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Pathology

LABORATORY FINDINGS OF ROUTINE CEREBROSPINAL FLUID ANALYSIS

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ABSTRACT

INTRODUCTION:
The cerebrospinal fluid is a dynamic metabolically active substance. Cerebrospinal fluid analysis is used to diagnose the diseases affecting brain, its coverings and spinal cord. It may be due to infection, inflammation or non infectious causes. A series of laboratory tests is done on a sample of CSF. It is a clear fluid that provides cushion to the brain. It also delivers nutrients to central nervous system. Central nervous system includes brain and spinal cord. CSF is produced by the choroid plexus and reabsorbed into brain .Different variables from routine analysis should be combined in order to arrive at a diagnosis. It includes colour, volume, appearance, cell count, protein, sugar, microbiological findings and others. These values when combined together will increase the diagnostic sensitivity.

MATERIALS AND METHODS:
This is a retrospective study, results of routine CSF analysis are collected from pathology, biochemistry and microbiology laboratories. The following criteria are taken into consideration.

COLOUR: With the help of colour changes we may not be able to arrive at diagnosis but it may be useful in identifying the additional substances in CSF.

TURBIDITY: When the CSF is found to be turbid or cloudy ,there may be white or red blood cells, micro organisms or increase in protein values.

CELL COUNT: Cytological examination should be carried out within 2 hours after puncture because there will be lysis of RBC and WBC.

CHEMICAL TEST: CSF glucose-It is about 50-60% of blood glucose[9].The levels get decreased when any abnormal cells are present because these cells will utilize the glucose present.

CSF protein-Usually only a small quantity of proteins are present . High protein values are significant.

MICROSCOPIC EXAMINATION: In a normal CSF ,there will be very less or no cells .In case of more than 5 cells, the laboratories will definitely perform differential count.

MICROBIOLOGY: The samples are cultured in blood agar,chocolate agar and Mc conkey agar.

CONCLUSION: The age and gender co-relation for 56 cases taking into consideration all the samples irrespective of clinical diagnosis was determined. Results showed a male predominance. Of the 56 samples, 13 were Neutrophil predominance including degenerated neutrophills which will be useful in initial diagnosis.In my study, two new borns had protein values 17 and 11 mg and were clinically diagnosed as seizure disorder.13 samples had increase in protein value.6 samples had low CSF glucose values which were diagnosed as pneumococcal meningitis, hydrocephalus, seizure, TB meningitis, meningioencephalitis. Gram negative cocci was found in one sample which was diagnosed clinically as post OP (24 hr culture).Gram positive bacilli was found in another sample which was diagnosed clinically as febrile illness, seizure.

KEYWORDS :

INTRODUCTION:
The cerebrospinal fluid is a dynamic metabolically active substance. Cerebrospinal fluid analysis is used to diagnose the diseases affecting brain, its coverings and spinal cord. It may be due to infection, inflammation or non infectious causes. A series of laboratory tests is done on a sample of CSF. It is a clear fluid that provides cushion to the brain. It also delivers nutrients to central nervous system. Central nervous system includes brain and spinal cord. CSF is produced by the choroid plexus and reabsorbed into brain .Different variables from routine analysis should be combined in order to arrive at a diagnosis. It includes colour, volume, appearance, cell count, protein, sugar, microbiological findings and others. These values when combined together will increase the diagnostic sensitivity. To manage a patient with CNS disease clinically,visual,microscopic and chemical examination of CSF is needed.

AIM AND OBJECTIVES:
To review findings in cerebrospinal fluid (CSF), normal laboratory reference values, and key aspects of CSF sample collection, gross and microscopic examination, microbiologic testing, and chemical analysis.

MATERIALS AND METHODS:
CSF samples are usually collected by doing lumbar puncture .It is also known as spinal tap. It is taken in less than 30 minutes. It is difficult to collect when compared to blood collection.

