List the functions of cerebrospinal fluid

[Skip to Navigation] In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. Something went wrong. Wait a moment and try again. The cerebrospinal fluid (CSF) is contained in the brain ventricles and the cranial and spinal subarachnoid spaces. The mean CSF volume is 150 ml, with 25 ml in the ventricles and 125 ml in subarachnoid spaces.CSF is predominantly, but not exclusively, secreted by the choroid plexuses. Brain interstitial fluid, ependyma and capillaries may also play a poorly defined role in CSF secretion.CSF circulation from sites of secretion to sites of absorption largely depends on the arterial pulse wave. Additional factors such as respiratory waves, the subject's posture, jugular venous pressure and physical effort also modulate CSF flow dynamics and pressure.Cranial and spinal arachnoid villi have been considered for a long time to be the predominant sites of CSF absorption into the venous outflow system. Experimental data suggest that cranial and spinal nerve sheaths, the cribriform plate and the adventitia of cerebral arteries constitute substantial pathways of CSF drainage into the lymphatic outflow system.CSF is renewed about four times every 24 hours. Reduction of the CSF turnover rate during ageing leads to accumulation of catabolites in the brain and CSF that are also observed in certain neurodegenerative diseases.The CSF space is a dynamic pressure system. CSF pressure determines intracranial pressure with physiological values ranging between 3 and 4 mmHg before the age of one year, and between 10 and 15 mmHg in adults.Apart from its function of hydromechanical protection of the central nervous system, CSF also plays a prominent role in brain development and regulation of brain interstitial fluid homeostasis, which influences neuronal functioning. Cerebrospinal fluid (CSF) is an extremely useful matrix for biomarker research for several purposes, such as diagnosis, prognosis, monitoring, and identification of prominent leads in pathways of neurologic diseases.From: Handbook of Clinical Neurology, 2018William Vernau, ... Cleta Sue Bailey, in Clinical Biochemistry of Domestic Animals (Sixth Edition), 2008Cerebrospinal fluid has four major functions: (1) physical support of neural structures, (2) excretion and "sink" action, (3) intracerebral transport, and (4) control of the chemical environment of the central nervous system. Cerebrospinal fluid provides a "water jacket" of physical support and buoyancy. When suspended in CSF, a 1500-gm brain weighs only about 50 gm. The CSF is also protective because its volume changes reciprocally with changes in the volume of intracranial contents, particularly blood. Thus, the CSF protects the brain from changes in arterial and central venous pressure associated with posture, respiration, and exertion. Acute or chronic pathological changes in intracranial contents can also be accommodated, to a point, by changes in the CSF volume (Fishman, 1992; Milhorat, 1987; Rosenberg, 1990).The direct transfer of brain metabolites into the CSF provides excretory function. This capacity is particularly important because the brain lacks a lymphatic system. The lymphatic function of the CSF is also manifested in the removal of large proteins and cells, such as bacteria or blood cells, by bulk CSF absorption (see Section II.D). The "sink" action of the CSF arises from the restricted access of water-soluble substances to the CSF and the low concentration of these solutes in the CSF. Therefore, solutes entering the brain, as well as those synthesized by the brain, diffuse freely from the brain interstitial fluid into the CSF. Removal may then occur by bulk CSF absorption or, in some cases, by transport across the choroid plexus into the capillaries (Davson and Segal, 1996; Fishman, 1992; Milhorat, 1987; Rosenberg, 1990).Because CSF bathes and irrigates the brain, including those regions known to participate in endocrine functions, the suggestion has been made that CSF may serve as a vehicle for intracerebral transport of biologically active substances. For example, hormone releasing factors, formed in the hypothalamus and discharged