

Bone Marrow Aspirate/Trephine Guidelines For Adult Bone Marrow Biopsies

1. Competence

Only those who have documented competence may undertake this procedure unsupervised.

Specialist Registrar: Competency assessment is undertaken as part of the Specialist Registrar training programme and is documented on their training portfolio (e.g. JRCPTB e-portfolio).

Clinical Nurse Specialist: Competence is undertaken using the established nursing competency framework.

Physician Associate: Competency assessment is undertaken as part of training for inclusion within the bone marrow biopsy service and should be documented on their training portfolio. As not currently “Registered” practitioners they remain unable to prescribe medications, sign for the use of or be the responsible person for administration of inhaled pain relief or sedation.

As part of their competency assessment, everyone must read these guidelines and the [Planned Adult Bone Marrow Biopsies LocSSIP](#).

2. Patient assessment and procedure cautions

In patients with multiple or severe co-morbidities and/or frailty, bone marrow aspirate and/or trephine should be avoided where possible. In these patients and those aged over 80yrs, the expectation is the procedure will have been discussed with the supervising Haematology Consultant before proceeding. All appropriate non-invasive investigations, including a blood film, should be undertaken in the first instance.

Consideration should be given to the fact that an aspirate alone is less invasive and often sufficient. The assessment and decision regarding proceeding should be well documented in the patient record.

3. Anticoagulant and antiplatelet drug management pre procedure

Responsibility for managing antiplatelet/anticoagulant drug management pre biopsy lies with the clinician requesting the bone marrow biopsy for a particular patient. This should be documented on the EPR request for BM Biopsy. It is a mandatory set of boxes.

Bone marrow biopsy is considered to be a low bleeding risk procedure.

Warfarin and DOAC MILS advice:

[Elective Surgery and Invasive Procedures in Patients Taking Warfarin or a Direct Oral Anticoagulant \(DOAC\) \(sharepoint.com\)](#)

Antiplatelets advice: NSSG: H120 Guidelines for the management of patients taking Antiplatelet Medication [OUH Guidelines for the Management of Patients taking Anti-Platelet Drugs](#)

4. Bone marrow biopsy Lists

At the Churchill Hospital: Routine lists run Monday to Thursday mornings and can accommodate 4-5 patients per list.

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Urgent/ad hoc procedures may be accommodated, with the agreement of the operator performing the procedure and the bone marrow biopsy coordinator.

Bone marrow biopsies should ideally be performed in the bone marrow biopsy room on the Haematology ward at the Churchill Hospital given the equipment and nursing support available there. Other locations that meet the procedural requirements e.g. ventilation, trained staff may be used subject to prior agreement.

5. Other Locations

Single operator biopsies may occasionally be necessary. When the procedure is carried out as a single operator procedure or outside the bone marrow biopsy room it should be carried out in a safe, uncluttered, and private environment with immediate access to appropriate support and emergency equipment. Ward staff should be made aware that the procedure is taking place, and the patient offered a chaperone or support person. Trolleys should be laid up immediately prior to use and ideally at the bedside. No inhaled pain relief or sedation can be used.

6. Anticoagulant and antiplatelet drug management during procedure

The operator is responsible for checking that pre-procedure instructions have been carried out by the patient prior to the procedure. Throughout the procedure bleeding should be assessed and decisions made as to whether a requested trephine is appropriate or not, given bleeding during aspirate.

7. Anxious patients and those who find bone marrow biopsies painful/distressing

It is acknowledged that for some patients, bone marrow biopsies are distressing and/or painful.

As standard, nursing support and Entonox for pain relief is present on all planned biopsy lists at the Churchill Hospital, Oxford. Patient audit has shown that this makes a substantial difference to their experience. All staff who are involved in carrying out and supporting bone marrow biopsies should have read and comply with [Safe Sedation for Adult and Children by Non-Anaesthetists](#)

7.1 Inhaled Pain relief

At the Churchill Hospital, there is the facility for patients to use inhaled pain relief e.g. Entonox. The use of inhaled pain relief requires rooms to have enhanced ventilation to comply with staff exposure limits. There must be immediate access to emergency equipment, oxygen and support. The area must be well ventilated. Pulse oximetry should be available and is recommended. Staff supporting the patient using inhaled pain relief must receive specific training for this.

