BODY FLUID/CSF CELL COUNTS AND DIFFERENTIALS

I. Principle:

Various types of body fluids are removed from the body for analysis:

Serous: Serous fluid is normally found in small amounts in the pleural, peritoneal, and pericardial cavities where it forms a thin film to reduce friction between opposing surfaces. Removal of one of these fluids from a cavity is called "paracentesis". Removal of fluid from a body cavity is indicated for diagnosis, relief of symptoms, instillation of drugs, or drainage of a hemothorax or empyema. An effusion is diagnosed by physical and radiologic examination, but its cause is determined by laboratory tests. Transudates must be distinguished from exudates, since the former is produced by mechanical, hydrostatic or oncotic disturbances, and the latter by pathological processes of pleural or peritoneal surfaces necessitating different therapeutic approaches.

Synovial: Arthrocentesis or removal of synovial fluid from a joint is usually performed for diagnosis, but can also provide relief of symptoms or drainage of purulent fluid. Also, drugs may be instilled at the end of the procedure.

CSF: Most studies of CSF are based upon lumbar puncture which is done for specific diagnosis of meningitis, encephalitis, syphilis, brain abscess, sub-arachnoid or other intracerebral hemorrhages, multiple sclerosis, Guillain-Barre syndrome, acute leukemia or lymphoma with CNS involvement, and spinal cord/brain tumor.

Bronchial Wash/Lavage: Usually obtained during bronchoscopy.

II. Reagents and Materials:

Materials:

A. Transfer dispo-pipettes
B. Body Fluid microscope slides
C. 20, 100, 200 µL MLA pipets and sterile pipet tips.
D. 12 x 75mm tubes.
E. Disposable Phase hemocytometer
F. Aerospray slide stainer
G. Cell tally counter
H. Sysmex XN-2000
I. Cytospin centrifuge
J. Phase microscope
K. Calculator

Reagents:

A. Hyaluronidase – Stored in freezer. A dried enzyme that breaks up hyaluronic acid, chondroitin and chondroitin sulfates in fluids, especially synovial fluid.
B. CSF Diluting Fluid - Store at R.T. Reagent label bears expiration date. Discard if signs of bacterial contamination are present or if elevated background counts are obtained when performing Monthly QC Checks.
C. Absolute Methanol - Store at room temperature in labeled Coplin jar located next to the slide stainer. Flammable. Store away from heat. Change solution daily or as necessary.
D. Saline – 0.9% saline should be used for all dilutions made due to high cell concentration.

III. Specimen Collection and Preparation:

A. Body fluids are physician-collected specimens. A Specimen label, Laboratory Downtime Requisition, or a specimen bag with a Body Fluid Requisition/Instruction label must accompany each specimen. Receive per procedure.
B. All specimens are to be properly labeled with patient's name, hospital number, time and date of collection, random number, and initials or name of person collecting the specimen
C. Synovial fluids should be placed in an EDTA or heparin tube for cell counts.
D. CSF specimen are collected in sterile clear tubes, and handled to maintain a sterile specimen, in case further testing is required.
E. Due to the fragility of cellular material, all fluid specimens should be processed as if they are STAT, and tested within 2 hours of receipt.
F. Specimens that are received clotted or contain a substantial clot should not be run through the analyzer. The physician should be contacted and asked if the cell count is still desired. If a cell count is still needed, perform a manual count and add a comment stating that the count may be inaccurate due to presence of a clot in the specimen.
G. Fluids are not to be rejected due to labeling errors since they are too difficult to re-obtain. Enter a disclaimer under comment in MCare stating that portion of the labeling which was incorrect, consult supervisor, and perform tests.
H. The test code for Serous fluids, synovial fluids and Bronchial levages is **BFCC.** For CSF the test code is **CSFCC.**

IV. Quality Control:

For specimen run on XN-2000:

Body fluid controls (XN-Check BF) will run on each unit each day. QC is good for 24 hours. Record the time of QC run on the daily maintenance form.
See the XN-2000 procedure, Quality Control for detailed instructions on running Quality Control.

For manual specimen counts:

The CSF diluting fluid should have a background check performed on each day that manual fluid counts are performed. If background is unacceptable, filter stain and recheck before performing test. Record results on appropriate result entry screen

A cytoprep should be made on all specimens and the visual estimate of the Wright's stained slide should be compared to the manual cell count. If there is a difference (i.e. – a cell count of 2000 RBC and 15 WBC, but the slide contains an equal amount of WBCs and RBCs), redo the manual count and make another slide, making sure the specimen is well mixed for each, and that the specimen does not contain clots. If there is a clot present see Step F in Specimen Collection section above. If the slide and cell counts match, enter OK in the BFEST field on the appropriate result entry screen.

