinct clinical syndromes include acute bacterial meningitis, viral meningitis, encephalitis, focal infections such as brain abscess and subdural empyema, and infectious thrombophlebitis, etc. Each may present with a nonspecific prodorme of fever and headache, which in a previously healthy individual may initially be thought to be benign, until (with the exception of viral meningitis) altered consciousness, focal neurologic signs, or seizures develop.[1] Meningitis is usually caused by bacteria or viruses, fungal, parasites, but can be a result of injury, cancer, or certain drugs. It is important to know the specific cause of meningitis because the treatment differs depending on the cause.

The brain is naturally protected from the body's immune system by the barrier that the meninges create between the bloodstream and the brain. Normally, this protection is an advantage because the barrier prevents the immune system from attacking the brain. However, in meningitis, the blood-brain barrier can become disrupted; once bacteria or other organisms have found their way to the brain, they are somewhat isolated from the immune system and can spread. When the body tries to fight the infection, the problem can worsen; blood vessels become leaky and allow fluid, WBCs, and other infection-fighting particles to enter the meninges and brain. This process, in turn, causes brain swelling and can eventually result in decreasing blood flow to parts of the brain, worsening the symptoms of infection.[2]

Since prompt and precise etiological diagnosis remains a challenge and often a thorough cerebrospinal fluid examination may not give a precise diagnosis, a quick and reliable test is required for rapid bedside

diagnosis. Brain tissue has a relatively large amount of enzyme activity and elevation of various enzymes in meningitis has been reported and many mechanisms have been postulated.[3-6]

However, no correlations were observed between serum activities and CSF of any of the enzymes. The prognosis for individual patients cannot be established on the basis of these enzymatic activities alone, but depends on several other factors. For this, many investigators Aggarwal AP et al, Jain MK et al, Donald PR et al, Yu SZ et al, Pancewicz SA et al, AM Al-Noaemi et al, Maharotra TN et al, Dave KN et al, Knight JA et al, have used them for the diagnosis and also for determining the prognosis in meningitis.[7-15]

In this context that the present study was planned an epidemiological study to find out the epidemiology of meningitis and role of Creatine kinase and lactate Dehydrogenase in its diagnosis.

## II. Materials And Methods

It was a observational, cross sectional and institution based study. The study was conducted among **50** patients above 12 years of age admitted in a tertiary care centre with features suggestive of meningitis. Study area was both rural and urban area of the tertiary care centre. Inclusion criteria were patients of either sex above 12 years of age with signs of meningeal irritation, fever, headache with CSF study suggestive of meningitis. Exclusion criteria were patient suffering from liver, muscle, cardiac, renal disease, neurological disorders like stroke, intracranial SOL, trauma, subarachnoid haemorrhage. Patients on antipsychotic and anti epileptics and pregnant females were also excluded from the study. *Study was conducted from the month of January 2017 to September 2017.* Parameters like detailed history, through clinical examination, ECG and imaging studies were taken.

Twenty five, age and sex matched individuals without any evidence of neurological disease and with minor ailments like hernia, hydrocele, etc who were to be operated under spinal anaesthesia were taken as controls. The CSF was collected during the time of spinal anaesthesia for cytological and biochemical examination including creatine kinase and lactate dehydrogenase.

LDH and CK was measured by sensitive colorimetry method (Spectrophotometry). LDH was estimated by using ENZOPAK LDH (L-P) KIT and CK was estimated by using CK (NAC act.) Kit. The case records were studies, analyzed and compared by suitable statistical methods. Correlations between different findings were established by bar diagram, pie charts, scatter diagram etc.

## III. Results And Discussion

In the study 56% patients were males and 44% were females, 66% were Muslims and 34% of the patients were Hindus. Residence of majority of the patients were rural (92%) and residence of only 08% were urban (Table-1).

16% of patients had pyogenic meningitis, 24% had viral meningitis and 60% of patients tubercular meningitis. Majority of the patients i.e. 44% with meningitis in the study are adults (20-40 years age group). Most types of meningitis presented with the common symptoms of fever, headache and neck stiffness. Seizures was present in 5 patients (16.66%) of tubercular and 3 patients (37.5%) of pyogenic meningitis. Cranial Nerve Palsy was present in 7 patients (23.33%) of tubercular and 1 patient (12.5%) of pyogenic meningitis (Table-2).