into the CSF of the third ventricle, may be carried in the CSF to their effective sites in the median eminence. The CSF may also be the vehicle for intracerebral transport of opiates and other neuroactive substances (Davson and Segal, 1996; Fishman, 1992; Milhorat, 1987; Rosenberg, 1990).An essential function of CSF is the provision and maintenance of an appropriate chemical environment for neural tissue. Anatomically, the interstitial fluid of the central nervous system and the CSF are in continuity (see Section II.A); therefore, the chemical composition of the CSF reflects and affects the cellular environment. The composition of the CSF (and the interstitial fluid) is controlled by cells forming the interfaces, or barriers, between the "body" and the neural tissue. These semipermeable interfaces, the blood-brain barrier, the blood-CSF barrier, and the CSF-brain barrier, control the production and absorption of CSF and provide a fluid environment that is relatively stable despite changes in the composition of blood (Davson and Segal, 1996; Fishman, 1992; Milhorat, 1987; Rosenberg, 1990).G.A. Rosenberg, in Primer on Cerebrovascular Diseases (Second Edition), 2017The cerebrospinal fluid (CSF) and interstitial fluids (ISF) are critical for preserving normal brain cell function. Choroid plexus epithelial cells and cerebral capillaries secrete the CSF/ISF, which acts as the lymph fluid of the brain. Normally about 500 mL of CSF is produced daily and an equal amount is absorbed across the arachnoid granulations. Failure to remove the CSF/ISF results in hydrocephalus if the ventricles are obstructed or increased intracranial pressure. Sampling the CSF by lumbar puncture is an essential clinical procedure in the diagnosis of brain infections and immunological diseases. Damage to the blood–brain barrier results in life-threatening brain edema.Edmund S. Cibas, in Cytology (Third Edition), 2009Inflammatory cells such as macrophages, plasma cells, and eosinophils are an abnormal finding in CSF. They may accompany malignancy, but are also seen in a variety of non-neoplastic conditions.Macrophages have abundant, vacuolated cytoplasm that sometimes contains ingested cells, organisms, or pigment (Fig. 6.10).Macrophages in cerebrospinal fluid are associated with:•meningitis•subarachnoid hemorrhage•intraventricular hemorrhage•cerebral infarction•post-treatment inflammation•multiple sclerosis36Plasma cells are also an abnormal but nonspecific finding in CSF (Fig. 6.11).Plasma cells in cerebrospinal fluid are associated with:•viral meningitis (e.g., enterovirus, human immunodeficiency virus [HIV])•Lyme disease•tuberculosis•cysticercosis•syphilis•multiple sclerosis36Polymorphonuclear leukocytes are a normal finding if there is contamination by peripheral blood, but numerous neutrophils unaccompanied by a proportionate increase in red blood cells raise the possibility of acute meningitis (Fig. 6.12). In a patient with acquired immune deficiency syndrome (AIDS), numerous neutrophils are highly suggestive of cytomegalovirus (CMV) radiculopathy. Viral cytopathic inclusions, however, are not seen. The diagnosis of CMV radiculopathy can be confirmed by viral culture.37DIFFERENTIAL DIAGNOSIS OF NEUTROPHILS IN CEREBROSPINAL FLUID:•peripheral blood contamination•acute bacterial meningitis•CMV radiculopathy•Toxoplasma meningoencephalitis•viral meningitis (early stage)Eosinophils are rare in CSF; when present, especially in large numbers (Fig. 6.13), they suggest a parasitic infection, particularly Taenia solium and Angiostrongylus cantonensis.38DIFFERENTIAL DIAGNOSIS OF EOSINOPHILS IN CEREBROSPINAL FLUID:•parasites•Coccidioides immitis•ventriculoperitoneal shunts•Rocky Mountain spotted feverStephen M. Reed, ... Eduard Jose-Cunilleras, in Equine Internal Medicine (Second Edition), 2004CSF is an actively transported ultrafiltrate of plasma that bathes the CNS.1 The CSF is located in the ventricles of the brain and subarachnoid space of the spinal canal (Figure 10.2-1) and originates from the choroid plexus and ependymal lining of the ventricles.2 CSF flows from the ventricular system up over the cerebral hemispheres and through the subarachnoid