NOTE: Because low manual counts are performed on straight fluid and the Cytoprep concentrates a larger volume of fluid, it is possible that you will not see any cells (WBC or RBC) on the manual count and see some cells on the Cytoprep slide. In this case repeat the manual counts to verify that no cells are seen, and then report out the 0 counts. For example - if you do not see any WBCs on the manual count but see a few on the Cytoprep, repeat the manual count, if you still do not see any WBCs, report out the 0 for the WBC and DO NOT report any kind of differential.

V. Procedure:

NOTE: The department distributing the body fluid should enter a complete description including a total volume from all tubes combined in the specimen comment line.

A. Gross examination:

1. Gross examination of the fluid specimen for total volume, color, clarity, presence of a clot and xanthochromia should be performed routinely by Hematology/Microbiology personnel as follows:
   a. Total volume - Record total volume in cc of all tubes submitted.
   b. Color - Record color of a well mixed specimen. If variability is noted between successive tubes, description of each individual tube is necessary. Xanthrochromia should be noted with color, if indicated.
   c. Clarity - Turbidity shall be graded as clear, cloudy or turbid
   d. Presence of a clot - If a clot is present in the fluid, notation thereof should be included in the description of the fluid.
   e. Tube # - for CSF, record the tube number of the specimen that the count is being performed on.

   NOTE: On a CSF specimen, if the viscosity of the specimen is greater than normal, this should be notated in the comment line.

B. Automated cell counts (on Sysmex XN-2000):

All types of body fluids can be run on the XN-2000

1. Prepare body fluid for Sysmex XE-2100.
   a. Add 1 ml of body fluid to a properly labeled glass test tube.
      1. For viscous fluids only (including all synovial fluids): Dip a clean applicator stick into the hyaluronidase powder. (Hyaluronidase is in the Jewett freezer).
      2. Insert applicator sticks with particles of hyaluronidase into aliquot and stir until powder dissolves. Only a very small amount of hyaluronidase is necessary for each specimen. (Since hyaluronidase is a powder used in small amounts there is no dilutional effect on the specimen).
      3. Place treated aliquot on rocker.
2. Determine if Sysmex QC is needed. If QC has not been run within the last 24 hours, run QC per Sysmex XN-2000 QC procedure.
3. Body Fluid Analysis on XN-2000
   a. Check the status of the analyzer.Confirm the analyzer is ready.
   b. If necessary, press the Mode Switch  to eject the tube holder.
   c. Select the Change Analysis Mode button on the control menu.
   d. Select [Body Fluid]
   e. Select [OK]. The analyzer will automatically perform a background check up to three times.
   f. Select the Manual Analysis button on the control menu.
   g. Input the sample ID or select [Read ID].
   h. Select [OK].
   i. Properly mix the specimen and place in tube holder. If running a microtainer, remove the cap using caution to avoid splattering.
   j. Press the Start Switch  on the analyzer.
      The tube holder will slide in and the sample will be aspirated.
      When the analysis is complete, the tube holder slides out.
   k. Remove the sample

l. Return analyzer to Whole Blood mode prior to running whole blood samples, or press Mode Switch to return unit to auto mode.

4. Body fluid reports will not automatically print – manually print out a report.
   a. Body fluid flagging codes:

XN-2000 flag	test	reason	resolution
#89 Fluid WBC ABN Scat	WBC-BF	Abnormal scattergram	Perform manual count.
#90 WBCBF Linearity (H)	WBC-BF	WBC-BF > 35.6	Dilute with DCL, re-run
#91 RBCBF Linearity (H)	RBC-BF	RBC-BF > 4.1	Dilute with DCL, re-run
#92 WBCBF Linearity (L)	WBC-BF	WBC-BF < 0.003	Perform manual count.
#93 RBCBF Linearity (L)	RBC-BF	RBC-BF < 0.002	*** see note***

