



# CYTOLOGICAL EVALUATION OF CSF: AN EARLY, COST EFFECTIVE METHOD OF DIAGNOSIS OF PYOGENIC MENINGITIS

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## Abstract

**Introduction:** CSF is a clear body fluid, occupying between arachnoid mater and the pia mater. It is formed in the choroid plexus. Infection of the meninges by various pathogens is termed as meningitis. The aetiology of meningitis can be bacterial, viral

and tubercular. Differentiating bacterial from non-bacterial types is important in deciding the treatment as bacterial meningitis is more prone for life threatening neurological complications and require immediate parenteral antibiotics as compared to non- bacterial antibiotics. The present study is done to evaluate the cytological findings of CSF, along with the clinical history to classify the various types of meningitis.

**Materials and Methods:** The present study has been undertaken in the Department of Pathology, Dhiraj Hospital, for a period of one year. Lumbar puncture was performed. The direct cell count was done manually using Improved Neubauer counting chamber. Sediment smears were done and stained with Haematoxylin & Eosin, Giemsa stain and special stains like India ink as and when required.

**Results:** The total body fluids evaluated during the study period were 385. CSF accounted for 100 samples. The range of age the group varied, between new-borns to 90 years of age. Out of 100 cases of CSF fluid, 83 were normal, 15 were viral, 2 were bacterial. The cell count results were correlated with glucose and protein values accordingly.

**Conclusion:** This study makes an effort to use the cost effective diagnostic procedure to enable early diagnosis and prompt treatment, which in turn reduces mortality.

**Keywords:** CSF, Meningitis, Bacterial, Viral.

## Introduction:

Lumbar puncture was first done in 1891. Tumour cells were first reported in CSF in 1904. It helped in evaluation of disease related to CNS i.e. febrile illness. CSF is a clear body fluid present in between pia mater and arachnoid mater. It is formed by the choroid plexus. Functions of CSF are to protect spinal cord and brain from changes of pressure, to maintain a stable environment and acts as a media for excretion of waste products of cerebral metabolism.

Inflammation of meninges is induced by a variety of anatomical and physiological stimuli which leads to changes in blood brain barrier. That leads to leakage of proteins and inflammatory infiltrates into CSF. Hence the early diagnosis of meningitis will help in early recovery and reduction in mortality.

Bacterial meningitis has more life threatening neurological complications and requires immediate treatment as compared to non- bacterial meningitis.

This study is conducted to identify the cause of meningitis by cytological evaluation of CSF. This method is not only cost effective but faster than the other methods.

AIM: Early, cost effective diagnosis of pyogenic meningitis.

## OBJECTIVES:

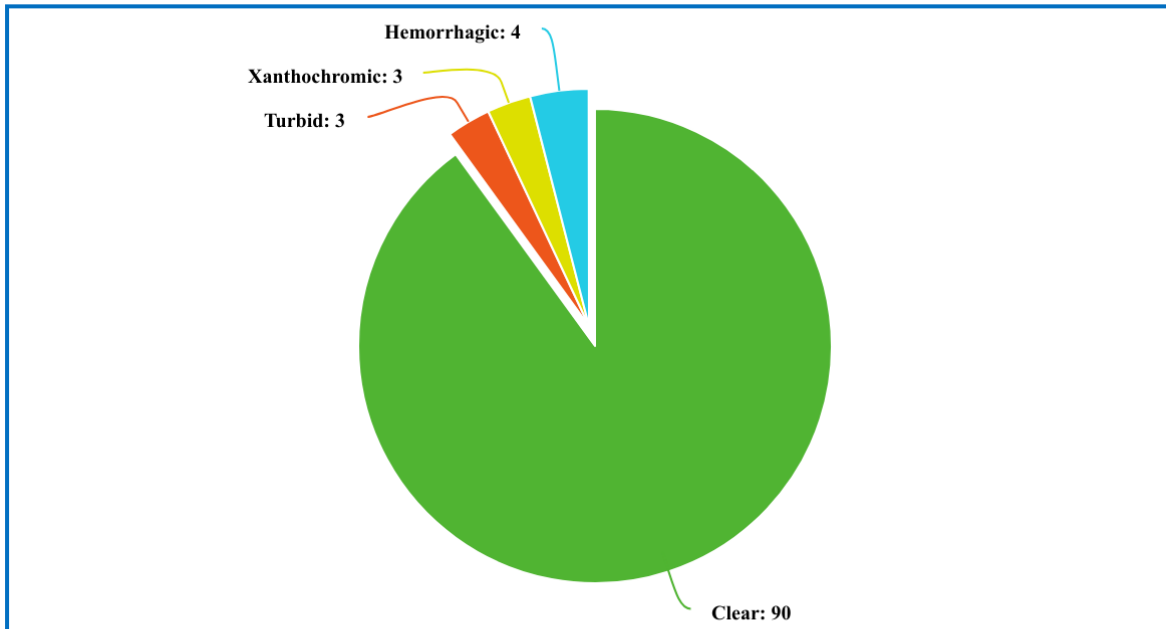
- To diagnose the cause of meningitis and start early treatment of meningitis.
- To compare the cytological findings of CSF to the cytological findings of other studies.