During administration of inhaled pain relief, there should be a minimum of 2 personnel present, one of whom must be a Registered Health care professional (Medical or Nursing). If a non-registered member of staff is present the Registered member of staff remains the responsible person for usage and patient safety. If a Physician Associate is doing the procedure, then a Registered member of staff (Nursing or Medical) must be present to allow the inhaled pain relief to be used and will be the responsible person. The inhaled pain relief must be prescribed and signed off on EPR if used for a patient-

The current pain relief of choice within OUH FT Hospitals is Entonox:

All operators and supporting personnel should complete the OUH E learning module.

["https://mylearninghub.ouh.nhs.uk/totara/catalog/index.php?catalog_fts=entonox&orderbykey=score&itemstyle=narrow#"](https://mylearninghub.ouh.nhs.uk/totara/catalog/index.php?catalog_fts=entonox&orderbykey=score&itemstyle=narrow#)

and read:

Guideline for the Administration of Entonox (BOC)/ Equanox (Airliquide) Administration for Procedural Pain in Adult Patients

<http://ouh.oxnet.nhs.uk/SafetyQualityRisk/Policies%20Procedures%20%20Guidelines/Entonox%20Equanox%20Guideline.pdf>

Contraindications to Entonox should be discussed as part of the pre-procedure checklist and include:

- Eye surgery within 12 weeks (it is not a contraindication post cataracts)
- Bullous emphysema and/or anyone who may have CO₂ retention.
- Head injury with suspicion of intracranial air
- Any suspicion of air-filled spaces in body e.g. pneumothorax or abdominal obstruction

7.2 Oral Lorazepam:

This anxiolytic can be helpful in conjunction with inhaled pain relief for patients with high levels of anxiety about the procedure. Discuss with the Bone marrow biopsy coordinator. Doses of Lorazepam may be prescribed at the Clinician's discretion (usually 0.5mg-1mg) and given to the patient pre biopsy. Usually 2 doses are prescribed, one dose to be taken the evening before to aid sleep pre biopsy and one dose to be taken two hours pre biopsy. (Peak effect occurs at 2 hours and half-life is 12 hours). It should be noted on the request form that this has been prescribed and dispensed to the patient, so that those administering inhaled pain relief are aware of this. Immediate access to emergency equipment and support is necessary during the biopsy and patients should be advised not to drive for 48hrs. Pulse oximetry and BP monitoring should be available and used if clinically needed. Patients are kept until clinician is satisfied of recovery and for a minimum of 30 mins post procedure.

7.3 Midazolam:

Intravenous sedation with midazolam is only very occasionally necessary and should be undertaken with caution. This would only be carried out by a Registered Health Care Professional. Ideally, the Registrar scheduled to perform the procedure should be informed of any plan for sedation prior to the day itself to allow safety and contingency planning. A second registered health care professional must be in attendance to monitor the patient during the procedure. These patients will be scheduled with a double slot on the list. They will receive a letter outlining instructions for starving pre biopsy in line with the [Safe Sedation for Adult and Children by Non-Anaesthetists](#)

Please note that when used in conjunction with Entonox, the typical dose of intravenous Midazolam required is 0.5 to 2mg with the aim of reducing anxiety as an adjunct to pain relief.

Midazolam injection is available in several strengths, ONLY the 1mg/ml preparation should be used for sedation. Using an alternative strength, even if diluted to a 1mg/ml concentration is unacceptable. The rationale for this is to prevent patient harm where a higher concentration product had been miss-selected for the 1mg/ml strength. Any overdose given due this, regardless of the patient impact, is a Never Event.

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Staff should be reminded that as per the Never Events framework for 2015, that miss-selection of midazolam preparation is a Never Event and will be treated as a Serious Incident Requiring Investigation. Such incidents will require immediate notification and escalation as outlined in the Incident Reporting and Investigation Policy.

Immediate access to emergency equipment and support must be available. Patient observations must be recorded before, during (15 min intervals) and after the procedure until they are felt by the clinician to be recovered and for a minimum of 30 mins post procedure, with observations at 15 min intervals or more frequently as clinically indicated. The patient should be consented and positioned on the bed before the prescribed midazolam is administered. Intravenous midazolam is given before the site is identified, cleaned and local anaesthetic is infiltrated to minimise anxiety associated with these steps.