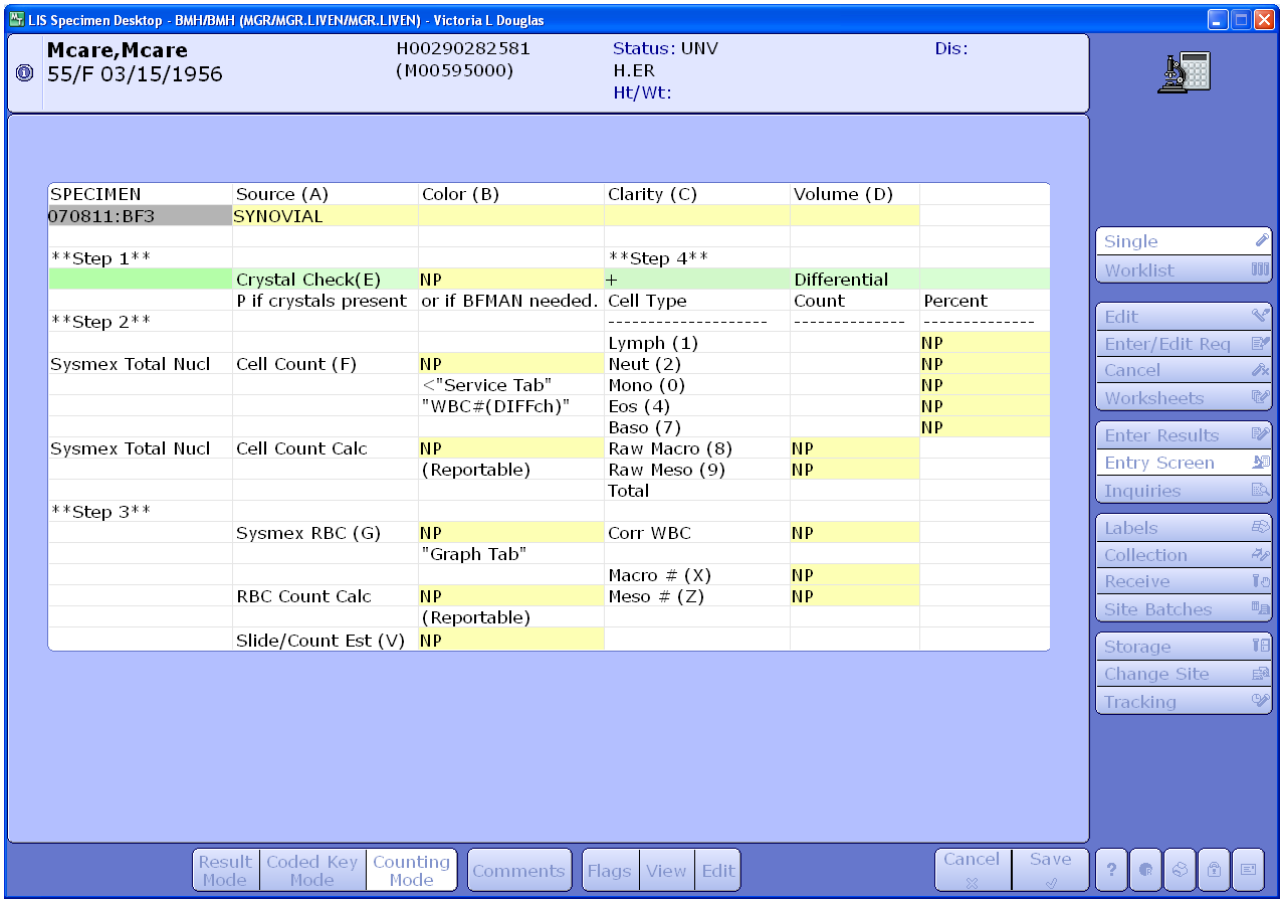
*** NOTE: on CSF, perform manual count, on other body fluids, report as < 2000 ***

   b. Use results from the XN-2000 as follows on **BFA** result entry screen (see below):
   WBC-BF – Sysmex Total Nucl. (Total nucleated cell count).
   RBC-BF – Sysmex RBC.
   c. Other results from the Xn-2000 (not reported out):
   MN – Mononuclear Cells, including Mesos and Macros.
   PMN – Polymorphonuclear cells (Neutophils).
   TC-BF# - research parameter – not used.

