Beaumont Laboratory
Royal Oak

Effective Date: 01/03/2020
Supersedes: 06/29/2017
Related Documents:
RC.HM.PR.044 Wright-Giemsa Stain
RC.HM.PR.053 Iron Stain with Fast Red Counterstain
RC.HM.PR.073 Bone Marrow Aspiration and Biopsy Collection
RC.HM.PR.077 Tissue-Tek Coverslipper
RC.HM.WF.032 Bone Marrow Receipt in Lab Workflow

BONE MARROW ASPIRATION AND BIOPSY ASSISTANCE AND PROCESSING

RC.HM.PR.046.r13

Principle

Specimens of bone marrow are obtained by percutaneous needle biopsy and by needle aspiration. The biopsy site must be relatively accessible and in a bone containing hematopoietic tissue. The posterior superior iliac crest is an excellent place to obtain both a trephine biopsy and an aspirate specimen and is, therefore, the preferred site when possible.

Specimen Collection and Handling

Type:	Bone marrow biopsy **with** aspirate is the preferred sample.
Anticoagulant:	None required, although aspirate can be placed in EDTA or heparin vacutainer tubes for special studies.
Amount:	Minimum aspirate sample size is 2.0 mL; optimum is 6.0 mL.
Special Handling:	Aspirate specimen must be handled quickly when preparing smears before clotting begins. Treat all bone marrow specimens as infective and handle according to the WBH Universal Precautions policy. (See Note 1.) See Attachment A for handling specimens from pediatric patients.
Timing:	Aspirate and biopsy specimens should fix in B-Plus Fix™ for a minimum of 3 hours. Maximum time is not applicable. Outreach specimens may be received in B-Plus Fix™ or 10% neutral buffered formalin. Maximum time is not applicable.

Reagents

1. **B-Plus Fix™ (BBC-Advanced Biomedical Reagents & Technologies):** Contains water, 37% formaldehyde, zinc chloride. Already prepared. Store at room temperature.

> **CAUTION:** Toxic by inhalation if swallowed. Irritating to the eyes, respiratory system and skin. Risk of serious damage to eyes. Potential cancer hazard—repeated or prolonged exposure increases the risk. Strong sensitizer; may cause sensitization by inhalation or skin contact. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. For eyes, get medical attention. Dispose of down the drain. Safety goggles must be worn at all times with side shields. Impervious protective clothing must be worn to prevent skin contact.

2. **Wright-Giemsa stain:** (See Wright-Giemsa Stain Procedure.)

> **CAUTION:** Toxic by inhalation if swallowed. Irritating to the eyes, respiratory system and skin. Risk of serious damage to eyes. Potential cancer hazard—repeated or prolonged exposure increases the risk. Strong sensitizer; may cause sensitization by inhalation or skin contact. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. For eyes, get medical attention. Dispose of down the drain.

3. **10% Formalin Fix (DDI) (Outreach only):** Already prepared. Store at room temperature. Avoid contact with eyes, skin and clothing. Avoid breathing vapor. Use with adequate ventilation.

> **CAUTION:** Safety goggles must be worn at all times with side shields. Impervious protective clothing must be worn to prevent skin contact.

Supplies

1. **On-Control® Bone Marrow Comprehensive Tray which includes:**

Polybacked Towel	25g Needle
6” Round Cut Out Fenestrated Drape	21g Needle
8 – 3” x 3” Gauze	19g Filter Needle
Island Dressing	Scalpel with #11 retractable blade
20 mL Syringe	OnControl® Tray/Components with Depth Guide
10 mL Syringe	18g 1-1/2” blunt filter needle

Alternatively:

2. Jamshidi (T-Lok) Bone Marrow Pack which includes:

#11 Mini Scalpel	1 CSR Wrap
21g x 1½" Needle	1 Fenestrated Drape
25g x 5/8" Needle	1 10% Povidone Iodine Swabs
19g x 1½" Filter Needle	1 Probe Guide
5 mL Syringe L/L	1 Obturator
20 mL Syringe L/L	1 Male Luer Cap
11g x 4" Bone Marrow Needle "J" Type	1 T·Lok® Extraction Cannula
6/7 Dram Snap Cap Vials - Amber	1 Towel
1 Specimen Label	1 2" x 3" ADH Dressing
1 Stirring Rod	10 Micro Slides - Frosted End
1 3x3" Sponges in stacks of 5 (4-Ply)	1 Glass Slide Poly Bag

NOTE: Do NOT use the 4mL EDTA Specimen Tubes provided with the Jamshidi kit.