Post procedure, once the patient is recovered adequately; oral fluids are offered. Then when adequately recovered a further drink and biscuit are offered. They can be discharged once the clinician is satisfied of recovery and a minimum of 30 mins has passed since the procedure ended. They are given written instructions about not driving for 48 hours and having someone to stay with them for a minimum of 12 hours post sedation.

If there are any questions or concerns about using the above for a particular patient, then please contact the OUH Sedation lead for further advice. Dr Amar Keiralla, Consultant Cardiothoracic Anaesthetics, OUH Sedation lead

Please note that the department has a power assisted device. Please ensure you follow the relevant procedure. Only those trained to use the Teleflex On-Control device and signed off as competent may use it.

7. Procedure

7.1 Equipment:

1. Appropriate consent form and procedure check list
2. Cleaned dressing trolley.
3. Standard dressing pack, sterile gloves, and apron
4. Chloraprep cleaning sticks
5. Lidocaine 2%. **NB: The stated maximum safe dose of lidocaine is 3mg/kg with recommendations to not exceed 200mg at any weight which equates to 10mls of 2% solution.** This department uses 2% Lidocaine (without adrenaline).
6. Filter needle (for drawing up Lidocaine), 25-gauge (orange hub) and 21-gauge (green hub) needle (for administering Lidocaine)
7. Selection of syringes, 10ml (typically 3) and 2ml
8. Bone marrow aspirate needle +/- trephine needle +/- universal container containing small amount of formalin for trephine analysis (CellStor pot) +/- microscope slide holder
9. Packet of small gauze and adhesive dressing
10. Slides for immediate spreading of marrow
11. EDTA tubes and cytogenetic media.
11. Pencil to label slides

7.2 Procedure: Aspirate (at posterior superior iliac crest)

1. Complete the **Procedure checklist**. [H-102-bone-marrow-biopsies-procedure-check-list.pdf \(oxford-haematology.org.uk\)](https://www.oxford-haematology.org.uk/H-102-bone-marrow-biopsies-procedure-check-list.pdf) (This includes positive patient identification, and is designed to reduce the risk of Never Events)
2. Ensure that a full explanation has been given to the patient and that informed written **consent** has been obtained (to include pain, infection, bleeding, failure of procedure, potential damage to surrounding structures). Ensure the patient copy of the consent form is given to the patient.
3. A separate consent form is required for Bio-banking. Use Study specific patient information and consent forms:
4. The Bio-bank consent forms are expected to be done ahead of time by the research team.
5. Wash hands
4. Clean trolley with cleaning wipes
5. Clean hands
6. Lay out a sterile field and all essential sterile equipment.
7. If available, place an incontinence sheet on the bed to protect it.
8. Position patient – lying on their side with legs hugged as close as possible to their chest and identify the site for aspiration.
9. Clean hands and apply sterile gloves.
8. Clean the area in the region of the posterior iliac crest with Chloraprep.
9. Draw up lidocaine with the filter needle (to exclude glass shards) and administer as an intradermal injection using a 25-gauge needle to infiltrate the superficial layer of the skin, and the 21-gauge needle to infiltrate deeper down to posterior crest.
10. Allow lidocaine approximately **5 minutes** to work and assess efficacy with the patient.
11. Pass the aspirate needle perpendicularly through the cortex and just into the marrow cavity using a twisting action and appropriate pressure.
12. Remove the introducer and attach syringe (2ml or 10ml). Draw back to aspirate no more than 0.5 ml of marrow. The patient should be warned that they may experience discomfort as the marrow is aspirated.
13. The marrow sample should be placed on glass slides and spread immediately.
14. As clinically indicated, further marrow may be aspirated preferably as one pull, and placed into EDTA tubes and cytogenetics tubes as required. Bio bank samples typically require 5-10mls of aspirate.
15. Remove aspirate needle and apply firm pressure on puncture site with sterile gauze.
16. If a trephine sample is required, go onto perform this as per (section 7.3)
17. Apply folded gauze and adhesive dressing once adequate haemostasis is achieved.
18. Label all specimens at the bedside with using EPR labels via “Bone marrow biopsy care set”.
19. Discard all equipment into appropriate containers and clean the procedure trolley.
20. If applicable, advise patient when to restart any stopped antiplatelet/anticoagulants.
21. Provide patient with “After your bone marrow biopsy” [61577Pbiopsy.pdf \(ouh.nhs.uk\)](https://www.ouh.nhs.uk/61577Pbiopsy.pdf) leaflet which has aftercare advice and Triage contact numbers.