## MATERIALS AND METHODS:

The present study has been undertaken in the Department of Pathology, Sumandeep vidyapeeth for a period of one year. Relevant clinical information regarding age, sex and accompanying clinical symptoms has been documented. Lumbar puncture was performed by clinicians and further sent in three sterile containers to the collection centre at Sumandeep Vidyapeeth. A request form with relevant clinical details was sent with the samples. Immunocompromised status was also mentioned in order to look for opportunistic infection. It was further processed in the pathology, microbiology and biochemistry departments respectively. The samples received were immediately processed. Cytological evaluation was performed within 2 hrs. The direct cell count was done manually using the Improved Neubauer counting chamber. Cell count for RBCs and WBC was. separately done for haemorrhagic tap and corrected

WBC count was accordingly reported. The sample was then centrifuged at 3000 rpm for five minutes. Sediment smears were done and stained with Haematoxylin & Eosin, Giemsa stain and special stains like India ink as and when required.

Appearance of fluid



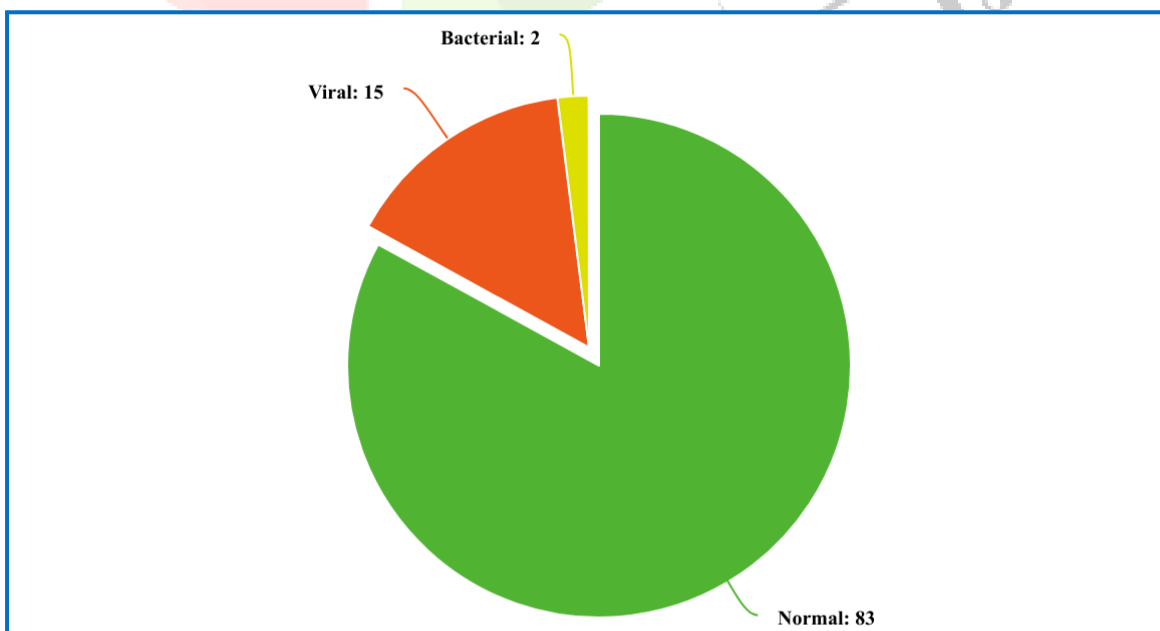
■ Clear   
 ■ Turbid   
 ■ Xanthochromic   
 ■ Hemorrhagic

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**Results:**

The total body fluids evaluated during the study period were 387. CSF accounted for 100 samples. The range of age groups varied, between new-borns to 90 years of age. Maximum number of cases was in the range of 0-09 years, followed by 40-49 years. Males constituted 57 of 100 cases and females comprised 43 of 100 cases. Male to female ratio was 1.36:1. In our study out of 100 cases, 90 were clear, 03 were turbid, 03 were xanthochromic, and 04 were hemorrhagic. Microscopically 83 cases showed normal cell count. 17 cases showed elevated counts with the following pattern of differential count. Lymphocyte predominance was seen in fifteen cases, neutrophil predominance in two. Out of 100 cases of CSF fluid CSF 83 were normal, 15 were viral and 2 bacterial. The cell count results were correlated with glucose and protein values accordingly.