3. The following items may be needed for this procedure:

70% Isopropyl Alcohol	1% Lidocaine (Obtain from Pharmacy)
22g 3½" spinal needle	Caps (hair bonnets)
Steri-strips 6 x 75 mm	EDTA, 5 mL and sodium heparin, 7 mL vacutainer tubes
B-Plus Fixative™ : 6 jars (21 mL)	Isolator microbial tubes
Empty 20 mL vials	Dispo glass transfer pipettes (9")
Blue pads	Needle disposal container
Squeegees	Slide folders
2" Surgical tape and paper tape	Coverslips 24 x 40 mm
Non-sterile gauze	Sterile surgical gloves
10 mL slip tip syringes	Disposable gowns
Sterile saline	Mask/face/eye protection
Heparin Lock Flush Solution, USP, 10Units/mL	CloraPrep® w/Tint and 70% Isopropyl Alcohol One Step-Applicator
Sterile gauze	Surgical (Sterile) Markers and Labels
Microscopic slides (frosted end)	Wipe away pads

Sterile powder-free nitrile (no latex) surgeon's gloves are used by the nurse practitioner (NP) / resident / fellow / pathologist when obtaining bone marrow specimens. The technologists who assist with bone marrows are never in direct contact with the patient without the use of a protective barrier (sheet). Technologists who have allergies to gloves are directed to Occupational Health Services who will determine if the employee needs an alternate glove type. As of June, 2011, nitrile gloves have become standard throughout the institution.

Quality Control

1. Strict adherence to procedural technique is the only adequate means of quality control.
2. Technical processing of bone marrow samples at the patient beside is assessed by direct observation by the nurse practitioner.

Personal Protective Equipment

The following personal protective equipment must be utilized when collecting or assisting with collection of a bone marrow specimen from a patient:

1. Disposable gown
2. Mask/face/eye protection
3. Gloves
4. Cap (hair bonnets) if the collector/assistor has hair beyond shoulder length.

Procedure

Refer to Bone Marrow Biopsy and Aspiration Collection procedure for instructions on how to obtain a bone marrow specimen.

PROCEDURE FOR TECHNOLOGIST:

1. Each morning, check cart to assure all reagents and special supplies are adequate.

2. Wash working area of bone marrow cart with 70% alcohol.

3. **Upon arriving on the nursing unit,** verify that patient's blood has been drawn.

4. **In patient's room, prepare for procedure as follows:**
   a. The hematology tech should verify that the patient has had their blood drawn.
   b. Identify patient and print bone marrow labels utilizing SoftID.
   c. Position wastebasket between bed and bone marrow cart.
   d. Place all materials to be used for procedure on top of cart **and** put on non-sterile gloves.
   e. Decant aliquot of B-Plus Fixative™ into 20 mL vial for biopsy (sufficient to cover biopsy).
   f. Hand Nurse Practitioner(NP)/fellow/pathologist blue pad.
   g. Remove outer package of sterile gloves (in NP/fellow/pathologist's size) and hand to NP/fellow/pathologist.
   h. Open sterile bone marrow pack being careful not to touch interior as it must remain sterile.
   i. Wipe top of EDTA tube with 70% alcohol if viral cultures are ordered. **Allow alcohol to dry completely before puncturing the stopper with the needle!!**
   j. Open the following items and drop into the opened bone marrow pack respecting their sterile condition:

1 10 mL syringe or alternative
1 3M Steri-strip (6mm x 75mm) (if requested)

k. While NP/fellow/pathologist is anesthetizing patient, line up 10 slides on working area of cart. Label these slides in indelible ink with patient name and date (and "RT" or "LT" if bilateral procedure). Also, position two slides with frosted side down for aspirate material and place an open EDTA vacutainer in glass jar.