5. Perform Manual Differential – see Step D below.

6. Enter results into appropriate field in the **BFA** result entry screen.

MCare Result Entry Screen example:



C. Manual Cell Counts

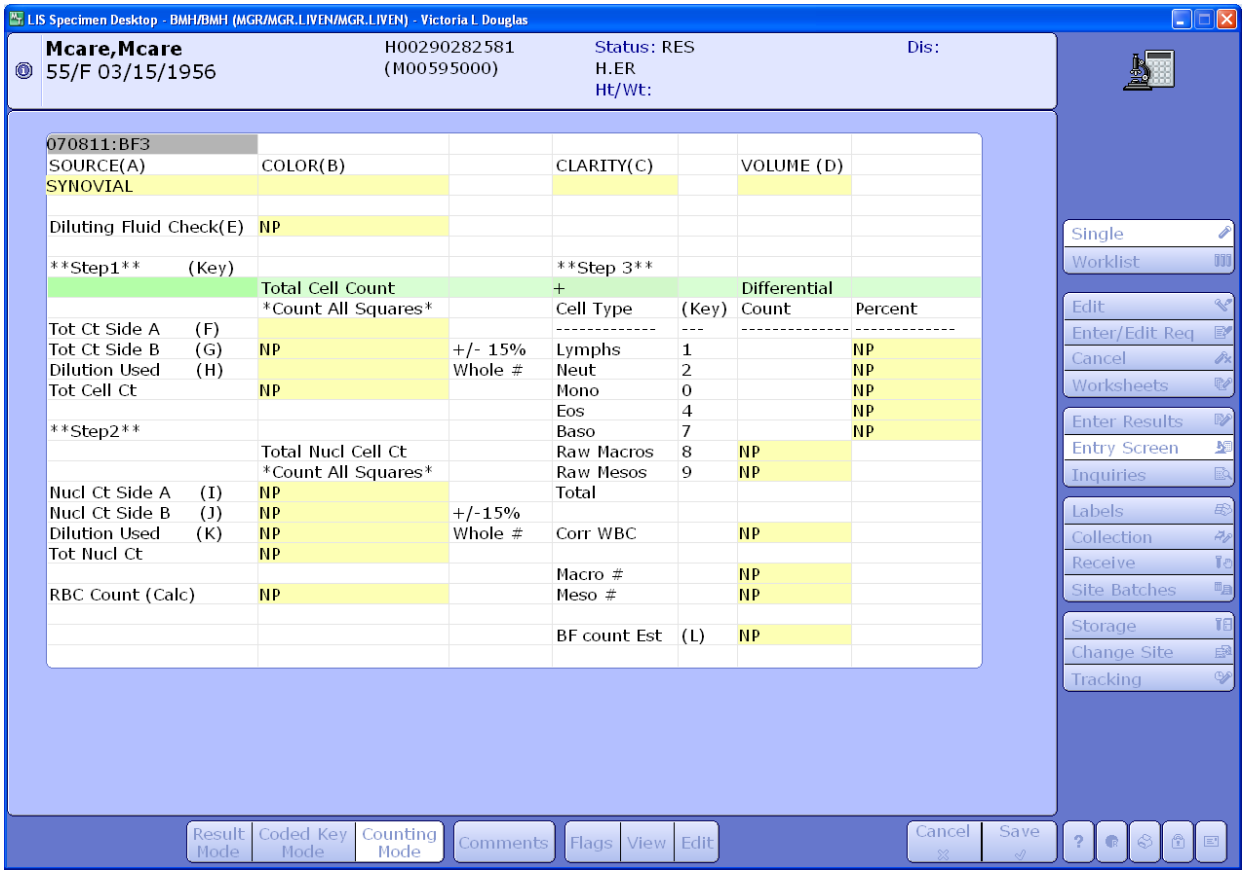
Cell counts should be performed as follows, according to the clarity of the fluid submitted. For Body Fluids that have results below linearity, enter results in the appropriate field on the BFA result entry screen and a BFM will automatically be added on the patient. All results are entered into MCare and calculations are performed by MCare.

