**HEMATOPATHOLOGY CONSULTATION**
**BONE MARROW BIOPSY AND ASPIRATE**

**Related Background and Clinical Data:**

**REQUESTED ANALYSIS/TESTING**

### ACUTE LEUKEMIA
- Hematopathology
- Cytogenetics
- Flow cytometry
- NPM1 by PCR (AML-new dx)
- FLT3 by PCR (AML-new dx)
- c-KIT (D816V) by PCR (AML-new dx)
- CEBPa mutation by PCR (AML–new dx)
- BCR/ABL- p190/p210 by PCR (ALL–new dx)*
- BCR/ABL- p190 by PCR (ALL monitoring)*
- PML-RAR α by PCR (APL-new diagnosis)*

### LYMPHOMA
- Hematopathology
- Cytogenetics
- Flow cytometry:
- FISH – C-Myc, BCL2

### CHRONIC LYMPHOCYTIC LEUKEMIA
- Hematopathology
- Cytogenetics
- Flow cytometry (Zap 70, CD38) new dx
- FISH – CLL panel
- IGHV by PCR

### MYELOPROLIFERATIVE NEOPLASMS
- Hematopathology
- Cytogenetics
- Flow cytometry
- BCR/ABL p190/p210 by PCR (CML new dx)*
- BCR/ABL p210 by PCR (CML monitoring)*
- JAK 2 by PCR (new diagnosis) *
- PDGFR α by PCR (new diagnosis)
- c-KIT (D816V) by PCR (AML-new dx)
- PDGFR β by PCR (new diagnosis)
- BCR/ABL mutational analysis

### MYELOMA
- Hematopathology
- Cytogenetics
- Flow cytometry
- FISH – Myeloma panel

### MYELODYSPLASTIC SYNDROMES
- Hematopathology
- Cytogenetics
- Flow cytometry
- FISH – MDS panel

### PANCYTOPENIA/THROMBOCYTOPENIA/APLASTIC ANEMIA
- Hematopathology
- Cytogenetics
- Flow cytometry
- PNH - CD55 and CD59 by flow cytometry

### OTHER TESTING: T-Cell Subsets
- Mutational Analysis-Relapsed/Refractory CML
- Other Provider Signature: ID# Date: Time:
- Attending Provider Signature: ID# Date: Time:
## SPECIMEN PROCESSING REQUIREMENTS

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<td>Cytogenetics-3ML DRK GRN</td>
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<td>NPM1 by PCR (AML-new dx)</td>
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<td>3ML LAV TO ARUP 40174</td>
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<td>FLT3 by PCR (AML-new dx)</td>
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<td>PML-RAR α by PCR (APL-new diagnosis)*</td>
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<td>Chimerisms- 2 YELLOW ACD TUBES. SEND TO BMT</td>
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### MYELOPROLIFERATIVE NEOPLASMS

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<td>3ML DRK GRN TO ARUP 2002360</td>
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<td>JAK2 by PCR (new diagnosis)</td>
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<td>3ML LAV TO MAYO 89007 *</td>
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<td>PDGFRα by PCR (new diagnosis)</td>
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<td>3ML DRK GRN TO ARUP 31155</td>
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<tr>
<td>PDGFRβ by PCR (new diagnosis)</td>
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<td>3ML DRK GRN TO ARUP 400617</td>
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### MYELODYSPLASTIC SYNDROMES

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### PANCYTOPENIA/THROMBOCYTOPENIA

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<td>TRANSPLANT COORDINATORS</td>
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### INFECTIOUS DISEASE

* May be evaluated by peripheral blood
Ommaya Reservoir Access and Drug Administration

Scientific Principle
An Ommaya reservoir is an intraventricular catheter system that can be used for the aspiration of cerebrospinal fluid or for the delivery of drugs (e.g., chemotherapy) into the cerebrospinal fluid. It consists of a catheter in one lateral ventricle attached to a reservoir implanted under the scalp. It is used to treat brain tumors, leukemia/lymphoma, and leptomeningeal disease by intrathecal drug administration. In the palliative care of terminal cancer, an Ommaya reservoir can be inserted for intracerebroventricular (ICV) injection of morphine.

Procedure
1. Assemble supplies
   - 25-gauge butterfly needle
   - 3–10 mL syringes (if drawing CSF for lab studies)
   - 2–4 sterile plastic tubes for sample transport
   - Syringe containing preservative-free medication to be injected
   - Sterile drape
   - Pack of 3 iodine swab sticks
   - Pack of 3 alcohol swab sticks
   - Band-aid or sterile bandage
   - Personal protective equipment (if administering chemotherapy)
   - Two pair of sterile gloves
   - Mask

2. Position patient with head elevated 20°–60° based on position of comfort for the patient. Assess site by palpating and locating center of port, clip hair as needed.

