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ORIGINAL ARTICLE

Examination of Cerebrospinal Fluid in Patients with Depressed Level of Consciousness Admitted to Intensive Care Unit

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ABSTRACT

A relationship between changes in cerebrospinal fluid and decrease in level of consciousness in patients admitted to intensive care unit could be helpful in treatment and prevention of complications and decrease in mortality rate. In this prospective descriptive study, lumbar puncture was done for all the patients with loss of consciousness whom admitted to intensive care unit of Urmia Emam & Ayatollah Taleghani teaching hospitals at 2012 -2014. Patients whom had lumbar puncture contraindications were excluded from the study. Glucose, protein, RBC and WBC count of the samples were evaluated and data were analyzed by SPSS software ver18. Patients included 36 female(40%) and 54male (60%). Mean ± SD age of the patients was 68.26 ±14.7 years(max 87 and min 19 years). Six of the patients (6.6%) had abnormal WBC (more than 5 cell/mm³),33 patients had abnormal RBC count, 39 patients had abnormal protein concentration in CSF and none of them had abnormal glucose concentration. Culture of all the samples were negative. According to this and previous studies although evaluated variables in CSF do not have enough sensitivity and specificity in diagnosis of all the pathologies , which cause decrease in level of consciousness but it is still a method , which used to diagnosis meningitis and CNS infections.

***Key words**: Consciousness, Cerebrospinal fluid, Intensive care unit*

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INTRODUCTION

Cerebrospinal fluid is a clear-odorless fluid with specific gravity about 1.007 which produced by choroid plexuses of ventricles of Brain [1].

It circulates around brain and spinal cord .Ventricular system and subarachnoid space contains about 125-150 ml of this fluid .Absorption of fluid occurs through arachnoid villi of superior sagittal sinus. Choroid plexuses of lateral ventricles and to a lesser extent third and fourth ventricles secret CSF at about 0.37 $^{cc}/_{min}$ [2].

A semi permeable membrane called Blood-CSF Barrier and the other one called Blood Brain Barrier (BBB) are presents between blood-CSF and Brain-CSF respectively [3].These 2 barriers are impermeable to plasma proteins-large organic molecules [4].Composition and concentration of substances of CSF listed in table 1.

Laboratory studies of CSF are very important aspects of diagnosis of many neurologic and even other systemic diseases. Many systemic and Neurologic disorders change CSF profile. In intensive care units (medical and surgical units) up to 25% of patients develop sepsis and multiple organ failure (MOF). In the past these complications occurred frequently in patients of intensive care units before death. Today with newer therapeutic interventions such as transfusions-use of appropriate antibiotics, early recognition of infection sites and progress of mechanical ventilation techniques these patients can survive days-weeks

or even more. At intensive care units up to 40% of patients of these units can be cured completely. This point indicates importance of early diagnosis of infections particularly CNS infections [5].
Multiple studies demonstrated that central nervous system and peripheral nervous system may be involved in up to 70% of patients with sepsis or Multiple Organ Failure (MOF). After beginning of sepsis there maybe encephalopathy signs and symptoms which is called septic encephalopathy. This encephalopathy caused by presence of microorganisms or their toxins in circulation. Because CNS infections can depress level of consciousness it is mandatory to rule out this etiology as a causeof unconsciousness and differential diagnosis of septic encephalopathy [6].
There are few studies of CSF changes in patients with depressed level of consciousness especially at ICU wards [7,8].This study was done to evaluate the CSF changes in these patients admitted to ICU and to diagnose CNS infections especially meningitis in ICU patients .Of course meningitis can be a part of septic complications such as sepsis syndrome.

Table 1

Average values of constituents of normal CSF and serum

	CEREBROSPINAL FLUID	SERUM
Osmolarity	295 mosmol/L	295 mosmol/L
Sodium	138.0 meq/L	138.0 meq/L
Potassium	2.8 meq/L	4.1 meq/L
Calcium	2.1 meq/L	4.8 meq/L
Magnesium	2.3 meq/L	1.9 meq/L
Chloride	119 meq/L	101.0 meq/L
Bicarbonate	23.0 meq/L	23.0 meq/L
Carbon dioxide tension	48 mmHg	38 mmHg (arterial)
pH	7.33	7.41 (arterial)
Nonprotein nitrogen	19.0 mg/dL	27.0 mg/dL
Ammonia	30.0 g/dL	70.0 g/dL
Uric acid	0.24 mg/dL	5.5 mg/dL
Urea	4.7 mmol/L	5.4 mmol/L
Creatinine	1.1 mg/dL	1.8 mg/dL
Phosphorus	1.6 mg/dL	4.0 mg/dL
Total lipid	1.5 mg/dL	750.0 mg/dL
Total cholesterol	0.4 mg/dL	180.0 mg/dL
Cholesterol esters	0.3 mg/dL	126.0 mg/dL
Glucose	60 mg/dL	90.0 mg/dL
Lactate	1.6 meq/L	1.0 meq/L
Total protein	15–50 mg/dL	6.5–8.4 g/100 dL
Prealbumin	1–7%	Trace
Albumin	49–73%	56%
Alpha$_1$ globulin	3–7%	4%
Alpha$_2$ globulin	6–13%	10%
Beta globulin (beta$_1$ plus tau)	9–19%	12%
Gamma globulin	3–12%	14%

SOURCE: Reproduced by permission from Fishman.