1. Perform a total cell count:
   a. If the specimen is clear and colorless or yellow, you may use undiluted fluid. For specimens that are hazy or cloudy, you should make an appropriate dilution using saline.
   b. Using a sterile transfer pipet, slowly charge both sides of a hemocytometer with well-mixed fluid (avoid overfilling the chamber). Place hemocytometer in a Petri dish with a dampened piece of paper. Let hemocytometer sit for 5 minutes to allow cells to settle.
   c. Using the phase microscope and the high power objective (40X), count the total number of cells in each of the nine large squares on both sides of the hemocytometer (total of 18 sq. mm). Counts from each side should duplicate within $\pm$ 15% of each other.
   d. If your plating has more than 100 cells per square
      1. You may make a higher dilution and recount
      2. You may count fewer squares (as long as there are <400 cells per square and cells are evenly distributed). This works best using 1(the center) square or 3 (diagonal) squares since these yield whole numbers to enter in MCare:
         There are two ways to adjust the counts to enter into MCare
            a. Multiply cells counted by the number of squares counted and divide by 9
               Enter this number in the cells counted field on the result entry screen
            b. Divide nine by the number of squares counted and enter this as your dilution.
               If a dilution was made and you count a different number of squares, remember to multiply the original dilution by nine and divide by the number of squares counted, enter this number as your dilution.

2. Perform a **WBC/TNCC** (Total Nucleated Cell) count:
   NOTE: For serous fluids, synovial fluids and bronch washes the term Total Nucleated Cells is used, due to the higher possibility of non-WBCs being counted as WBCs. The WBC will be determined after the differential is performed. For CSF, this step will provide the WBC count to be reported.
   a. In a labeled 12 x 75 tube, pipet 200 µL (MLA pipet) of fluid and 200 µL of CSF diluting fluid
   b. Mix well.
   c. Using a transfer pipet or capillary tube, charge both sides of a clean hemocytometer. Place hemocytometer in a Petri dish with a dampened piece of paper. Let hemocytometer sit for 5 minutes to allow cells to settle.
   d. Using the phase microscope and high power objective (40X), count all of the WBCs (stained purple) in each of the 9 large squares on both sides of the hemocytometer.
   e. If your plating has more than 100 cells per square
      1. You may make a higher dilution and recount
      2. You may count fewer squares (as long as there are <400 cells per square and cells are evenly distributed). This works best using 1(the center) square or 3 (diagonal) squares since these yield whole numbers to enter in Meditech:
         There are two ways to adjust the counts to enter into Meditech
            a. Multiply cells counted by the number of squares counted and divide by 9
               Enter this number in the cells counted field on the result entry screen
            b. Divide nine by the number of squares counted and enter this as your dilution.
               If a dilution was made and you count a different number of squares, remember to multiply the original dilution by nine and divide by the number of squares counted, enter this number as your dilution.

   e. Enter the results into the appropriate result entry screen
3. Perform differential per step D below.

Example of MCare BFM Result Entry screen:



NOTE: Don't forget to result the diluting fluid background check and body fluid count estimate. Background should be acceptable (or filter fluid and redilute before reporting) and BF COUNT EST should be OK. See QC above

D. Differential:

1. Use the Cytospin to prepare a smear for the differential (see procedure "Cytospin2"). WBC must be known before preparing Cytospin slides. Allow film to air dry. Label slide as shown below:

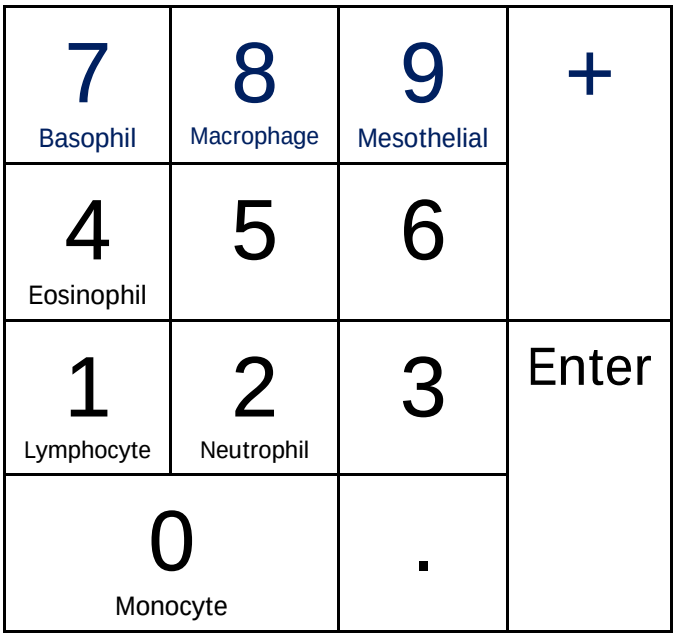
Acc # Name Fluid /Date
specimen

2. Fix in absolute methanol and stain with Wright's stain using the slide stainer.

Note: For slides with elevated cell counts, you may try making a straight smear first. Using the sandwich technique may help, especially with viscous fluids. As long as the WBC morphology is acceptable (intact cells with distinct features) the differential may be reported from this smear. If morphology is poor, dilute and make a cytospin.