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22. Document procedure on EPR under “Haematology Procedure” using Bone marrow biopsy Power note and prescribe/sign for any medication used including inhaled pain relief and/or sedation. Document Volume of Lidocaine 2% used.
23. Consent forms and procedure checklists should be scanned and filed on EPR via the admin department.
24. See further down document for how to send samples.

7.2.1 Sternal aspirates:

Sternal aspirates are rarely conducted but are occasionally necessary and must only be undertaken by a Haematology Consultant, where they personally consented the patient to the procedure. Extreme caution should be used in myeloma and osteopaenic patients due to the risk of fracture. **Sternal marrows are NO LONGER considered Standard of Care and Specialist Registrars are NOT expected to perform these under any circumstances.**

For very difficult cases, to ensure patient safety, radiology guidance should be sought by the teams.

For academic purposes, the aspirate procedure is as described above; however, the depth to which the aspirate needle is to be inserted is determined using the local anaesthetic needle. The sternal guard **MUST** be in place at this depth before attempting the aspirate. Smaller sample volumes are to be expected.

7.3 Procedure: Trepine

A bone marrow trephine will normally be performed at the same time as a bone marrow aspirate. The aspirate should be done first followed by the trephine. Additional anaesthesia is not normally required.

1. Apply steps 1-15 as per section 7.2
2. Introduce the trephine needle perpendicularly through the cortex into the marrow cavity, using a twisting action and appropriate pressure until the needle is anchored (such that it will support its own weight).
3. Withdraw the introducer.
4. Angle the needle towards the anterior superior iliac spine and using a rotary movement continue to advance the trephine needle for a further 1 to 3cm, check depth with measure.
5. Place the tweezer trocar down the needle.
6. Remove the needle whilst exerting pressure on the surrounding skin to prevent puckering.
7. Apply firm pressure on puncture site with gauze.
8. Retrieve the trephine sample from the needle.
9. If a trephine roll is indicated, see 7.3.1
10. Drop the sample into the formalin.
11. Apply steps 17-24 as above.

7.3.1 Trepine roll

If no aspirate or if a haemodilute sample is acquired and subsequent trephine is then obtained, a roll of the trephine sample on an aspirate slide can be sent to the laboratory and may provide diagnostically useful information.

8. Sample handling: Use Bone marrow biopsy careset on EPR as this will mark samples as collected.

If urgent samples are being taken ad-hoc, then please contact the relevant laboratories pre-procedure (particularly if it is a Friday) so that they are aware to expect samples that will need urgent processing.

Flow Cytometry lab: ouh-tr.immunophenotyping@nhs.net

Cytogenetics lab: dutyscientist.oxfordgenetics@ouh.nhs.uk

- **Aspirate slides and EDTA** for morphology, immunophenotyping and molecular testing. Request on EPR under “Bone Marrow Careset”, “Bone marrow aspirate” (This will print 4 labels). In clinical details document reason for biopsy, and referrer’s requests for tests. In “Copy to” fill in original referrer or consultant. Send via City Sprint to Molecular Haematology lab, level 4, JR. **Additional aspirate tests such as AML FLOW MRD, and other MRD markers may be labelled separately and sent to appropriate destinations. Discuss with Bone marrow biopsy coordinator if unsure.**
- **Trephine** – Request on EPR under “Bone marrow biopsy Careset”, “Histopathology-Cellular pathology” (again “copy to” referrer and send with aspirate sample via City Sprint to the Molecular Haematology lab, Level 4, JR.
- **Bio-Banking samples: Label with patient initials and Bio-bank ID if known. Otherwise ensure labelled with patient’s name and MRN.** Leave on appropriate tray in BMB Room for collection. Inform Bio-bank team to collect.
- **Other trial samples** – give directly to trial practitioner overseeing that trial ensuring that they are labelled before leaving the room and document when the sample is collected.