3. Open sterile supplies. Establish sterile field.

4. Put on mask.
5. Drop onto sterile field
   - 25-gauge butterfly needle
   - Empty 10 mL syringe(s)
   - Medication (if ordered)

6. Put on sterile gloves.

7. Maintaining sterile technique, prepare skin over Ommaya reservoir. Swab to cleanse skin over reservoir with povidone-iodine using a circular motion from inner to outer aspect, extending beyond the injection site. Repeat with 2 additional swabs. Allow to dry for 2 minutes, then repeat process using alcohol swabs to remove the iodine. **Change to clean pair of sterile gloves now.**

8. Overlay sterile draping now so that port is exposed in center.

9. Pump the reservoir gently 3 or 4 times.

10. Attach empty 10-mL syringe to butterfly needle tubing.

11. Insert 25-gauge butterfly needle through middle of dome, at an angle perpendicular to the dome. Gently advance needle until the tip of the needle meets the backstop of the reservoir (alternate insertion sites in dome).

12. Slowly aspirate 1–2 cc CSF in syringe and set aside.

13. Attach empty syringe and aspirate as much CSF as needed for ordered testing; remove and set aside. Up to 40 cc may be aspirated safely, but it is very rare to ever need this much sample (use second syringe if needed).

14. Attach intrathecal chemo syringe (if ordered); administer chemo over 2–3 minutes and then remove chemo syringe.

15. Attach syringe containing the 1–2 cc of CSF that was previously set aside and slowly inject. This will flush the chemo remaining in the tubing into the port.

16. Remove butterfly needle from reservoir.

17. Place sterile dressing or bandage over reservoir and pump dome 5–10 times.

18. Dispense collected CSF into separate sterile tubes to be sent for ordered testing. (Remember to label the tubes appropriately with patient information)

19. May discharge patient 15–30 minutes after procedure completed if nausea, headache, or hypotension do not occur.

Outline of recognized standard procedure(s) courtesy of Rodney Haltom, PA-C, to be adapted in accordance with standard procedures and protocols within individual organizations.
Lumbar Puncture Procedure (Diagnostic and Intrathecal Medication Instillation)

Scientific Principle
Lumbar puncture is useful in the diagnosis of bacterial, fungal, mycobacterial, and viral CNS infections and, in certain settings, for help in the diagnosis of subarachnoid hemorrhage, CNS malignancies, demyelinating diseases, and Guillain-Barré syndrome. Because the blood-brain barrier is effectively bypassed during this procedure, chemotherapy can be effectively administered to the brain for prophylaxis and treatment of active malignancy.

Procedure
1. Assemble supplies
   - LP tray
   - Sterile gloves
   - Mask
   - Some institutions may also require that you wear a disposable gown

2. Position patient in either upright or lateral decubitus/fetal position.
   - The lateral decubitus position is required if performing opening pressure.
   - If opening pressure not needed, then the upright position is preferred.

3. Locate position of top of iliac crests by palpation with both hands. Visualize the center of the spine that lines up with this location and palpate for the L4/L5 interspace. The space above (L3/L4) and the space below (L5/S1) can also safely be used for the procedure.

4. Mark the desired interspace with a light pen mark or a pressure mark.

5. Open LP tray and drop intrathecal chemo onto sterile field. LP needle should also be dropped if the tray does not have a needle you like (gauge too large or you do not want to use a Quincke needle).

6. Put on sterile gloves and mask (and gown if required by institution).

7. Swab to cleanse skin over lumbar area with povidone-iodine using a circular motion from inner to outer aspect, extending beyond the injection site. Repeat with 2 additional swabs. It is best to cover at least 1 other lumbar interspace during this step in case you need to change spaces during the procedure due to difficulty accessing your initially chosen space.

8. Draw up 3–5 cc lidocaine with provided syringe and 20-gauge needle and then replace with 25-gauge needle.

9. Make lidocaine skin wheal at interspace and then inject more lidocaine slowly through the center of the skin wheal as you advance with the 25-gauge needle. If patient is obese it may be
necessary to now switch back to the longer 20-gauge needle and administer lidocaine deeper into the tissue.