Keep a close watch to anticipate anything the nurse practitioner / pathologist / fellow / resident may need and to be aware of where he/she is in procedure. When pathologist tells patient, "Now you will feel a sharp, quick pain", be ready to receive syringe with aspirate.

5. **Aspirate:** When syringe of aspirate is handed to you, take hold of syringe without touching nurse practitioner's / pathologist's gloves and **work quickly** before specimen clots to process aspirate as follows:
   a. Gently expel 0.5 mL onto the two frosted-side down slides.
   b. From syringe, gently expel 0.5 mL into EDTA vacutainer.

If additional studies are desired, extra aspirate should be distributed into vacutainer tubes as described below:

Flow Cytometry:	0.5 mL minimum in EDTA
Molecular Pathology:	0.5 mL minimum in EDTA
Cytogenetics:	1.0 mL minimum in heparin
Virology:	0.5 mL in EDTA
Cultures:	1.5 mL in sodium polyanetholesulfonate (SPS). Obtain tubes from Microbiology.

Top of CULTURE tube should have been wiped with 70% isopropyl alcohol by nurse practitioner / pathologist and top should NOT be popped. By removing the rubber stopper (top), aerosols are generated when Microbiology centrifuges the specimen!

Put needle on syringe to introduce aspirate into culture tube. *If WBC is low, send more than 1.0 mL of sample if possible. If the patient is hard to get and you send less than 1.0 mL, explain in the LIS order entry comment field why an inadequate specimen was sent.

   c. Observe for white particles and inform pathologist of presence/absence of particles. (Many times leukemia cases may not have any particles and the thin smears are still good for morphologic analysis and cytochemical stains.)

d. From **one** slide of aspirate, pick a particle out of blood by rubber bulb suction with 9" Dispette and drop onto a clean glass slide slightly off center.
e. Lay a coverslip on top of particle and as particle begins to spread, pull coverslip off at right angle to the long axis of the slide.

   When properly done, the result on the glass slide is a 1/2 ellipse with a white streak of the marrow particle in the central zone and peripheral area of residual "blood" which appears pink.
f. Make as many smears as practical, usually 5-10, until the aspirated material has clotted on the slide. Place smears in cardboard slide folder.
g. After making 3-4 slides, drain the blood off the second slide of aspirate and push the particles down to the edge of the slide with another glass slide. Put aside until aspirate clots. Cap the vacutainer tube(s) and mix gently. Continue making aspirate smears from particles on the first slide of aspirate.
h. Once clotted, "push" the edges of the clotted blood and entrapped marrow particles with the edge of another glass slide until the clot moves freely. Insert glass slide with clot into fixative and float clot off into fixative. (Clot should be flat and thin.)

   When NO ASPIRATE is obtained, 4-5 "touch preps" of the biopsy specimen should always be made on glass slides. Make touch preps by gently rolling the core biopsy over the surface of a glass slide.
i. The clot and biopsy and any bone marrow specimens should be labeled at bedside with the collection labels generated through SoftID. Clot, biopsy and all other specimens (purple or green tops) should have side and time indicated on them. Fix aspirate and clot in B-Plus fixative™ for minimum of three hours.
j. Ensure that specimens are placed in the designated carrier by the last Courier pickup time.

6. **Core biopsy:** Upon obtaining the core biopsy from nurse practitioner/ pathologist on a sterile gauze, drop it into 10 mL of B-Plus Fixative™ **after** making touch preps then forward to Anatomic Pathology.
   a. If insufficient aspirate was obtained:
      1) Place biopsy in small amount of saline solution for transport to the hematology lab.
      2) Once in hematology lab, cut core with handled scalpel.
      3) Place core samples into RPMI media for transport and submission to designated laboratories.
   b. Ensure that the specimens are placed in the designated carrier by the last Courier pickup time.

      If patient has a suspected lymphoma, granuloma, cancer or a fever, STEP SECTIONS must be ordered from Histology.