space surrounding the spinal cord.1 Pulsation of blood in the choroid plexuses forces the CSF in a caudad direction. The rate of CSF production varies from 0.017 ml/min in cats to 0.5 ml/min in human beings3 and is independent of the blood hydrostatic pressure. The rate of CSF production for horses has not been determined. Osmotic and hypertonic solutions such as mannitol and dimethyl sulfoxide, when added to blood, decrease CSF production and decrease CSF pressure and edema.1Collections of arachnoid villi (arachnoid granulations) are located in the venous sinus or the cerebral vein and absorb CSF. CSF absorption is related directly to the pressure gradient between the CSF and venous sinus. When CSF pressure exceeds venous pressure, these villi act as one-way ball valves forcing CSF flow to the venous sinus.4CSF functions to suspend the brain and spinal cord for protection, regulate intracranial pressure, and maintain the proper ionic and acid-base balance.1Richard A. LeCouteur, Stephen J. Withrow, in Withrow & MacEwen's Small Animal Clinical Oncology (Fourth Edition), 2007Cerebrospinal fluid collection and analysis are indicated when plain radiographs do not provide a complete diagnosis. A lumbar puncture is recommended for CSF collection, and the needle may be left in place for myelography, pending the results of the cytologic examination of CSF. The alterations in CSF caused by spinal tumors should be interpreted according to the same criteria discussed for brain tumor diagnosis;76 however, it must be remembered that the protein content of CSF collected from a lumbar location is normally higher than that of CSF collected from the cerebellomedullary cistern.82 Lymphoma affecting the spinal cord often results in an elevated white cell count, predominantly abnormal lymphocytes.178,182David Francoz, in Food Animal Practice (Fifth Edition), 2009Cerebrospinal fluid glucose, electrolyte, and enzyme (CK and LDH) concentrations are not routinely evaluated in ruminant medicine. Reported normal concentrations of glucose in the CSF are approximately 80% of the contemporary blood glucose concentrations. Decreases in CSF glucose concentrations have been associated with bacterial infections.12,21 Increased CK and LDH CSF concentrations have been associated with neurologic diseases.21,22 However, they provide little additional information in the establishment of a precise diagnosis.In some cases of salt poisoning (hypernatremia) and hypomagnesemia, animals may present neurologic signs despite normal serum electrolyte values.1,2 In such cases, determination of Na and Mg CSF concentrations may help. Sodium CSF concentrations above 160 mEq/L or a CSF/serum-sodium ratio greater than 1 is diagnostic for salt poisoning.1 Likewise, a magnesium CSF concentration below 1.45 mg/dl is sufficient for diagnosis of hypomagnesemia.2 However, CSF is difficult to obtain on animals with clinical signs of hypomagnesemia.Joane Parent, in Small Animal Clinical Diagnosis by Laboratory Methods (Fourth Edition), 2004CSF analysis requires general anesthesia. CSF is the only readily accessible tissue that evaluates current CNS status and is warranted every time a CNS disorder is suspected. Primary CNS inflammatory diseases rarely cause CBC or serum biochemical profile changes. If CBC or profile changes occur, a multisystemic disorder with secondary CNS involvement is likely. CSF analysis is indicated even if the CBC and profile are normal. Repeated CSF analysis can help evaluate response to treatment and obtain baseline data before discontinuation of treatment. It is good practice to routinely collect and analyze CSF obtained before conducting myelograms.Ronald F. Pfeiffer, in Handbook of Clinical Neurology, 2011Cerebrospinal fluid (CSF) copper levels are elevated in persons with WD and neurological dysfunction and decline with successful symptomatic treatment (Weisner et al., 1987). Some investigators suggested that CSF copper levels may be the most accurate reflection of brain copper load (Hartard et al., 1993). In one report in which CSF copper concentrations were measured in four WD patients, the average treatment time to normalize CSF copper content (