

Diagnostic Importance of Cerebrospinal Fluid in Pathognomic Condition

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Abstract

Collection and evaluation of CSF in pathognomic conditions is of most importance in investigation and diagnosis of various diseases with involvement of central nervous system and spinal cord. Scanty information is available regarding biochemical and physiological laboratory tests and biochemical referral values of biological ingredients of CSF, hence this paper is informative for academicians and field veterinarians.

Keywords: cerebrospinal fluid, atlanto occipital, lumbosacral

Introduction

The studies on CSF were majorly carried out on the experimental animals but now-a-days CSF is frequently examined for diagnostic purpose and for understanding the severity and nature of the disease process involving the CNS.

Collection of CSF

For collection of CSF the material required is 12.5 cms long 14G needle with a stylet, 3 inch 16 G spinal needle, cotton swab, BP handle with knife, rectified spirit, sterilized test tubes, sharp razor etc in sterilized condition and aseptic precautions should be taken during collection.

Methods of collection

The CSF is collected from two sites,

- A. Cisterna magna or atlanto-occipital puncture in horse, cat and dog.
- B. Sub lumbar or lumbosacral puncture in cow, sheep and goat.

A. Atlanto occipital puncture: The collection can be done either in the standing position or in the lateral recumbency with following steps,

1. Restrain the animal, casting with rope.
2. Sedation of the animal by giving local anesthesia such as 2% Xylocain, Lignocain and tranquilization with Siquil or Largactil.
3. Flex the head by bending and stretching the neck, so that it forms a 90° angle with the longitudinal axis of the neck and hold it in this position firmly.
4. Clip, clean and sterilize the selected area.
5. Use a 3-4" long and 16 G spinal needle with a stylet and insert it slowly at the cranial edge of

the wings of atlas. Direction of the needle should be parallel to the long axis of the head. When the needle enters subarachnoidal space resistance is not felt.

6. Needle enters into atlanto-occipital joint, remove the stylet so that the CSF flows out and collect approximately 1 to 2 ml of CSF.

B. Sub lumbar puncture: The collection is done in the standing position.

1. Presurgical and aseptic precautions are taken and the depression between the dorsal process of last lumbar vertebra and cephalic end of median crest of sacrum is palpated. Needle is passed and punctured at this site. Insert the needle vertically, then slightly oblique by applying gradual pressure in forward and backward directions. As the needle enters in subarachnoid space comparatively less resistance is felt.
2. Animal must be tied firmly to avoid damage to the spinal cord.

CSF collection is done by removing the stylet, apply a syringe and suck the fluid.

Examination of CSF

The CSF is examined for following tests,

- I. Physical examination described in Table No.1.
- II. Chemical examination

a. Proteins: Normal protein content of CSF is 12-40 mg/100 ml and most of it is albumin.

b. Glucose: The quantitative estimation of CSF glucose is done by the Folin – Wu technique. The concentration of the glucose in CSF is approximately 60-70 % of blood glucose level and ranges from 40-80 mg/100 ml in normal CSF.

Table-1. Physical examination of CSF.

Parameters	Observation	Inference
Colour	Clear, watery and transparent	Normal
	Red	Puncture of blood vessel during collection
	Dull red / brownish	Intracranial hemorrhage, cranium fracture
	Yellow (xanthochromic)	Presence of bile pigments (jaundice), hemorrhage.
	Grayish or greenish	Due to infection leading to pus formation
Turbidity	Clear, transparent	Normal
	Hazy, ground glass like	Presence of cells/ white clots appearance (pleocytosis)
	Cloudy/purulent	Encephalitis, bacterial meningitis.
	Red turbid	Puncture of blood vessel during collection.
Coagulation	No coagulation	Normal
	Coagulation	Presence of abnormal amount of proteins especially fibrinogen in cases of meningitis
	Blood (in large quantities)	Internal hemorrhage or improper collection.

The glucose level in CSF depends upon the

1. Blood glucose levels,
2. Selective permeability of the blood to CSF barrier,
3. Presence or absence of glycolytic barrier.