Mean value of LDH and CK in CSF as 106.62 IU/L and 54.4 IU/L in 50 patients of meningitis and mean value of LDH & CK in CSF in the 25 patients of control group was 21.25 IU/L and 10.35 IU/L respectively. Mean CSF LDH in control, pyogenic meningitis, tubercular meningitis and viral meningitis was 21.25 IU/L, 227.87 IU/L, 105.56 IU/L and 27.58 IU/L respectively. Mean CSF CK in control, pyogenic meningitis, tubercular meningitis and viral meningitis was 10.35 IU/L, 94 IU/L, 59.23 IU/L and 15.91 IU/L respectively (Table-3).

Mean value of LDH & CK in serum as 206.62 IU/L and 170.96 IU/L in 50 patients of meningitis and mean value of LDH & CK in serum in the 25 patients of control group was 116 and 98.43 IU/L respectively. Mean serum LDH in control, pyogenic meningitis, tubercular meningitis and viral meningitis was 116 IU/L, 312.5 IU/L, 211.2 IU/L and 124.58 IU/L respectively. Mean serum CK in control, pyogenic meningitis, tubercular meningitis and viral meningitis was 98.43 IU/L, 277.25 IU/L, 166.03 IU/L and 112.42 IU/L respectively (Table-4).

**Table 1 :** Distribution of patients according to sex, religion and type of residence**.**

| **Sex distribution** | **Male** | **Female** | **Total** |
|---|---|---|---|
| | 28 (56%) | 22 (44%) | 50 (100%) |
| **Religion distribution** | **Muslim** | **Hindu** | |
| | 33 (66%) | 17 (34%) | 50 (100%) |
| **Type of residence** | **Rural** | **Urban** | |
| | 46 (92%) | 04 (08%) | 50 (100%) |

**Table 2 :** Showing distribution of age and different clinical symptoms of various types of meningitis

| **Age (years)** | **Pyogenic Meningitis** | **Tubercular Meningitis** | **Viral Meningitis** |
|---|---|---|---|
| 12-19 years | 0 | 2 | 1 |
| 20-25 years | 4 | 1 | 3 |
| 26-40 years | 0 | 18 | 4 |
| 41-60 years | 4 | 8 | 4 |
| > 60 years | 0 | 1 | 0 |
| **Total** | **8** | **30** | **12** |
| | | | |
| **Complaints** | n=8 | n=30 | n=12 |
| Fever | 7 | 30 | 12 |
| Headache | 8 | 30 | 12 |
| Neck Stiffness | 8 | 30 | 10 |
| seizure | 3 | 5 | 0 |
| CN Palsy | 1 | 7 | 0 |
| Hemi/Quadriparesis | 0 | 2 | 0 |

**Table 3** : Showing the mean CSF, LDH and CK Levels in patients with meningitis and control group and in CSF, LDH and CK Levels in various meningitis and control group.

| | **Mean CSF LDH (IU/L)** | **P Value** | **Mean CSF CK (IU/L)** | **P Value** |
|---|---|---|---|---|
| Control | 21.25 | 0.0001 | 10.35 | 0.0001 |
| Diagnosed Meningitis | 105.62 | | 54.4 | |
| | **Control** | **PM** | **TBM** | **VM** |
| CSF LDH (IU/L) (Mean ±SD) | 21.25 ± 11.16 | 222.87 ± 86.06 | 105.56 ± 43.36 | 27.58 ± 12.29 |
| CSF CK (IU/L) (Mean ±SD) | 10.35 ± 7.16 | 94 ± 10.08 | 59.23 ± 15.93 | 15.91 ± 6.15 |

**Table 4 :** Showing the mean serum LDH and CK Levels in patients with meningitis and control group and inserum LDH and CK Levels in various meningitis and control group.

| | **Mean Serum LDH (IU/L)** | **P Value** | **Mean Serum CK (IU/L)** | **P Value** |
|---|---|---|---|---|
| Control | 116 | 0.0001 | 98.43 | 0.0001 |
| Diagnosed Meningitis | 206.62 | | 170.96 | |
| | | | | |
| | **Control** | **PM** | **TBM** | **VM** |
| Serum LDH (IU/L) (Mean ±SD) | 116 ± 47.25 | 312.5 ± 42.81 | 211.2 ± 40.52 | 124.58 ± 24.24 |
| Serum CK (IU/L) (Mean ±SD) | 98.43 ± 27.54 | 227.25 ± 34.36 | 166.03 ± 34.85 | 112.42 ± 34.76 |