10. Take up spinal needle and insert through center of skin wheal. The spinal needle may be advanced slowly, angling slightly toward the head. The flat surface of the bevel of the needle should be positioned to face to the side. This will allow the needle to spread rather than cut the dural sac, which may decrease incidence of spinal headache. Many providers choose to advance the needle incrementally, removing the stylet periodically to check for CSF flow, then reinserting the stylet until the subarachnoid space is entered. Sometimes a characteristic pop can be felt when the space is accessed, but this is not always the case. If patient complains of sharp pain then the needle is either close to or touching a spinal nerve root. Stop advancing and ask if the pain goes away. If so, then try again to advance slowly. Sometimes the pain will not recur, but if it does the needle will likely need to be withdrawn and reinserted. If bone is hit before the CSF is accessed, then the needle will need to be removed and reinserted at a different angle. Continue until CSF is obtained.

11a. (If opening pressure needed)
If opening pressure is needed it is important to remember that patient must be in lateral decubitus position with head at same level as spine. Opening pressure must be performed before samples are taken. Attach flexible tubing to spinal needle. Attach stopcock to flexible tubing. Attach plastic measuring straws to stopcock. Turn stopcock handle such that CSF flows up the measuring straws. Stopcock must be held level with spinal column. Allow CSF to flow up the straw until it stops. Take measurement. Turn stopcock to position that allows collected CSF to drain into sample collection tubes and then turn again to allow free flow of CSF directly into sample tubes until all samples obtained. Recheck pressure by allowing CSF to once again flow into the measurement straw. If pressure is elevated it is often desirable to drain CSF until pressure comes into normal range but not below half the original value. Record the final value of closing pressure.

*Opening Pressure Normal Results*
10 to 100 mm H$_2$O in young children
60 to 200 mm H$_2$O over 8 years of age
Up to 250 mm H$_2$O in obese patients
Intracranial hypotension is defined as an opening pressure of less than 60 mm H$_2$O
Pressure greater than 250 mm H$_2$O is diagnostic for intracranial hypertension

11b. (If no opening pressure needed)
Collect CSF for required testing. Some spinal trays may include tubing that can be attached to the spinal needle to facilitate sample collection. Let the CSF flow out at its own natural pace. NEVER try to aspirate the CSF with a syringe.

12. Attach chemo syringe to tubing or end of spinal needle. Inject slowly over 2–3 minutes.
13. Remove spinal needle. Some people prefer to reinsert the stylet prior to removal of needle. I have seen it taught both ways.

14. Wipe off iodine with wet paper towel and place bandaid over access site.

15. Instruct patient to lie flat for 1 hour post-procedure.

16. Encourage patient to drink plenty of water. Caffeine may decrease incidence and severity of LP headache.

**CSF Typical Normal Results**
Appearance: clear, colorless
CSF total protein: 15–60 mg/100 mL
Gamma globulin: 3%–12% of the total protein
CSF glucose: 50–80 mg/100 mL (or greater than 2/3 of blood sugar level)
CSF cell count: 0–5 white blood cells (all mononuclear), and no red blood cells
Chloride: 110–125 mEq/L

**Approved Drugs for Intrathecal Chemotherapy and Typical Dose**
Cytarabine 100 mg
Methotrexate 12 mg
Rituximab 10 mg
Hydrocortisone 7.5–30 mg
Dexamethasone 4 mg
Topotecan 0.4 mg
Punch Biopsy and Suturing

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# Lesion Assessment

## Suspect Skin Cancer

<table>
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<tr>
<th>Condition</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Melanoma</td>
<td>Full excision</td>
</tr>
<tr>
<td>Suspicion for melanoma</td>
<td>Punch of most suspicious part</td>
</tr>
<tr>
<td>Basal Cell Cancer</td>
<td>Shave, Punch if sclerosing lesion</td>
</tr>
<tr>
<td>Squamous Cell</td>
<td>Deep Shave or Punch</td>
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## Suspect Benign Skin Condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Lesion Confinced to Epidermis</td>
<td>Shave</td>
</tr>
<tr>
<td>Dermal Lesion</td>
<td>Punch</td>
</tr>
<tr>
<td>Inflammatory Disorder</td>
<td>Punch</td>
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# Biopsy Types

- Punch
- Shave
- Excision
Facial Skin Tension Lines


Skin Tension Lines

• Follow skin tension lines to
  - eliminate or minimize scar formation
  - facilitate easy closure of the wound
• May vary person to person
Body Skin Tension Lines

Punch Biopsy

- Can be done to sample a suspicious lesion
- Can be done to completely remove lesions less than 4 mm