An increased glucose level in the CSF is termed as "hyperglycorrhacia" and is seen in association with any disease having a hyperglycemia (Diabetes mellitus), encephalitis, spinal cord compression, brain tumors or brain abscess. A decreased glucose level in the CSF is termed as 'hypoglycorrhacia' and is associated with systemic hypoglycemia or acute pyogenic infection.

c. Chlorides: Normal CSF values in domestic animals ranges between 650-850 mg/100ml. Lower values are

seen in pyogenic meningitis, protracted vomiting, advanced pneumonia, hypochlorimia, while normally higher values of chlorides in CSF are recorded than in serum.

d. Sodium: Slightly higher in CSF than in blood in salt poisoning cases.

e. Cholesterol: Hemorrhages in the CNS, tumors, meningitis and brain abscess lead to an increase in cholesterol content. Usually normal cholesterol level is very low and values recorded in Horse: 0.36 - 0.55 mg/dl and Goat: 0.51 mg/dl.

f. Determination of enzymes: Increased levels of CSF GPT: 20.1(9-46 unit) and GOT: 13.7 (2-32 units) have been observed in dogs suffering from distemper with

Table-2. Chemical Examination of CSF.

Sr.No.	Tests	Observation	Inference
1.	Foam test Take CSF in test tube and shake the test tube at least for 5 minutes	Slight foam that disappears after few minutes More foam that remains Protein lvesl Increased	Normal Protein levels
2.	Sulfosalicylic acid test (SSA) 3 ml of 3% SSA + 1 ml CSF Mix and allow to Stand	Increase in the turbidity	Presence of proteins
3.	Nonne - Apelt test 1 ml saturated ammonia solution + 1 mlCSF Do not mix. Allow to stand	White to grayish ring at the junction of two fluids	Presence of increased amounts of globulin in CSF which is seen in 1. Encephalitis, 2. Meningitis, 3. Neoplasia, 4. Hemorrhage, 5. Hydrocephalus, 6. Tissue destruction,
4.	Pandy test 1 ml saturated phenol or Pandeys reagent, 1-2 drops of CSF Shake (Pandy's reagent is prepared by dissolving 10 grams of pure phenol in 150 ml of distilled water)	White cloudy or turbid	7. Uremia, 8. Toxoplasmosis, 9. Pneumonia

involvement of CNS, purulent meningitis and cerebral infarction.

Lactic dehydrogenase enzyme level of CSF are also increased in bacterial meningitis, metastatic carcinoma, lymphoid tumor, subarachnoid hemorrhage and cerebral infarction. A marked elevation in the CPK (creatinine phosphokinase) is also seen in certain neurological conditions.

g. Calcium: Normally the calcium is lower in CSF than in serum. Increased level of protein bound calcium in CSF indicates disturbance in blood brain barrier.

III. Cytological examination

The total cell counts of the CSF must be estimated within 20 minutes of collection, since the cells degenerate rapidly. The estimation of the number of cells is done as for the determination of WBC's of the blood. The total number of cells which are obtained are then multiplied by 0.6 to get number of cells in one cu mm of the CSF.

Normal counts:

Cattle, sheep and pig	0 - 15 cells/ cu mm
Dog	upto 25 cells/cu mm
Horse	upto 23 cells/cu mm

Pleocytosis or increased number of WBC's are seen in inflammatory conditions of brain, spinal cord or meninges, abscess of brain or spinal cord,

encephalitis, chronic inflammatory conditions, toxic or degenerative conditions.

Differential Count: Prepare the smear from CSF, dry it and stain with leishmans stain, examine under microscope. Neutrophilia indicates pyogenic or bacterial infection, abscesses in brain, bacterial meningitis, encephalitis and hemorrhage, while lymphocytosis is observed in uremia, toxemia, chronic viral and fungal infection.

IV. Bacteriological examination

It is carried out when the CSF cell count and protein contents are high. The organisms are isolated in CSF and identified by cultural methods.

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