9. Cytogenetics

- **Cytogenetics tubes for myeloma FISH only** – This sample should be in a green topped Lithium Heparin tube. Add request to EPR when writing clinical details in the “Bone Marrow Care set” and send with other aspirate samples to the Molecular Haematology lab Level 4, JR (These samples are then subsequently sent onto the Wessex lab in Salisbury from the JR)
- **Cytogenetics tubes for all other indications** – The sample should be placed in a Bone Marrow transport medium tube, obtained from the Cytogenetics lab or fridge in the Medication room on the Haematology ward. If such tube is not available, then a Lithium Heparin tube may be used. Request the sample on a cytogenetic request form (to be found in bone marrow room or on intranet) and send via helpdesk to cytogenetics lab at Churchill Hospital.

10. Collection/Delivery

The Trust uses a courier company called City Sprint to transfer samples to Molecular Haematology at the John Radcliffe Hospital.

There are scheduled pick-ups at 11:30 and 13:30 from bone marrow biopsy room at the Churchill Hospital so ordering additional ones is rarely necessary, However, should this be required there are details of how to do so in labelled folders in the bone marrow biopsy room and at the Haematology ward nurse’s station.

11. Documents/References

- Dacie, J and Lewis, S (1992) Practical Haematology Churchill Livingstone, London.
- Bain B.J (2005) Bone marrow biopsy morbidity: review of 2003. J Clin Pathol 2005; 58:406-408.
- <https://ashpublications.org/blood/article/122/21/1752/13112/Accurate-Needle-Placement-A-Must-For-a-Safe-and-Safe-Sedation-for-Adult-and-Children-by-Non-Anaesthetists>
- [Incident Reporting and Investigation Policy](#)
- Patient information leaflets “Having a Bone Marrow Test” and “After Your Bone Marrow Biopsy” available on OUH Trust Website
- [Guideline for the Administration of Entonox \(BOC\)/ Equanox \(Airliguide\) Administration for Procedural Pain in Adult Patients](#)

OUH Haematology Diagnostics Laboratory SOP,
OUH Trust Consent policy
OUH Blood sample management policy
ANTT guidelines

Author

Linda Bywater, Angela Flory, Pamela Roberts Clinical Nurse Specialists Version 1 March 2002

Review

Name	Revision	Date	Version	Review date
Pamela Roberts, Clinical Nurse Specialist. Graham Collins, Consultant	General content	Dec 2010	2.0	Dec 2012
Sandy Hayes, Quality Manager	Consultation feedback, OUH policies	Feb 2011	2.1	Feb 2013
Sandy Hayes, Quality Manager	Patient assessment following an SSI. Reference article	June 2011	2.2	June 2013
Sandy Hayes, Quality Manager Prof. Paresh Vyas, Consultant	BM samples	Dec 2011	2.3	December 2013
Dr Graham Collins, Consultant Dr Deborah Hay, Consultant Sandy Hayes, Quality manager	Competence, age limit, lignocaine dose limits, sternal aspirate, general review	Dec 2014	3.0	December 2016

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Dr Graham Collins, Consultant Dr Deborah Hay, Consultant Joel Sedumedi, Quality manager	General guidelines/content	Sept 2017	3.1	September 2019
Dr Kieran Burton, Specialist Registrar Dr I-Jun Lau Specialist Registrar Dr Faye Sharpley Registrar Dr Stephen Booth Registrar Pip (H) Doling, Deputy Sister, Bone Marrow Biopsy Coordinator Dr Amar Keiralla, Consultant Cardiothoracic Anaesthetics, OUH Sedation lead, Nadjoua Maouche Lead Pharmacist	General guidelines, Sample handling, Feedback from patients Anticoagulant/antiplatelet guidance. Conscious sedation guidelines.	September 2020	4.0	September 2022
Dr Nick Denny, Specialist Registrar Dr Murali Kesavan, Haematology Consultant Pip (H) Doling, Deputy Sister, Bone Marrow Biopsy Coordinator	Review of formatting, Update of the Sample Handling and Sternal Aspirate Guidelines	April 2023	4.1	November 2024
Dr I-Jun Lau, Consultant Pip (H) Doling, Deputy Sister, Bone Marrow Biopsy Coordinator.	Updating to incorporate inclusion of Physician Associates in service. Updating of Antiplatelet Guidance and sample handling	April 2024	5	April 2026

Circulation

NSSG website.