

# CSF Analysis

## CSF profiles

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	Color	Opening Pressure	WBC	Diff	RBC	Protein	Glucose	Misc
Normal	Clear, colorless	70-200 mm H2O	0-5	Mononuclear	0	<45-50 mg/dL	>2/3 serum	
Bacterial meningitis	Cloudy, straw-colored	increased	>100	PMN	0	100s-1000s	decreased (CSF/serum < 0.2)	Gram stain, culture
Viral meningitis	Cloudy, colorless	normal	10s-100s	Lymphs	0	mildly elevated	normal	May see PMNs early
Fungal / TB	Cloudy, straw-colored	increased	10s-100s	Lymphs, Monos (PMNs early)	0	100s	decreased (CSF/serum < 0.3)	AFB fungal cultures
HSV / viral encephalitis	Cloudy, straw-colored	normal to increased	∅ (normal in ~3%)	Lymphs	∅ in HSV otherwise 0	normal to ∅	normal	Check HSV PCR
Cancer / Lymphomatous Meningitis	Cloudy, straw-colored	increased	normal to 100s	PMNs and lymphs	∅∅	normal to increased	normal to decreased	Cytology positive in ~50%
Subarachnoid hemorrhage	Cloudy, pink	increased	RBC/WBC ratio similar to serum	PMNs and lymphs	RBC/WBC ratio similar to serum	10s-100s	normal	RBCs last 2 weeks, xanthochromia lasts longer
AIDP	Clear, yellow	normal	normal to 10s	Mononuclear	0	normal to 100s	normal	Protein normal early on
MS	Clear, colorless	normal	normal to 10s	normal or mononuclear predominance	0	∅	normal	Oligoclonal bands, IgG index

Note: these CSF profiles are rules of thumb, and exceptions are frequent. Most importantly, the diff is predominantly lymphocytic in some cases of bacterial meningitis. As another example, PMNs sometimes predominate in viral, fungal, TB, or carcinomatous meningitis.

- WBC corrections
  - Reduce wbc by one cell for every 700 RBC ∅ OR
  - $WBC (corr) = WBC (CSF) \cdot WBC (blood) \times RBC(CSF)/RBC (blood)$
- Normal csf glucose is ~ 2/3 of serum glucose
- Corrected protein: subtract 1mg/ml for every 1000 RBC
- Opening Pressure is only accurate in the lateral decubitus position with legs extended and patient relaxed.
- Correct coagulopathy with FFP prior to doing LP (INR needs to be <1.5)
- CSF studies to send (always send the first 4; other depending on clinical setting)
  - Cell count with differential ∅ usually sent on tubes 1 and 4
  - Glucose
  - Protein
  - Gram stain, culture
  - HSV PCR
  - Cryptococcal Ag
  - TB PCR
  - Cytology
  - Oligoclonal bands, IgG index (demyelination) ∅ don't forget to send serum for IgG and O-bands at the same time! Myelin basic protein (very nonspecific).
  - Protein 14-3-3 (CJD)
- Other tests if indicated (ie more specific viral or fungal tests) ∅ collect more CSF than needed so that if other tests become necessary, can add on. Ask the lab to save a tube.
- Always hand-carry CSF down to the lab and ask for evaluation of xanthochromia w/centrifugation of cloudy/colored specimens.

## CSF studies: Volumes & miscellaneous lab info

(compiled from the [UMHS pathology handbook](#))

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Study	COE code	Normal volume (mL)	Minimum volume (mL)	Notes
14-3-3 protein	SENDOUT	1	0.5	
Acanthamoeba / Naegleria exam	ML MISC	1	0.5	

aerobic culture /smear	CSFG	1	0.5	Specimen collection: Cleanse area with soap solution, remove soap with 70% ethanol. Apply 1% tincture of iodine. Iodine must remain on skin 2-4 minutes for maximum effectiveness. Remove with 70% alcohol. If patient is allergic to iodine, alcohol alone can be used. DO NOT touch prepared skin during collection of specimen.
AFB culture	AFB	0.5 - 10		Staff physician or member of ID service must contact the lab with the clinical necessity for the test before it will be processed. Clinical indication must be written on requisition.
amino acids, quantitative	CAA	2	1	
anaerobe culture	ANNC	0.5 - 5		Same as AFB culture. Also, specimens with volume < 1 mL must be sent in anaerobic transport.
arbovirus antibody panel	ML MISC	0.75 (+0.75 of serum)	0.5 (+0.5 of serum)	Includes California encephalitis, Eastern equine encephalitis, St. Louis encephalitis, West Nile Virus, Western equine encephalitis.
beta-2 transferrin	OLI BAND	50 (microL)	10 (microL)	
beta glucuronidase	BGCC	1	0.5	
BKV DNA PCR		0.3 - 1		
Blastomyces antibody	CBLAST O	4	3	
cell count & differential	CSF FC, CSF FD	1	1	Get to lab within 1 hour.
Coccidioides antibody	CCOCCI	4	3	
Cryptococcus antigen	CRAGC	1	0.5	
cytology	CCSF		1	Cannot be split for other tests. Left over from other CSF samples cannot be used. Results will not be released without a clinical history provided.
Enterovirus DNA PCR	PCREV	1	0.5	
fungal culture	FNG	0.5 - 10		Send immediately to lab. If suspecting cryptococcal meningitis, a specimen should also be submitted for cryptococcus antigen screen. Do not refrigerate as this can inhibit Histoplasma growth. Clinical diagnosis must be written on requisition.
fungal antibody panel	FUNCSF	4	3	
glucose	GLCSF	1	0.5	
glutamic acid decarboxylase antibody		1	1	
HHV-6 DNA PCR		0.3 - 1		
HHV-8 DNA PCR		0.3 - 1		
Histoplasma antibody	CHISTO	4	3	
HSV DNA PCR	PCR HSV	1	0.5	
Immunoglobulin G Index	GIN	0.5	0.5	Send with 0.5 mL serum. Serum should be sent in SST tube. Can be rejected if more than one request in 28 days.
Immunoglobulin G and albumin	G ALB	0.5	0.25	May be rejected if gross hemolysis seen or if more than one specimen received in 28 days.
JCV DNA PCR		1.5	1	
lactic acid dehydrogenase	LDCSF	1	0.5	
lactic acid	LACCSF	1	0.5	
Lyme disease antibody	ML MISC	0.5	0.25	Requires serum specimen collected at the same time.
myelin basic protein	MBPC	0.5	0.25	
oligoclonal bands	OLI BAND	3 (+ 1 of serum)	2.5 (+ 0.5 of serum)	CSF and serum may be collected within 3 weeks of each other.
paraneoplastic antibody evaluation	PAEVAL	4	3	
Parvovirus B19 DNA PCR		1.5	1	
protein	PRCSF	1	0.5	

Rubeola virus antibody (IgG & IgM)	ML MISC	0.25	0.1	
VDRL	ML MISC	0.5	0.2	Should only be performed if serum FTA is reactive, otherwise, may be rejected by lab.
Toxoplasma antibody (IgG & IgM)	ML MISC	1	0.5	
viral culture (incl/excl CMV)			2	Includes HSV culture.
West Nile virus antibody (IgG & IgM)	ML MISC	0.5	0.25	

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