Appearance of fluid



■ Normal   
 ■ Viral   
 ■ Bacterial

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## Discussion:

CSF examination provides an inestimable diagnostic skylight into the pathology of the central nervous system. Commonly performed tests on CSF in cytology are physical examination which includes appearance of fluid and supernatant colour. Total leukocyte counts, differential count, and microscopic examination. Biochemical tests like glucose and protein levels are estimated. Cytological evaluation of CSF is a cost effective diagnostic tool for an early diagnosis of meningitis and a better treatment(1,2,3)

Lumbar puncture is a procedure performed to collect CSF for biochemical, microbiological and cytological analysis. This is an important procedure done to diagnose and differentiate a variety of infectious and non-infectious neurological conditions(4,5)

Normal CSF is crystal clear(6). The presence of white blood cells or red blood cells, will impart an altered colour to CSF, making it appear turbid. Xanthochromia is a condition which shows yellowish discoloration of CSF. This change in colour is due to lysis of RBCs, thus causing haemoglobin breakdown into methaemoglobin and bilirubin. It is usually seen in patients with subarachnoid haemorrhage and newborns(3). Newborns will have xanthochromic CSF because of elevated levels of bilirubin and proteins for that age group. Erythrophages are seen before 24 hours after haemorrhage; siderophages containing hemosiderin are encountered 1-2 days after haemorrhage and may persist for 4 weeks. Macrophages haematoid appears 2 weeks after bleeding. These above mentioned features are signs of previous sub arachnoid haemorrhage(7). In our study out of 99 cases, 90 were clear, 03 were turbid, 03 were xanthochromic, and 03 were haemorrhagic. A similar study has mentioned that examination of the CSF especially in patients with bacterial meningitis characteristically reveals a cloudy fluid with leukocytosis and predominance of neutrophils(8)

The normal CSF contains up to 05 WBC's per cubic mm in adults and 20 WBC's in newborn. Increased WBC counts are seen in varying conditions such as after seizure, intracerebral bleed, inflammatory condition, traumatic tap(9). In our study, traumatic tap was encountered in 4 cases. In a study conducted by Pinky P et al(1) out of 356 cases, 153 had normal cell count (0-5 cells per cubic mm), while 129 cases had cell count of 5-100 cells per cubic mm and 74 cases had more than 100 cells per cubic mm. in our study we encountered 79 (79.8%) cases with normal WBC count and 20 (20.2%) cases with raised WBC count. In a study conducted by Ali Hassan Abro et al, leukocytosis was noted in 91% of cases with bacterial meningitis and 17% of viral meningitis cases showed mild elevation of white cell count(2) In a study conducted by Rabab Fouad et al(4) leucocytosis was encountered in 47.9% of cases with bacterial meningitis, while only in 24.1% of patients with non-bacterial meningitis showed leucocytosis.

The differential count in normal CSF consists of approximately 70 percent lymphocytes and 30 percent monocytes. Occasional polymorphonucleocyte can be seen in normal CSF. The differential count alone cannot differentiate bacterial and non-bacterial meningitis. In our study, lymphocyte predominance was seen in fifteen cases, neutrophil predominance in two single case. The study conducted by Pinky et al(1), showed neutrophil predominance in 13 cases of bacterial meningitis and lymphocytic predominance in three cases of fungal meningitis. In a study conducted by Rabab Fouad et al(4), patients with bacterial meningitis had predominantly neutrophilic CSF with neutrophil Cryptococcal meningitis is the most common form of fungal meningitis. It is caused by Cryptococcus neoformans. Cryptococcal infection is commonly encountered in immunocompromised patients with impaired cell mediated immunity. In HIV infection, Cryptococcal infection occurs in advanced stages of disease with CD4+ count less than 50-200 cells/microL. It occurs in non-HIV patients who are immunodeficient due to diabetes, cancer, solid organ transplants, chemotherapeutic drugs, haematological malignancies and very rarely in healthy individuals with no obvious predisposing factors(10)

## Conclusion

Csf analysis is an important diagnostic tool to differentiate various causes of meningitis and hence aid in the early treatment and recovery of patients. In immunocompromised patients, an early diagnosis of meningitis will help in timely treatment.

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