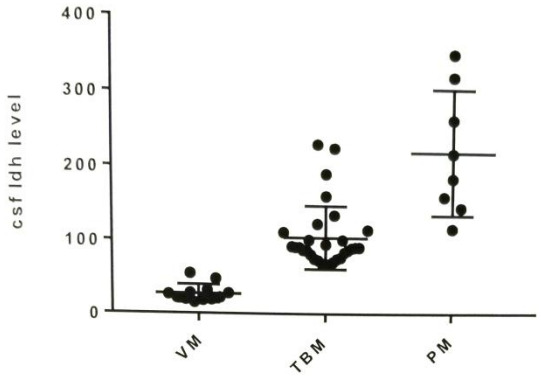


**Figure 1 :** One way ANOVA data showing CSF LDH levels in different types of meningitis

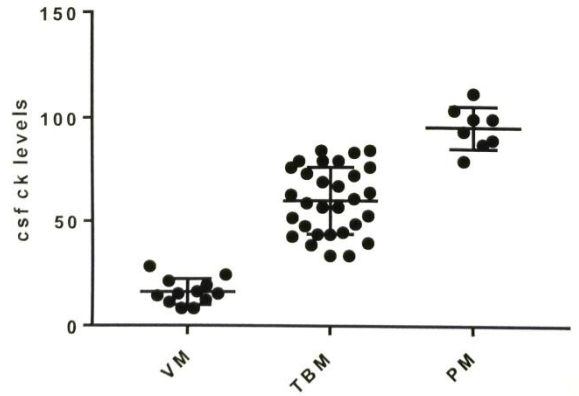


**Figure 2 :** One way ANOVA data showing CSF CK levels in different types of meningitis

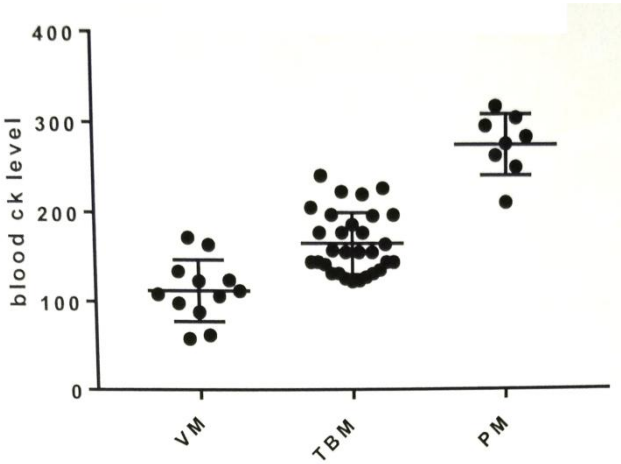


**Figure 3 :** One way ANOVA data showing Bblood CK levels in different types of meningitis

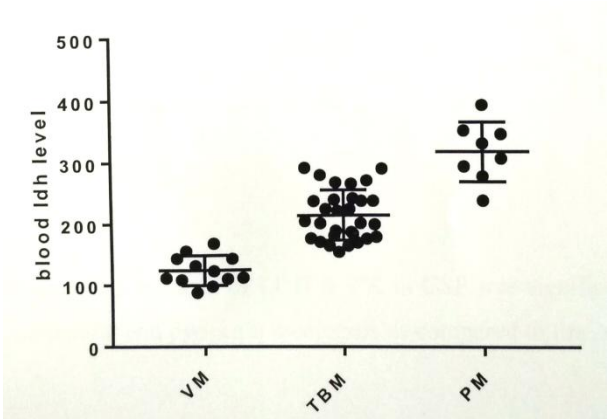


**Figure 4 :** One way ANOVA data showing Blood LDH levels in different types of meningitis

## IV. Conclusions

A total of 50 patients with meningitis were assessed in this study and they were evaluated as per protocol. Among 50 patients 12 patients were having viral meningitis, 30 having tubercular meningitis and 8 were having pyogenic meningitis. Most patients of meningitis presented with common symptoms of fever and headache. Seizures were present in 16.66% of patients. Study showed that LDH and CK in CSF was significantly increased in all types of meningitis as compared to control group (p=0.0001). When compared to viral, tubercular and pyogenic meningitis individually with the control group, the LDH and CK in CSF of patients was found to be significantly increased (p=0.0001). These results may be helpful in diagnosing patients

of partially treated pyogenic meningitis where CSF may show a lymphocytic predominance and patients with tubercular meningitis who may have a polymorphonuclear predominance in CSF in the initial stage. Serum LDH and CK may not be effective in differentiating patients with control i.e. normal population and patients with viral meningitis.

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