MATERIALS AND METHODS

This prospective descriptive study was performed in Urmia Emamand Ayatollah Taleghani teaching hospitals at1.1.2012-1.1.2014. After being approved by the ethics and research committee of URMIA university of medical sciences, written informed consents were obtained from patients accompanying family members / guardian prior to enrollment. Sample of CSF obtained by neurologist from all patients

admitted to intensive care units of these two centers with depressed level of consciousness without clear and obvious causes. Total 90 patients were examined.All patients with contraindications of lumbar puncture and patients with clear cause of decreased level of consciousness were excluded from study. All samples examined for glucose-protein- cell counts and differential and culture for microorganisms. Samples examined by unique cell counter and machine. Data are given as mean ± standard deviation(SD).statistical analysis was performed using SPSS software (SPSS,USA) ver 18.

RESULTS

As mentioned earlier, 90 patients included in our study .36 (40%) were female and 54(60%) were male (Figure 1).The average (mean) and standard deviation of ages of patients was 68/26 ±14/7 .The age ranged from 19 to 87 years. Primary (admission) diagnosis was sepsis syndrome in 21 patients (23.3%)-metabolic encephalopathy in 15 patients (16.6%)-chronic obstructive pulmonary Disease (COPD)in 12 patients (13.3%) – stroke in 9 patients (10%) –epilepsy in 12patients (13.3%) and Multiple Myeloma in three(3.3%) .In 18 patients (20%) the primary diagnosis was solely depressed level of consciousness without structural CNS cause (Figure 2). Common aspect of all these cases was unknown etiology for consciousness disorder. On neurologic examination, 30 % of patients had focal neurologic signs (aphasia-hemiparesis-facial and gaze deviations) and 63 patient (70%) didn't had any focal signs and their neurologic examinations were entirely normal except for depressed level of consciousness.

The CSF findings from 90 patients were abnormal in only 6 cases (6.6%). The protein and glucose and WBC differentiated cell counts were entirely normal in 84 patients (93.4%).In 6 cases WBC were more than 5cell/mm^3(230, 195,180,155,100,and 78) and in three cases glucoses were below than 45 mg/dl (30, 25,and 18). In those six cases protein were more than45mg/dl (89, 80, 77, 73, 67, and 61).All cultures were negative.