3. Perform a differential count by enumerating 100 white blood cells while classifying them by cell type.
   a. Use F3 to switch to count mode.
   b. Enter number of cells to be counted (Use 25 or 50 cells if WBC count is very low)

c. Using the computer keypad, count designated number of cells (usually 100) by pressing the corresponding key on the keypad. The macrophages and mesothelial cells will not be tallied in the differential.



d. MCare will correct the TNCC for the non-WBC's and calculate the number of macrophages and mesothelial cells.

NOTE: If you have recorded a 0 manual WBC, but see some WBCs on the cytoprep slide, this is acceptable as long as the number of WBCs you see is minimal (the cytoprep concentrates the specimen). Repeat the manual WBC to verify the 0 count – if you still see no WBCs on the manual count, report the 0 and DO NOT report any differential.

NOTE: If the WBC count is low and the number of mesos and/or macros change the count less than 1/mm³, do not change the count, but add a comment stating the number of cells seen/ 100 WBCs and that the WBC count is not significantly affected.

NOTE: Presence of tumor cells must be verified by Pathologist review.

NOTE: Certain cells are specific to the type of fluid being tested. Please see chart below for variant types of cells for each fluid.

CELL / FLUID	CELL TYPE	NOTE:	REPORT AS*:
All	TUMOR	Must be verified by path review.	Comment
Synovial	Synovial Lining cells	Appear as epithelial cells	Meso (comment)
Bronch Lavage	Epithelial	There are no mesothelial cells in bronch, report as epithelial.	Meso (comment)

VI. Calculations:

All calculations are performed in MCare when you enter results. Calculations are provided for reference or to use in case MCare is down.

Sysmex Results – WBC = Multiply WBC results by 1000 for cells/mm³
RBC = Multiply RBC results by 100000 for cells/mm³

Manual Cell Count results (Hemocytometer – all 9 squares counted)

$$\text{Total Cell Count} = \frac{\text{Ave Cell Count x (dil factor) x 10}}{9} = \text{cells/mm}^3$$

$$\text{WBC/TNCC} = \frac{\text{Ave Cell Count x (dil factor) x 10}}{9} = \text{cells/mm}^3$$

RBC = Total cell Count/mm³ - WBC/TNCC /mm³ = cells/mm³

NOTE: For fluids with high counts, you may count fewer squares. Replace the 9 in the above equations with the number of squares actually counted to correctly calculate results.

Differential Results

$$\text{Corrected WBC} = \frac{\text{100 x TNCC /mm}^3}{\text{100 + number of non-WBC (per 100 WBCS)}} = \text{cells/mm}^3$$

NOTE: For corrected WBC: If a 25 or 50 cell diff is performed replace the 100s in the above equation with 25 or 50.

Non-WBC count = WBC/TNCC /mm³ - Corrected WBC/mm³ = cells/mm³

Non-WBC count (multiple cell types) =

$$\frac{\text{\# of cell type}}{\text{Total non-WBC}} \times \text{Non-WBC count/mm}^3 = \text{cells/mm}^3$$

VIII. Interpretation (Clinical Significance):

CSF:

Clarity: Cloudy or turbid fluid may be due to leukocytosis (WBC count > 200/µl), microorganisms, RBC (>400 cells/µl), increased protein, or aspiration of epidural fat during lumbar puncture.

Clot Formation: Indicates increased amounts of fibrinogen either due to traumatic tap or to increased protein owing to a sub-arachnoid block, suppurative meningitis, tuberculous meningitis, or neuro-syphilis. Grossly bloody specimen due to sub-arachnoid bleeding will not clot in vitro.

Color of Well-Mixed Fluid: Distinction of a pathological bleed from a traumatic tap. Visual clearing of bloody fluid in serial tubes denotes trauma from the tap, but performance of a RBC cell count on serial specimens is a more exact way to make the distinction.