Punch Biopsy Technique

- If lesions are > 4 mm, chose the punch biopsy size that is needed to sample the most unusual part of the lesion
- If lesions are < 4 mm, chose the nearest punch biopsy size that will encompass the whole lesion
Punch Biopsy Technique

Punch Biopsy Technique


Punch Biopsy Technique

Punch Biopsy Technique

Punch Biopsy Technique

Excisional Biopsy Pearls

• To completely remove a suspicious or known cancerous lesion
• Helpful to mark the skin with a sterile surgical marking pen, leaving an adequate margin

Excisional Biopsy Technique

Correct Scalpel Excision

- Hold like a pencil
- Rest the hand holding the scalpel on the patient
- Incise perpendicular to the skin or no more than 10 degree outward bevel

Correct Scalpel Technique

Anatomy of the Needle

Choosing the Suture

<table>
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<tr>
<td>Wound</td>
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<tr>
<td>Face</td>
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<tr>
<td>Trunk</td>
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<tr>
<td>Extremities</td>
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Suture Removal

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| Face        | Best in 5 days  
Scalp 7 to 10 days |
| Trunk       | 7 to 14 days |
| Extremities | 7 to 14 days  
longer at/near joint |
Grasping the Needle Holder

• Hold the needle holder in the palm of the hand like a screwdriver
• The rings are used only to clamp and unclamp the jaws
• Forefinger is used to guide the tip

Arming the Needle Holder

- Grasping the needle is arming or loading
- Use the least amount of pressure necessary to hold the needle
- Grasp the needle 1/3 of the way down on the swage
- Grasp the needle at the tip of the needle holder

Grasping the Forceps

Hold like a pencil with the top of the forceps resting against the hand between thumb and forefinger


Grasping the Tissue

Never “pinch” the skin with the jaws of the forceps
Use one side of the forcep to elevate the skin

Wound Closure Pearls

• Wound Approximation
• Wound Tension
• Sequence and Spacing
• Eliminating/Minimizing Scars

Suture Techniques

• One-handed Tie
• Two-handed Tie
• Instrument Tie
Instrument Tie – Step 1

Instrument Tie – Step 2

Instrument Tie – Step 3

Instrument Tie – Step 4

PUNCH BIOPSY PROCEDURE CHECKLIST

Pre-Procedure

_____ Explain the procedure to the patient
_____ Obtain signed consent
_____ Gather equipment

• Punch biopsy in appropriate size
• Suture tray (may also be called laceration tray) containing needle holder, tissue forceps, scissors, gauze, drape, towel
• 1% lidocaine (with or without epinephrine depending on location of biopsy)
• Alcohol wipes/swab sticks or Betadine swab sticks (these may be included on some suture trays)
• Pathology specimen container
• Sterile gloves
• Suture
• Sterile marking pen (optional)

Procedure

_____ Place patient in comfortable position
_____ Mark biopsy area with sterile marking pen (optional)
_____ Open suture/laceration tray and other necessary equipment
_____ Don sterile gloves
_____ Drape biopsy area
_____ Prep the skin with alcohol or Betadine if patient not allergic
_____ Anesthetize biopsy site with 1% lidocaine with or without epinephrine
_____ Complete punch biopsy
_____ Close biopsy site with suture (2-mm punch biopsies may be left to heal by secondary intention; also consider leaving inflammatory or infected lesions open to heal by secondary intention)
_____ Apply antibiotic ointment (if patient not allergic) to site and cover with bandage or sterile dressing

Checklist courtesy of Kathy Sharp, MSN, FNP-BC, AOCNP®, CCD
Biopsy and Suturing Basics

Bibliography


Instructional Videos

How to perform a punch biopsy. American Academy of Dermatology.

Interrupted suture + instrument tie. Iain Hennessey.
http://www.youtube.com/watch?v=9J2aM9clkco&feature=player_embedded#t=85

Duke Suture Skills Course - Learn Suture Techniques.
http://www.youtube.com/watch?v=TFwFMav_cpE&feature=player_embedded#t=28

Simple Interrupted Suture With Instrument Tie. Andrew Wright.
http://www.youtube.com/watch?v=VmaenFTww9w&feature=player_embedded

SIM Vivo Videos Suture: The Instrument Tie
http://www.bing.com/videos/search?q=How+to+Tie+a+Suture&Form=VQFRVP#view=detail&mid=7DEA9038CC2640DC9E367DEA9038CC2640DC9E36