This is a laboratory based study. The details were collected from pathology, microbiology and biochemistry laboratories from a tertiary care hospital. Data on laboratory findings on cerebrospinal fluid were obtained and analysed. Details were collected by convience sampling. This is a retrospective study. The following criteria are taken into consideration.

COLOUR:
A normal CSF is clear and colourless. With the help of colour changes we may not be able to arrive at diagnosis but it may be useful in identifying the additional substances in CSF.

TURBIDITY:
When the CSF is found to be turbid or cloudy ,there may be white or red blood cells, micro organisms or increase in protein values.

CELL COUNT:
Cytological examination should be carried out within 2 hours after puncture because there will be lysis of RBC and WBC[10].

CHEMICAL TEST:
CSF glucose-It is about 50-60% of blood glucose[3].The levels get decreased when any abnormal cells are present because these cells will utilize the glucose present.For example in case of bacterial infection , white blood cells in inflammation, or tumour cells.

CSF protein-Usually only a small quantity of proteins are present because the are large in size unable to cross the blood brain barrier. High protein values are significant. The intergrity of blood-CSF barrier and CSF bulk flow will decide the amount of protein.[7,8]

MICROSCOPIC EXAMINATION:
In a normal CSF ,there will be very less or no cells .In case of more than 5 cells, the laboratories will definitely perform differentialcount.

MICROBIOLOGY:
The samples are cultured in blood agar,chocolate agar and Mc conkey agar.

TABLE 1:

CLINICAL DIAGNOSIS	NO OF PATIENTS
Seizure	10

Meningitis	9
Hydrocephalus	6
VP shunt	4
Unknown	4
Retinoblastoma	3
CKD stage 5	3
Acute febrile illness	2
Encephalopathy	2
CVA	2
Aspiration pneumonia	2
Neoplasms	2
Craniotomy	1
CA lung	1
Altered sensorium	1
Dengue	1
Post renal transplant	1
Intraventricular bleed	1
Neonatal sepsis	1

DISCUSSION:
56 samples were collected from a tertiary care hospital. The age and gender co-relation for 56 cases taking into consideration all the samples irrespective of clinical diagnosis was determined. Results showed a male predominance[Fig2].

COLOUR:
6 samples were reddish, 1 was yellowish and remaining were colourless which is normal.

APPEARANCE:
11 samples were turbid and others were clear which is normal.

TOTAL COUNT:
According to study by F.Deisenhammer, Innsbruck Medical University et.al, lymphocytes and monocytes at the resting phase are occasionally found in normal CSF. In my study of clinically diagnosed CNS disease patients, 23 samples were mononuclear predominance which were normal. An increased number of neutrophilic granulocytes can be found in bacterial and acute viral CNS infections[4,5] . Of the 56 samples, 13 were Neutrophil predominance including degenerated neutrophills. The clinical diagnosis were febrile status epilepticus ,seizure ,meningitis, post OP, intraventricular bleed,craniotomy which includes infectious conditions.These values may be useful in initial diagnosis and treatment.In case of neutrophilic predominance , the actual cause such as bacterial , viral or tuberculous can be founf using protein ans sugar values.Eosinophills are normally not present in CSF[6].The presence of atleast 10% eosinophills /ml in CSF is associated with parasitic infections, malignancies, ventriculo peritoneal shunts and coccidioiodomycosis. There was no clinical diagnosis of parasitic infection.Patients with VP shunts had no eosinophills. For remaining 20 samples, values were not available.

In conclusion, cell count is generally useful because most of the indications for CSF analysis include diseases that are associated with elevated numbers of various cells.

1016 cells was the highest which was clinically diagnosed as intraventricular bleed.24 samples had count less than 5 cells which is normal.

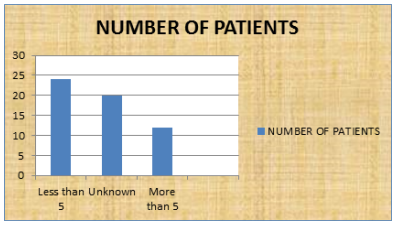

FIGURE 1:

X Axis: Number of patients Y Axis: Total cellcount

PROTEIN: 15 to 60 mg/100ml

According to their study, In newborns, the protein concentrations are high, but decrease gradually during the first year of life[1,2]. In my study, two new borns had protein values 17 and 11 mg and were clinically diagnosed as seizure disorder.