Xanthochromia refers to a pale pink to orange or yellow color in the supernatant of centrifuged CSF. In traumatic samples, the supernatant typically is crystal clear, while in a sub-arachnoid hemorrhage the supernatant usually is xanthochromic, provided erythrocytes have been present in CSF sufficiently long enough to lyse. Initial lysis of erythrocytes in CSF begins after about one to four hours. Probably, lysis of erythrocytes in CSF is due to lack of plasma proteins and lipids needed to stabilize the erythrocyte membrane. Thus, examination for xanthochromia requires that CSF be centrifuged within one hour or less after collection to avoid false positive. A variety of pigments may contribute to xanthochromia as observed visually. They are: Oxyhemoglobin (pale pink to pale orange), Methemoglobin (brownish), Bilirubin (yellow), increased concentration of CSF protein, contamination of CSF by Merthiolate used to disinfect the skin (orange), Carotenoids in CSF due to systemic hypercarotenemia (orangish), Melanin in CSF due to meningeal melanosarcoma

Viscosity: Increased viscosity of CSF has been reported with metastatic mucinous adenocarcinoma to the meninges.

Cellular Reaction: A neutrophilic reaction usually indicates meningitis due to pyogenic organisms. A mixed reaction (neutrophils, lymphocytes, and monocytes) may occur with subacute bacterial meningitis, tuberculous or mycotic meningitis, viral meningoencephalitis or aseptic meningeal reaction. Monocytic and/or lymphocytic pleocytosis is typical of viral meningoencephalitis; multiple sclerosis; and tuberculous or fungal or syphilitic meningitis.

SEROUS Fluid:

Color:

Red fluid - indicates presence of blood, possibly caused by hemorrhagic effusion or whole blood. Performance of a body fluid and whole blood hematocrit and comparison of the 2 results will distinguish between the two. If a body fluid Hematocrit is similar to that of peripheral blood, a hemothorax or hemoperitoneum exists.

Green fluid - contains bile and may result from a perforated gallbladder or perforated duodenal ulcer or pancreatitis.

Chylous effusions - have a milky color and indicate lymphatic obstruction.

Blood tinged fluid - can distinguish a traumatic tap because usually have streaking in the syringe with clearing upon continued aspiration.

Clarity: Cloudy fluids - usually indicate the presence of septic or non-septic inflammation or chronic effusions of any etiology.

Volume: Fluid will accumulate when there is increased hydrostatic pressure (eg. congestive heart failure), decreased production of albumin (liver disease), increased loss of albumin (renal disease), increased capillary permeability (inflammation) or decreased lymphatic drainage (tumor obstruction).

SYNOVIAL Fluid:

Normal synovial fluid contains no fibrinogen. Fluid from septic arthritis frequently clots. Except in untreated hemophilic arthritis, hemorrhagic fluid always clots. Various inflammatory disease fluids also exhibit clotting. Traumatic bleeding in synovial fluid appears as streaks of blood and hemorrhagic effusions are obvious from their gross appearance. Refer to table 3 and 4 below for a generalized listing of Pathologic Classification of Synovial Fluids and Associated Diseases. Most lab tests aren't diagnostically specific, but aid in the classification scheme instead. The lab can make a probable diagnosis by the presence of LE cells, however, and a definitive diagnosis by culturing microorganisms or identifying crystals.

PATHOLOGIC CLASSIFICATIONS OF SYNOVIAL FLUIDS

TEST	NORMAL	GROUP I (Non-inflammatory)	GROUP II (Inflammatory)	GROUP III (septic)	GROUP IV (Hemorrhagic)
Volume	<3.5	>3.5	>3.5	>3.5	>3.5
Color	Pale yellow	Yellow	Yellow-White	Yellow-Green	Red-Brown
Viscosity	High	High	Low	Low	Decreased
Mucin Clot	Firm	Firm	Friable	Friable	Friable
Leukocyte Count (cells/μL.)	180	200-2,000	2,000-100,000	10,000-100,000	5,000
Neutrophil %	25	25	50	75	25
Glucose (mg/dl) (Compared to blood)	same	same	25mg/dl lower	25mg/dl lower	same
Culture	Negative	Negative	Negative	Often positive	Negative

JOINT DISEASE

NONINFLAMATORY (I)	INFLAMATORY (II)	SEPTIC (III)	HEMORRHAGIC (IV)
Osteo-arthritis	Gout	Bacterial Infection	Hemophilia
Osteochondritis dessicans	Pseudogout	Fungal Infection	Trauma
Osteochondromatosis	Rheumatoid Arthritis	Tuberculosis infection	Pigmented villonudular synovitis
Neuroarthropathy	Systemic Lupus Erythematosis		