7. Collect specimens in SoftLAB utilizing SoftID.

8. Wash working area of cart with 70% alcohol after **each** use. (Wash with 10% bleach before returning to lab).

9. Dispose of needles and syringes in sharps container in patient room.

10. Remove gloves and clean hands using an effective antimicrobial method after manipulating biological samples (and after each patient contact).

11. **Receiving in host computer:**
    a. Peripheral blood specimen should already be ordered and received by Specimen Receiving or Outpatient Lab.
    b. Receive bone marrow specimen(s) in SoftLAB upon return to the laboratory.
    c. Order all other tests as applicable.
    d. Assign ROB# through SoftPATH.
    e. Affix SoftPATH labels to respective specimens.
    f. Place specimen(s) in designated carrier for courier pickup and delivery to Histology for decal processing.
    g. Contact Cytogenetics for pickup of Cytogenetics specimen(s).
    h. Deliver all other applicable specimens to respective laboratory.

12. **Bagging:**
    When sending bone marrow or blood samples to other labs, please place EACH sample in its own SEPARATE biohazard bag to avoid possible cross contamination.

13. **Peripheral blood:** Upon receiving the EDTA peripheral blood specimen, process as follows:
    a. Analyze on hematology analyzers for CBC-diff and retic. Obtain instrument scattergrams.
    b Prepare 2 good smears. (Stain, coverslip, and save for future reference.)

14. **Staining:**
    a. Perform Wright-Giemsa stain on bone marrow aspirates per SOP.
    b. Perform Iron Stain on bone marrow aspirates per SOP.

15. **Coverslipping:**
    Place stained slides on tissue-tek coverslipper for automated coverslipping.

16. **Differentials:**
    a. WBC Differential: Handle hematology analyzer differential according to same protocol for routine differentials. Print a duplicate computer report of results.
    b. Bone Marrow Differential: Perform a 250 cell differential on each of 2 aspirate smears. Obtain host computer printout and label printouts as "1" and "2". **If a bilateral bone marrow, a 300 cell differential ON EACH SIDE is acceptable.**

17. **Documentation:**
    a. Record all tests performed on the bone marrow specimen on the Bone Marrow Flowsheet. Ensure copy of flowsheet is delivered along with specimen(s) to respective labs.
    b. Record results of iron stain on Iron Stain Q.C. logsheet.

18. **Case Folder:**
    The folder presented to the pathologist for review should contain the following properly labeled items:
    a. 2 Wright stained peripheral blood smears;
    b. 3 Wright-Giemsa stained bone marrow aspirate smears;
    c. 1 Iron-stained bone marrow aspirate smear;
    d. all clot/biopsy sections (delivered to pathologist separately by secretarial staff);
    e. duplicate copy of CBC/diff/retic report labeled with ROB# slide or computer label;
    f. Hematology analyzer histogram/scattergram;
    g. Host computer printout of bone marrow differential

Expected Values

The interpretation of bone marrows requires evaluation of clinical history, physical findings, and laboratory data by the pathologist who will then issue an interpretive consultation of the morphologic findings.

Notes

1. All new suspect acute leukemia or myelodysplasia patients should have a Cytogenetics evaluation. Place extra aspirate into a heparinized vacutainer tube and contact Cytogenetics lab for pickup.
2. When bone marrow specimens (kits) are received from Outreach, the kit will be delivered to the hematology lab and the hematology staff will triage Flow Cytometry and Cytogenetics specimens to the appropriate lab.

MISCELLANEOUS INFORMATION

Referral Cases:

All referral cases (referred to WBH **or** requests for bone marrow slides / reports) are handled by the Clinical Pathology (transcriptionist) secretarial staff.

Flow Sheets for Special Testing:

For medico-legal reasons, Dr. Mattson changed the policy on length of storage of the flow sheets that indicate what special testing has been requested on bone marrows. These records are to be kept for a minimum of 5 years. They may be sent to an off-site storage facility as long as they are clearly marked as to inclusive dates so records can be retrieved quickly when needed. This policy was instituted beginning with the January 1, 2000 flow sheets.