Non infectious causes for an increased CSF protein and increased cell count include subarachnoidal haemorrhage, CNS vasculitis and CNS neoplasms[3].Elevated CSF protein concentration can be found in patients with bacterial, cryptococcal, tuberculous meningitis. 13 samples had increase in protein value. Clinical diagnosis were pneumococcal meningitis, CA lung, acute febrile illness, acute encephalopathy , seizure, TB meningitis, Post OP, septic encephalopathy, meningioencephalitis.

GLUCOSE: 50-80 mg/100ml

A high CSF glucose concentration has no specific diagnostic importance and is related to an elevated blood glucose concentration,for example in diabetes. Low CSF glucose levels can be caused by CNS infections, inflammatory conditions, subarachnoid hemorrhage, metastatic carcinoma.

6 samples had low CSF glucose values which were diagnosed as pneumococcal meningitis, hydrocephalus, seizure, TB meningitis, meningioencephalitis.

MICROBIOLOGICAL FINDINGS:
Gram negative cocci was found in one sample which was diagnosed clinically as post OP (24 hr culture).

Gram positive bacilli was found in another sample which was diagnosed clinically as febrile illness, Seizure .

CONCLUSION:
The study was performed at Saveetha medical college and hospital, Tamil Nadu.This is a retrospective study.The study aims at reviewing the findings in cerebrospinal fluid (CSF), normal laboratory reference values, and key aspects of CSF sample collection, gross and microscopic examination, microbiologic testing, and chemical analysis. The age and gender co-relation for 56 cases taking into consideration all the samples irrespective of clinical diagnosis was determined. Results showed a male predominance.

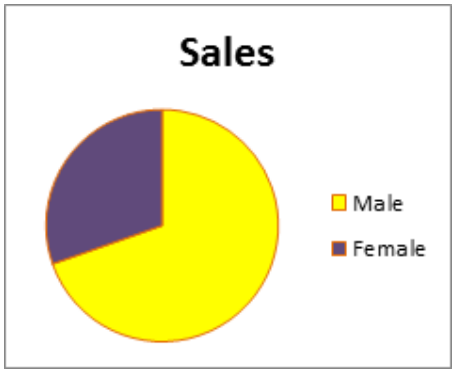

FIGURE 2;

The total number of cases chosen for the study is N=56.

Of the 56 samples, 13 were Neutrophil predominance including degenerated neutrophills. The clinical diagnosis were febrile status epilepticus ,seizure ,meningitis, post OP, intraventricular bleed,craniotomy which includes infectious conditions. In my study, two new borns had protein values 17 and 11 mg and were clinically diagnosed as seizure disorder. 13 samples had increase in protein value. Clinical diagnosis were pneumococcal meningitis, CA lung, acute febrile illness, acute encephalopathy , seizure, TB meningitis, Post OP, septic encephalopathy, meningioencephalitis.

6 samples had low CSF glucose values which were diagnosed as as pneumococcal meningitis, hydrocephalus, seizure, TB meningitis, meningioencephalitis.

Gram negative cocci was found in one sample which was diagnosed clinically as post OP (24 hr culture).Gram positive bacilli was found in another sample which was diagnosed clinically as febrile illness, seizure.

ADVANTAGES:
The cell count, protein and sugar values will be helpful in initial diagnosis of diseases and starting the treatment for faster recovery. The samples can be processed and reports can be given within two hours.

LIMITATIONS:
Limited number of cases and therefore limited number of samples. Since this is a retrospective study, the final diagnosis and patient follow up is not possible.

FUNDING: No funding resources.

CONFLICTS OF INTEREST: No potential conflicts of interests relevant to this article is reported.

ETHICALAPPROVAL: Not required. This is a retrospective study.

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