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: Competence assessment is undertaken as part of the Specialist Registrar training programme and is documented on their electronic training portfolio (JRCPTB e-portfolio).
Clinical Nurse Specialist competence is undertaken using the established nursing competency framework.
Physician Assistants should demonstrate evidence of competency equivalent to bone marrow DOPS, as part of JRCPTB e-portfolio.
As part of competency, all must read 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.

Responsibility for managing antiplatelet/anticoagulant drug management pre biopsy lies with the Clinician requesting the bone marrow biopsy for a particular patient. (See Referral to the Bone Marrow biopsy service H2.9.2, available on the NSSG, Clinical Haematology, Day Treatment Unit)

Where there is a difficult procedure, seek advice and assistance after a maximum of 3 attempts at aspirate or trephine.

3. Bone marrow biopsy Lists
At the Churchill Hospital: Routine lists run Monday to Thursday mornings and can accommodate 4-5 patients per list.
Urgent procedures may be accommodated ad hoc, with the agreement of the Operator performing the procedure and the Bone Marrow Biopsy coordinator.

4. Other Locations
At the Churchill Hospital, bone marrow biopsies should ideally be performed in the Bone Marrow Biopsy Room on the Haematology ward, given the equipment and Nursing support available there.
At the Horton hospital, bone marrow biopsies are carried out as a single operator procedure in the Pathology Dpt. Therefore neither Entonox nor intravenous midazolam can be used.

Emergency Single operator biopsies occur at the John Radcliffe Hospital and for occasional adhoc bone marrow biopsies at the Churchill hospital. Again no Entonox or sedation can be used unless there is a second healthcare professional present throughout who has these competencies and there is immediate access to appropriate emergency equipment.

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.

If the procedure is to be supported with Entonox, then it must be performed in a well-ventilated area as above and a second person must be in attendance. If support with Intravenous Midazolam is required then the patient should be booked onto a Bone marrow biopsy list at the Churchill rather than Ad-Hoc.

5. Anticoagulant and antiplatelet drug management pre procedure
Responsibility for managing this drug management pre biopsy lies with the Clinician requesting the bone marrow biopsy. The operator is responsible for checking that these 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.

6. 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

6.1 Entonox:
At the Churchill Hospital, there is the facility for patients to use Entonox for pain relief. If a Health Care Assistant (and not a Registered Nurse) is attending the patient, then the Registrar doing the procedure remains the responsible person for Entonox both for prescribing and patient monitoring. Each operator should have completed OUH E learning module “Administration of Entonox for wards at the OUH FT E-learning package” and should have read Guideline for the Administration of Entonox (BOC)/ Equanox (Airliquide) Administration for Procedural Pain in Adult Patients
The health care assistant can support the patient with technique of using. 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 if patient is very anxious or Entonox required throughout entire procedure.

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

- Eye surgery within 1 week
- Bullous emphysema
- Head injury with suspicion of intracranial air
- Any suspicion of air-filled spaces in body e.g. pneumothorax or abdominal obstruction

6.2 Lorazepam:
This anxiolytic can be helpful in conjunction with Entonox for patients with high levels of anxiety about the procedure. An oral dose of 0.5mg-1mg may be prescribed 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 one hour pre biopsy. It should be noted on request form so that those administering Entonox are aware of this. Again 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.

Midazolam:
Intravenous sedation with midazolam is only very occasionally necessary and should be undertaken with caution. 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 at the end of a 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 between 0.5-1mg 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.

Staff should be reminded that as per the Never Events framework for 2015, that miss-selection of midazolam 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. The intravenous midazolam is given before the site is identified; cleaned and local anaesthetic is infiltrated, so approximately 5-10 mins before the Entonox is started.

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 hrs 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 particular patients, then please contact the OUH Sedation lead for further advice. Dr Amar Keiralla, Consultant Cardiothoracic Anaesthetics, OUH Sedation lead

Please note the department is trialing a new power assisted device. Please ensure you follow the relevant procedure. This document will be updated at the end of the trial.

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. (This includes positive patient identification, and is designed to reduce the risk of Never Events (Document H102 available on NSSG)
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 specific patient information and consent forms: ORB (for patients with known or suspected Myeloma), or Myeloma-Bio and Haem-Bio (for patients with known or suspected myeloid disease). The biobank consent forms may be done ahead of time by the research team and 3 copies of each consent form will be produced: one for the patient, one for the notes and one for the biobanks.
4. Wash hands
5. Clean trolley with cleaning wipes
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.
10. Clean the area in the region of the posterior iliac crest with Chloraprep.
11. 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 need to infiltrate deeper down to posterior crest.
12. Allow lidocaine approximately 5 minutes to work and assess efficacy with the patient.
13. Pass the aspirate needle perpendicularly through the cortex and just into the marrow cavity using a twisting action and appropriate pressure.
14. 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.
15. The marrow sample should be placed on glass slides and spread immediately.
16. 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.
17. Remove aspirate needle and apply firm pressure on puncture site with gauze
18. If a trephine sample is required, go onto perform this as per (section 7.3)
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” leaflet which has aftercare advice and Triage contact numbers.
22. Document procedure on EPR under Haematology Procedure using Bone marrow biopsy
   Power note and prescribe/sign for Entonox if used. Document Volume of Lidocaine 2% used.
23. Consent forms 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 after full discussion with the supervising Haematology Consultant and by a competent operator. Extreme caution should be used in myeloma and osteopaenic patients due to the risk of fracture.
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: Trephine
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 yellow headed 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 Trephine 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.
Sample handling:

- **Aspirate slides and EDTA** for morphology, immunophenotyping and Molecular testing – Request on EPR under “Bone Marrow Aspirate Exam” (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. **Trephine** – Requests on EPR Histopathology-Cellular pathology (again “copy to” referrer and send with Aspirate sample via City Sprint to Molecular Haematology, Level 4, JR

- **Cytogenetics tubes for myeloma FISH only** – Add request to EPR -Bone Marrow Aspirate Exam” and send with other aspirate samples to Molecular Haem as above

- **Cytogenetics tubes for all other indications** – Request on Cytogenetic forms (to be found in Bone Marrow room or on Intranet) and send via Helpdesk to Cytogenetics lab at Churchill Hospital

- **ORB- label with patient initials and ORB No. Myeloma-Bio/Haem-Bio Samples-Label with patient stickie** – leave in appropriate tray inside bone marrow room for relevant research teams to collect

- **Other trial samples** – given directly to Trial practitioner overseeing that trial

**Cytogenetics:**
Cytogenetics tubes are stored in the fridge in the medication room on the Haematology ward or can be obtained direct from Cytogenetic lab.
The Oxford genetics laboratory do not currently process myeloma FISH so samples for this indication will need to be sent to the Wessex genetics laboratory in Salisbury. The pathology lab will arrange this and will complete the relevant forms. Therefore, MM FISH send as directed with Aspirate sample

**Collection/Delivery**
The Trust uses a courier company called City Sprint to move samples to Molecular Haematology at the John Radcliffe Hospital.
Their 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.

**Documents/References**
- [Safe Sedation for Adult and Children by Non-Anaethetists](https://ashpublications.org/blood/article/122/21/1752/13112/Accurate-Needle-Placement-A-Must-For-a-Safe-and)
- 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 (Airliquide) Administration for Procedural Pain in Adult Patients**

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

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**Review**

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<td>September 2020</td>
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Circulation
NSSG website.