Refer to Bone Marrow Bench Master Copy folders for latest version of the following documents:

Bone Marrow Flowsheet
Cytogenetic / Molecular Cytogenetic (FISH) Test Requisition

References

Williams WJ: Hematology, 3rd Ed, New York: McGraw Hill, 1983:25-27.
Dutcher TF: Personal communication.
Mattson JC: Personal communication.
Robinson-Dunn B: Personal communication

Attachments

Attachment A – Pediatric gone Marrow Procedure
Attachment B – Bone Marrow Scheduling
Attachment C – Time Out/ Final Verification (Universal Protocol)
Attachment D – Outside Cases

Authorized Reviewers

Medical Director, Hematology

Attachments

Attachment A - PEDIATRIC BONE MARROW PROCEDURE

1. **Before leaving laboratory:**
   a. Obtain patient name, hospital number, room number, and location from faxed pediatric procedure list. Ensure pediatric staff has entered the order in the HIS.
   b. Gather the following extra supplies to take to the room:
   1. slides
   2. coverslips
   3. bulb
   4. Dispo glass pipettes

   The nurses will set up the bone marrow tray.

2. Follow Time Out Verification and SoftID procedures for identifying patient.

3. **In the procedure room when aspirate is handed to you:**
   a. Expel specimen onto two glass slides (use one for preparing smears; save the other for clot).
   b. Drain excess blood from aspirate material.
   c. Prepare approximately 10 "particle" smears using the coverslip technique described in Step 5 of the adult procedure.

   If aspirate does not have any particles, make several thin push wedge smears. (Many times leukemia cases may not have any particles and the thin smears are still good for morphologic analysis and cytochemical stains.)

   d. Once second slide of aspirate has clotted, process as described in the adult procedure.
   e. If biopsy is obtained, process as described in the adult procedure.
   f. Label each aspirate smear with indelible ink with patient name, date, and "BM" and place in cardboard slide folder.
   g. Collect specimens in SoftLAB utilizing SoftID.
   h. Clean up area and put away supplies.

4. **In laboratory:**
   Effective April, 2009, pediatric bone marrow samples are read out by Clinical Pathology pathologists. Pediatric bone marrow specimens are handled in the same manner as adult bone marrow specimens.
      a. Stain 2 particle and 2 peripheral blood smears with Wright-Giemsa stain.
      b. Fill out Pediatric Bone Marrow Gross Description and submit with case.
      c. Process bone marrow specimen the same as an adult specimen.

Attachment B – BONE MARROW SCHEDULING

Bone marrows are done by appointment and are performed in the morning until 12:30, Monday through Friday. Outpatient bone marrows must be scheduled through the Appointment Center (800-328-8542). Appointment Center hours: 0800-2000 M-F; 0900-1300 SA; closed SU. Inpatient bone marrows are to be ordered through the HIS.

OUTPATIENT PROTOCOL: (to be performed by the Appointment Center staff)

1. Appointments must be made with at least 72 hours lead time.

2. Schedule appointments according to availability of established time slots. Contact nurse practitioner if a physician needs to schedule a patient and there are no available slots for the desired date.

3. Outpatient bone marrows may be scheduled Monday through Friday at designated times.

4. When scheduling outpatient bone marrows, please record the following information:

   Patient Name, **Birthdate** (not age), Patient Phone Number (including area code), Doctor, Diagnosis, Unilateral or Bilateral, and Beaumont Patient #, if available.

   NOTE: Instruct patient to bring prescription with them and to register at the designated registration desk one half hour before appointment to get their blood drawn. (For anesthesia patients, see #5 below.)

5. **Outpatients requiring anesthesia**: Outpatients scheduled to have bone marrows performed under anesthesia should only be scheduled according to the availability of established time slots to accommodate Anesthesia and to avoid keeping other patients waiting if anesthesia is delayed. These outpatients are scheduled by the Appointment Center. These patients register at the Suite100 registration desk an hour before their appointment. The nurse will draw their blood prior to starting an IV, then anesthetize them for the procedure.

   NOTE:
   1. The NP prints a copy of the patient's discharge instructions and gives to patient.
   2. The bone marrow tech must FAX (x82377) a copy of the day's scheduled bone marrow patients to the Cytogenetics lab.