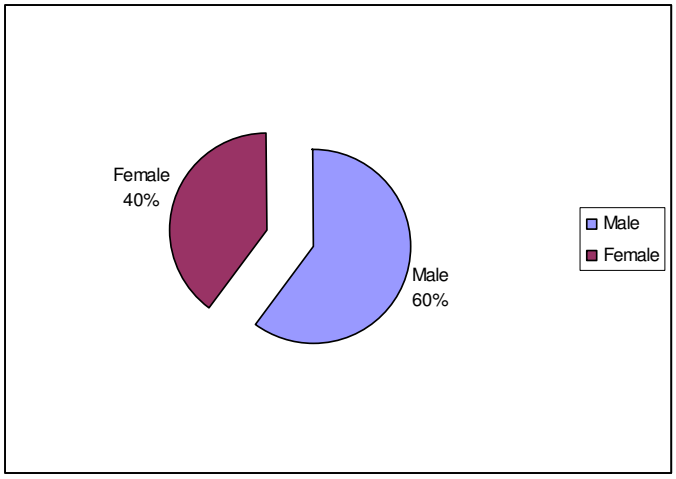

Figure-1: Diagnosis % in Male and Female

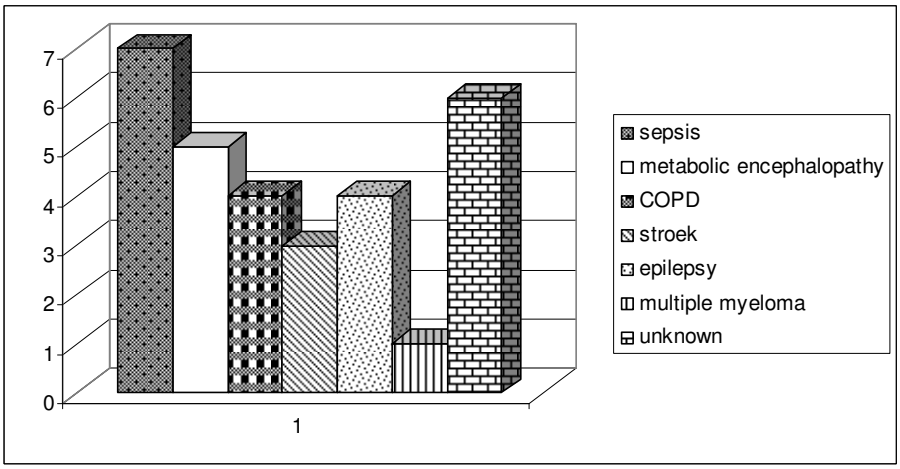

Figure-2: Diagnosis of Different CNS Diseases

DISCUSSION

Cerebrospinal fluid is in direct contact of brain and spinal cord thus several CNS disorders can affect CSF and CSF analysis and study is very important in many CNS and PNS and even systemic diseases that affect central nervous system [9].

Of 90 patients with disorder of consciousness in ICU of unknown origin only in 6 patients CSF analysis were abnormal and in 2 patient probable diagnoses was viral meningoencephalitis. Other patient had CSF pleocytosis due to status epilepticus.

CSF pleocytosis is one of the important parameters that strongly indicates CNS infections and other inflammatory and neoplastic etiologies. Thus it is an essential part of evaluation of patients with disorders of consciousness.

All patients with impaired consciousness must be lumber punctured for detecting CNS infections.

In our study other changes of CSF profile was increased protein content but it is very nonspecific marker and the cause of modest elevations of the CSF protein frequently remains obscure.

Hasani,M and sahraian M, in their study in 2005 examined the CSF changes in ICU patients to evaluate possible CNS infections. In one year period they examined 43 patients with lumbar puncture. CSF examined for cell count, glucose and protein content .Of 43 patients only in two cases CSF changes were consistent with Meningitis (4.65%).

These two patients were admitted with primary diagnosis of sepsis syndrome and with regard of their primary diagnosis, their results were statistically significant .They concluded that in patients admitted to intensive care units, CNS infections can be missed, thus CSF examination is a very important aspect of patients diagnostic evaluation [8].Our study approved that study although the cause of admission of patients varied.

In other study done by Kazemi et al in 1999, CSF changes evaluated in 50 patients with febrile convulsions. All patients under done lumbar puncture and their CSF examined. Results for CSF WBC-protein-glucose contents were entirely normal and infectious etiology never diagnosed.

Disorders of consciousness occur in more than 80% of ventilator-dependent patients admitted to intensive care units .Although many studies indicate that impaired level of consciousness can increase mortality up to 3 times but usually this aspect of patient's evaluation may be ignored. Thorough evaluation for detecting the etiology and causes of consciousness disorder strongly recommended [10].

Black & smith in their survey for causes of disorders of consciousness in critically ill patients concluded that ischemic strokes are most common cause of impaired consciousness in patients newly admitted to intensive care units and septic encephalopathy is the most common cause after admission to intensive care units [11].

The term septic encephalopathy refers to altered brain function related to the presence of microorganisms or their toxins in the blood. Clinical diagnosis of septic encephalopathy is one of exclusion [12]. Altered brain function in critically ill patients can be due to number conditions other than sepsis or infections. Disorders of consciousness may be followed by rigidity, tremor,asterixis, myoclonus, pupillary size and reaction alterations. Focal neurologic signs such as seizure-hemiparesis may occur. Young and Bolton in their Study of septic encepholopathic patients did not find any abnormalities in CSF examination [13, 14].Our study versus those studies [7-14] demonstrated that CSF examination were generally without significant changes.

One of the other important and interesting etiologies of CSF changes is paraneoplastic encephalitis. In this disorder antibodies against NMDA receptors develops in high titers in serum and CSF. This syndrome presents with depressed level of consciousness of unknown origin,seizures, status epilepticus, central hypoventilation due to pathologies in pons and medulla. This syndrome may occur in cancer patients admitted to intensive care units with depressed consciousness and if this disorder is suspected lumbar puncture should be done. Treatment is by plasmapheresis or Intravenous immune globulin(IVIG).Removal of primary tumor if possible also may be effective(5).In our study we haven't cancer cases and we didn't evaluated paraneoplastic encephalitis.

CONCLUSION

As our study indicated lumbar puncture is an indispensable part of examination of patients with signs and symptoms of meningitis, encephalitis or any patient in whom CNS infections is suspected. In patients with disorders of consciousness of unknown origin especially in critically ill patients and as a part of sepsis syndrome theoretically always there is a risk of CNS infection especially by hematogenous spread. Thus although previous small studies and our study demonstrates that this risk is small but it is very important to perform lumbar puncture to rule out CNS infections and other possible inflammatory disorders that can cause impairement of consciousness especially in intensive care unit patients .

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