X. Normal Ranges:

Parameter / Fluid	COL	CLAR	VOL. (ml)	WBC	RBC	NEUT %	LYM %	MON %	Other Parameters
CSF (NEWBORN)	Color-less	Clear	<5	0-30	0-675	0	63-99	3-37	Xanthrochromia - none
CSF (ADULT)	Color-less	Clear	10	0-5	0-10	0	63-99	3-37	Xanthrochromia - none
SYNOVIAL	Pale Yellow	Clear	≤ 3.5	13-180	0-2000	0-25	0-78	0-71	Synovial Cells - 0-12
PERICARDIAL	Pale Yellow	Clear	10-50	0	0	0	0	0	Presence of clot - None
PERITONEAL	Pale Yellow	Clear	<50	0	0	0	0	0	Presence of clot - None
PLEURAL	Pale Yellow	Clear	<20	0	0	0	0	0	Presence of clot - None

XI. Proficiency Testing:

Periodic CAP survey specimens and periodic written review demonstrate proficiency

XII. References:

CSF:

1. Clinical Diagnosis and Laboratory Management by Laboratory Methods, Todd, Sanford, Davidsohn and Henry, 16th ed., 1979, pp. 638-644.
2. Diagnostic Medicine, Body Fluids III; Tapping the Wealth of Information in CSF, Glasser, Lewis, M.D., January-February 1981, pp. 23-33.
3. Diagnostic Medicine, "Body Fluids IV: Cells in Cerebrospinal Fluid", Glasser, Lewis, M.D., March-April, 1981, pp. 33-35, 38-39, 43-50.
4. Gradwohl's Clinical Laboratory Methods and Diagnosis, Frankel, Sam., Ph.D., Reitman, Stanley, M.D., 6th edition, Volume 2, pp. 1930-31.

SEROUS:

1. Diagnostic Medicine, "Evaluation: Serous Fluids", Glasser, Louis, M. D., September/October 1980, pp. 79-90.
2. Clinical Diagnosis and Management by Laboratory Methods, Todd, Sanford, Davidsohn and Henry, 17th edition, 1984, pp. 483-489

SYNOVIAL:

1. Diagnostic Medicine "Body Fluids II, Reading the Signs in Synovia", Glasser, Lewis, M.D., November/December 1980, pp.35,36,39,42,45-48,50.
2. Clinical Diagnosis and Management by Laboratory Methods, Todd, Sanford, Davidsohn and Henry, 17th edition, 1984, pp. 475-483.
3. MLO (Medical Laboratory Observer) "Tips on Technology", Robert M. Nakamura, August, 1983, pp. 16-17.

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PROCEDURE AND FORM CHANGE CONTROL

Title:
BODY FLUID/CSF CELL COUNTS AND DIFFERENTIALS

Written	Date	By	Validated By	Date	Path Review	Date	Review By	Date	Effective Date	By	Reason for Revision
	1/03	EWE	Heme	1/03			ewe	1/03	2/3/03	Ewe	
Revised	8/04	EWE	pmi	8/04	ESB	10/9/04	ewe	8/04	08/30/04	ewe	Minor clarification on Quality control
Review							EWE	4/05			
Review							EWE	4/06			
Revised	11/06	EWE			ESB	12/4/06	EWE	11/06	11/25/06	EWE	Minor change – comment for meso/macro
Revised	03/07	EWE	DMI	03/07	ESB	03/17/07	EWE	03/07	03/12/07	EWE	Added **Note** on high manual cell counts
Revised	05/07	EWE	EWE	05/07			EWE	05/07	05/14/07	EWE	Added TUBE# to CSF test code and report
Review							EWE	2/08			
Revised	7/08	EWE	BEM/DMI	7/08			EWE	7/08	07/28/08	EWE	Use of Sysmex, new worksheet, labfusion calculations added.
Review							EWE	3/09			
Revised	8/19/10	DMI	VLD	8/20/10	JAP	8/20/10	EWE	8/20/10	8/20/10	VLD	Meditech changes
Revised	7/8/11	VLD	BEM	7/8/11	ESB	7/12/11	EWE	7/14/11	7/15/11	VLD	MCare changes
Review							VLD	2/29/12			
Revised	12/2013	EWE	DMI	12/3413	ESB	12/4/13	EWE	12/5/13	12/5/13	EWE	Revised for XN-2000 use.

Out of use:

Date: _____ By: _____ Reason: _____

C651-018 04/14/03