INPATIENT PROTOCOL: (to be performed by physician or floor secretary)

In HIS, order appropriate bone marrow procedure. A request will automatically go to phlebotomy for CBC-diff and retic to be collected. The request for the bone marrow exam will appear in the LIS Report Launcher or the BM Pending template which is checked daily at 7:00 a.m. (If ordered in HIS **after** 7:00 a.m. for that same day, please notify hematology. A bone marrow must be ordered before 11:30 a.m. to be performed on the same day.) An HIS pop-up message will appear, notifying the inputter of this.

Attachment C – TIME-OUT / FINAL VERIFICATION (UNIVERSAL PROTOCOL)

1. Objective
   To establish effective identification of the correct patient, procedure and site for a invasive procedure and ensure active involvement and effective communication between all team members.

2. Pre-Procedure Verification
   This is done to ensure that all of the relevant documents (i.e H&P, orders, consent) are available prior to the procedure, and that they have been reviewed and are consistent with each other, as well as the patient's expectations and all team members. Missing information or discrepancies must be addressed prior to starting the procedure.

3. Marking the Site
   a. This is done to definitively identify the intended site of incision.
   b. All procedures involving right/left distinction must be marked by the nurse practitioner/physician prior to procedure.
   c. A marker (one that will not wash off with usual skin prep) will be used and will be visible after patient has been prepped and draped.

4. Final Verification
   Prior to any invasive procedure, a focused moment of verbal communication between all team members involved with the procedure will occur to ensure final verification of the correct patient, procedure, site and special requirements.

   The following need to be verified:
   Identity of the patient, using at least 2 identifiers
   Location of the site
   Procedure to be performed
   Correct patient position
   Special equipment or requirements if applicable.

   a. All members of the team must verbally state that they concur with this information, before the procedure can begin.
   b. After the patient is prepped and draped, the site marking will be verified once more for visibility and accuracy.
   c. During the procedure, the following will occur: verification that all medications / solutions on or off the sterile field are labeled.
   d. Any questions or concerns will be resolved before procedure is started.

5. Documentation
   a. Time out/Final verification will be documented in the medical record using the following statement, "Time out/Final verification completed" and using the designated Bone Marrow Biopsy Procedure Checklist.
   b. Place a copy of the Bone Marrow Biopsy Procedure Checklist in the patient's chart.
   c. Retain a copy in the Clinical Pathology Office.

6. Audit
    a. Bone marrow procedures will be audited for completion of Time Out/Final Verification on a quarterly basis. All adult bone marrows will be assessed for checklist completion. A bone marrow report will be printed from the LIS.
    b. A report will be generated, stating the number of compliant procedures, noncompliant procedures, and percentage of compliance rate.

Attachment D – OUTSIDE CASES

Bone marrow aspirates may be received from an outside source. When this occurs, a requisition should accompany the specimen(s). The order should already exist in EPIC. Refer to Outreach Processing if order is not already in EPIC. The following steps should be taken:

1. Place a bone marrow order in SoftLAB.
2. Following SOP, receive the order/specimen in SoftLAB.
3. Flow, Cytogenetics and Molecular testing should be ordered separately by designated lab.
4. Following SOP, order in SoftPATH.
5. Cancel power drill charges in SoftPATH.
6. Per SOP, place specimens in carrier for delivery to AP.
7. Per SOP, take specimens to pathologist.
8. Document the approximate size of the core that was received and the number of aspirate slides.

BONE MARROW ASPIRATION AND BIOPSY ASSISTANCE AND PROCESSING

Document Control:

Location of Master: Hematology Procedure Manual
Master electronic file stored on the Clinical Pathology server:
S:\HEMACOAG\Document Control\Hematology\Procedure\Master Documents\bone marrow aspiration assistance and processing.doc
Number of Controlled Copies posted for educational purposes: 1
Number of circulating Controlled Copies: 0
Location of circulating Controlled Copies: NA

Document History

Signature	Date	Revision #		Related Documents Reviewed/ Updated
Prepared by: Nancy Ramirez MT(ASCP)SH	09/1990			
Approved by: Joan C. Mattson, MD	09/1990			
Reviewed by: (Signature)	**Date**	**Revision #**	**Modification**	**Related Documents Reviewed/ Updated**
Nancy Ramirez, MT(ASCP)SH	12/1990		Updates: HTLV III, BM diff	
Joan C. Mattson, MD	12/17/1991		Updates in blue	
Nancy Ramirez, MT(ASCP)SH	12/28/1992		Updated BM Cart supplies and note 4; added Appendix D / retyped Appendix C	
Joan C. Mattson, MD	12/28/1992		Changes noted	
Joan C. Mattson, MD	12/27/1993		OK; added outside slide procedure (Appendix E)	
Joan C. Mattson, MD	12/12/1994		OK	
Joan C. Mattson, MD	12/22/1995		Updated to include new dept. protocols for computer, Appendix B on peds BM's and new pg. numbering; added new appendices F,G,H	
Joan C. Mattson, MD	03/24/1997		Elaborated in #15 and #22, pg. 4, deleted instruction for SMART program, App.G; added new App. G; Immunohistochemistry form; added App. I: BM Scheduling.	
Noelle Procopio, MT(ASCP)SH	01/05/1998		No change	
Noelle Procopio, MT(ASCP)SH	01/04/1999		Updated Appt Ctr phone number in introduction (Appendix T); Removed Appendix F. (Duties and Tips for BM techs); added epi pen to BM cart – pg. 2.	
Joan C. Mattson, MD	01/08/1999		Above noted. Also added appendices on how to proceed if patient allergic to local anesthetics and ref on pg. 3 to this appendix.	
Joan C. Mattson, MD	01/24/2000		No change	
Joan C. Mattson, MD	12/06/2001		Removed references to Mercury	

			Precipitation, pg. 1; added to procedure for pathologist #2, pg. 3; removed references to HIV patient pg. 5 and pg.10. added to IMPORTANT, pg. 6; added steps k and l pg. 7; added appendices K-R.	
Noelle Procopio, MT(ASCP)SH	12/30/2002		No change	
Noelle Procopio, MT(ASCP)SH	12/22/2003		No change	
Joan C. Mattson, MD	01/13/2004		Removed B5 reference; updated to Zinc fomalin, pg. 17; updated reference to nurse practitioner, pg. 3-4; updated Anal Cytometry name to Flow Cytometry, pg. 6; updated culture requirements, pg. 6; added note to bone marrow pack, pg. 4; added bone marrow tech patient name verification, pg. 5; added LIS instruction to Ped Marrows, Appendix A, pg. 12; updated pathologist names, app. C, pg. 15; updated BM flowsheet, pg. 16; updated Appendix E (Outside Requests for BM slides), pg. 17; updated billing sheet, pg. 19; updated outside referral cases, App H, pg. 20; updated local anesthetic, App. J, pg. 23; added Appendices S-U. Also change buffy to Neut<2.0 from WBC <4.0	
Noelle Procopio, MT(ASCP)SH	01/10/2005		No change	
Joan C. Mattson, MD	12/20/2005	00	Standardized procedure format; updated to current fixative (B-plus, decal soln and formalin concentration, pg. 1; reformatted BM cart supplies pg. 2; incorporated former App. F to “Note”, pg. 3; updated aspirate and biopsy processing times, pg. 7; Incorporated prior Appendices (B,C,D,G,H,K,L, M,N,O,P-U) into Misc Info, pg. 10-11.	
Joan C. Mattson, MD	11/30/2006		No change	
Ann Marie Blenc, MD	05/27/2007	01	Updated cart supply list, pg. 2; updated nurse practitioner steps #4+17; eliminated references, to cytochemistry stains and “first drops;” updated H# to ROH#; eliminated attachment re sample slide labels; eliminated former attachment C re outside requests (incorporated into body of procedure). Removed reference to sternal specimen, pg. 1	
Ann Marie Blenc, MD	10/29/2007	02	Deleted references to EPI – pen; updated. Employee Health name; updated Quality Control section, #2; updated Patient 1 to Misys; added Attachment E; changed instructions for iodine. Added	

			audit instructions to Attachment E; added statement re Path Consult frequency.	
Ann Marie Blenc, MD	09/22/2008	03	Updated Appt. Ctr. Guidelines; removed comment re only one bilateral patient scheduled per day; clarified Microbiology instructions re NOT removing tube top; added directive to inform hematology PM shift of any bone marrow that is still processing or must be sent to Histology.	
Ann Marie Blenc, MD	10/06/2008	04	Updated buffy coat directive from WBC of 2.0 to 1.6; removed references to individual specimen processing sheets (included in Bone Marrow Flowsheet).	
Ann Marie Blenc, MD	09/14/2009	05	Removed path consult info to separate procedure; updated buffy coat to be done when "Neut <1.6 if requested by pathologist"; removed compliance bulletin (Att. D) for path consults; renamed Att. E (re time out procedure) as Att. D; updated slide label options; updated pediatric bone marrow process; updated to commercial bone marrow pack; removed references to packs provided by CPD; eliminated reference to pediatric hematologists reading out cases and updated pertinent workflow.	
Ann Marie Blenc, MD	07/26/2010	06	Removed references to obtaining reagents from histology; removed reference to Histology Special Stains form; removed reference to order LAP under PB accession number; updated Tylenol to Acetaminophen; removed reference to Rutzky numbers; added outpatients and anesthesia cases are scheduled according to available appointment slots; updated Jenner-Giemsa to Wright-Giemsa; removed references to Appt. Center and preauthorization; removed directives to nursing unit regarding conflicting procedure scheduling (now handled by nurse practitioner; removed task for techs to contact nursing unit (performed by NP); added PPE for NP/techs; added note regarding triaging of Outreach specimens to Flow & Cytogenetics.	
Ann Marie Blenc, MD	09/15/2011	07	Removed references to Tamtron; removed references to 2% Lidocaine; updated procedure to	OK

			reflect changes with Soft LIS; removed decalcification reagent and steps (now performed in Histology lab); added steps for cutting core if insufficient aspirate (clot) is obtained; added use of heparinized syringe if difficulty obtaining bone marrow specimen; added heparinized syringe and RPMI media to supply list; added universal switch to nitrile gloves; removed reference to Bone Marrow Supply list.	
Ann Marie Blenc, MD	09/16/2013	08	Removed procedural steps on how to obtain bone marrow aspiration and biopsy (moved to separate procedure); updated related documents; updated bone marrow supplies to match current practice; updated ROH to ROB; removed Att. C (Protocol for Local Anesthesia); moved former Att. D to new Att. C; removed Note re Path Consult mistakenly ordered on pediatric patient; added Iron Stain to related documents; updated steps to match current practice; added directive to allow 70% alcohol to dry before piercing EDTA cap with a needle; added Dr. Robinson-Dunn to references; added B-Plus Fix to Outreach specimens; updated B-Plus Fixative to B-Plus Fix; updated cc to mL (syringes).	OK
Ann Marie Blenc, MD	04/17/2015	09	Added directive and related document for Tissue-Tek coverslipper.	OK
Ann Marie Blenc, MD	10/19/2015	10	Added caution for 10% formalin; added safety goggles for B-Plus Fixative.	OK
Ann Marie Blenc, MD	04/17/2017	11	Added T-Lok to Jamshidi; updated to 20 mL vials; updated pencil labeling to indelible ink labeling; updated hematology staff notification to Courier staff notification; stated to contact Cytogenetics for specimen pickup; added placing of specimen(s) in carrier for courier pickup; removed reference to LAP score; updated discharge instructions given to patient; removed amounts of items on cart; added step regarding removal of gloves and cleaning hands.	OK
Ann Marie Blenc, MD	06/29/2017	12	Added Attachment D; added attachments section to body of procedure; added blunt filter needle to OnControl tray.	OK

Elizabeth Sykes, MD	02/02/2018			
Peter Millward, MD	01/30/2019		New Medical Director	
Ann Marie Blenc, MD	01/03/2020	13	Changed the optimal volume of aspirate from 4.0 mL to 6.0 mL. Removed direction to order a reticulin stain if no aspirate is obtained. Changed the number of peripheral smears needed.	OK