Bone Marrow Aspiration and Trephine Sampling – Full Clinical Guideline

Reference no.: CG-HAEM/2023/002

This guideline has been registered with the trust, only for use only within the department of clinical haematology. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague of expert. Caution is advised when using guidelines after the review date.

1. Introduction

The procedure known as trepanning, or trephination, of bone is the oldest surgical practice that continues to have clinical relevance in modern times. The method dates as far back as the Neolithic period and initially entailed the drilling of cranial bones as a form of medical intervention for headaches and mental illnesses. (Parapia, 2007)

A bone marrow aspiration/trephine biopsy is performed when the marrow cells need to be aspirated and examined.

This involves the insertion of a needle into the cortex of an area of flat bone, usually the posterior iliac crest. The samples obtained can be examined in order to diagnose a wide variety of haematological disorders (Trewhitt 2001). Bone marrow aspiration and trephine biopsy are complementary; bone marrow aspiration provides excellent cytological detail; where as trephine biopsy allows for an accurate analysis of overall cellularity and architecture (Bain, 2001). Aspiration/trephine biopsy is usually performed aseptically by a doctor or registered nurse competent in the procedure. Within UHDB NHS trust, the procedure of bone marrow aspiration and trephine biopsy may be performed by a registered nurse who has been assessed as competent in accordance with– Expanding the Scope of Professional Practice Policy . A self directed learning package has been developed to facilitate this.

2. Guidelines

Best Practice

Of the potential sites to obtain bone marrow, the posterior iliac crest is optimal for reasons of safety and ease of performance. (Bain,2001) **Nurses will not under any circumstances perform sternal aspirates.**

INDICATIONS

Bone marrow sampling has three main indications;

1. Diagnostic-follow-up of abnormal peripheral blood findings.
2. Staging-definition of the extent of the disease process
3. Assessment post treatment.

Bone marrow aspiration or biopsy is indicated for the assessment of many haematological disorders and is useful in the diagnosis of systemic disease or staging of other diseases, which involve, or potentially involve, the bone marrow. (Orazi, O'Malley and Arber, 2006)

Examples include:

- Severe anaemia
- Leukopenia and thrombocytopenia
- Myelodysplastic syndrome
- Suspected leukaemia's
- Multiple myelomas
- Lipid storage disease
- Staging for solid tumours
- Fibrosis

Bone marrow sampling can also be used to gauge the effectiveness of chemotherapy and other medical treatments.

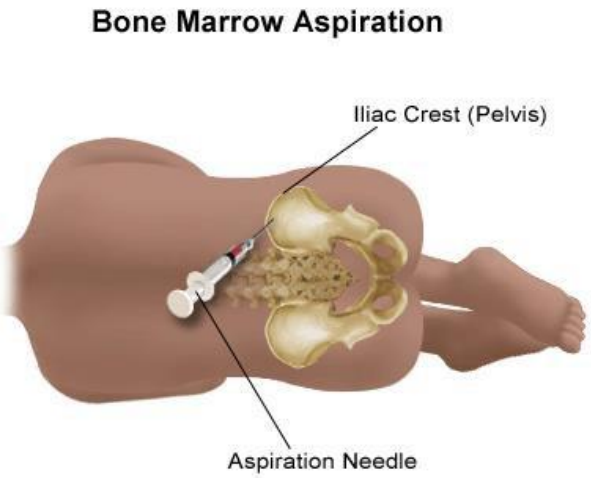
CONTRAINDICATIONS

- Cellulitis, osteomyelitis or radiation therapy involving the proposed needle entry site
- Severe, incorrectable coagulopathy
- Thoracic aortic aneurysm, if a sternal approach is used
- Although not strictly a contraindication, patients suffering from Paget's disease involving the iliac bone represent a high risk due to the potential for excessive bleeding at the trephine biopsy site. (Knowles and Hoffbrand 1980)

Particular care must be exercised in patients with suspected multiple myeloma and in elderly patients who may have osteoporosis, due to reduced bone density.

EQUIPMENT LIST

- Consent form
- Disposable T-Lok (trephine) needle
- Disposable Illinois (aspirate) needle
- Medium dressing pack
- Pair of sterile gloves
- Plastic apron
- Green needle
- Orange needle
- Small adhesive dressing
- Yellow topped formalin container – for trephine biopsy
- Cytogenetic medium
- 20% chlorhexidine gluconate in 2.5% denatured ethanol (Hydrex-Pink)
- 3 x 10ml syringe
- 2 x 5ml syringe
- 5ml Lidocaine (2 x 2%)
- Box of glass slides, (frosted end for labelling)
- Spreader
- Slide carrier
- EDTA bottle
- Pencil
- Sharps container
- Alcohol hand gel



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HAZARDS ASSOCIATED WITH THE PROCEDURE

1. INFECTION.

The skin is a closed system and performing a bone marrow aspirate and or trephine biopsy, however aseptically, is a breach of this system providing a means of entry for bacteria. Adherence to an aseptic technique will help to minimise the risk of infection. Using sterile, single use only equipment, cleansing the skin thoroughly and covering the biopsy site with a waterproof dressing, will help to minimise infection risks. Refer to the policy on Aseptic Non-Touch Technique (Derby Hospitals NHS FT 2014)

2. HAEMORRHAGE.

The major risk factors for haemorrhage, in order of frequency, are diagnosis of a myeloproliferative disorder, aspirin treatment, other putative platelet dysfunctions, and thrombocytopenia (Bain, 2003).

Careful questioning of the patient prior to the procedure should be undertaken, to ascertain whether they are taking any medication that may interfere with clotting.

At least five patients have been reported who have suffered considerable haemorrhage, sometimes with long term morbidity, as a result of trephine biopsies (Bain 2003). A patient's platelet count should be above 50 X 10 E9/L; if the platelet count is lower advice should be sought from the Haematologist

3. PROLONGED BLEEDING TIME.

This may be due to a medical condition or drug therapy e.g. Pagets disease of the bone, or anticoagulant medication. Warfarin should be stopped for three days prior to the procedure. This is a decision that is made by the referring consultant.

Careful questioning of the patient prior to performing the procedure is needed to help reduce this risk. Patients should be asked to remain flat until all bleeding/oozing has stopped.

4. INSUFFICENT SAMPLES.

The laboratory will not be able to process insufficient samples necessitating repetition of the procedure. However the procedure may have been difficult to perform in the first place, (the patients marrow may be fibrosed,) so an adequate sample may not be obtained.

If a practitioner's samples are regularly being identified as not being adequate, their practice should be observed by a colleague, to ensure that they are competent. The quality of slides taken will also be audited.

5. NEEDLESTICK INJURY.

Needles must not be re-sheathed; practitioners must adhere to the trust's sharps policy. In the event of a needle stick injury the practitioner must follow the Trusts safe handling, disposal and reporting of sharps and blood borne exposure injuries policy (Derby Hospitals NHS FT 2013)

6. INFECTED SAMPLES.

Whether known or suspected, these pose a health risk to any staff that has to handle them – this includes porters and laboratory staff. Appropriate identification through labelling and transportation of infected samples is covered in other documents, which should be read by the practitioner (refer to local policy and procedures as appropriate, e.g. Infection control guidelines)

In HIV positive patients, the haematology laboratory usually sends a technician assist with the bone marrow. They will spread the slides and fix it at the bedside to inactivate the virus.

7. ALLERGIC REACTION.

Careful questioning of patients prior to the procedure about any possible allergies helps to protect them from avoidable hypersensitive reactions. Non latex gloves may need to be used, if a patient has a latex allergy. Alternative waterproof dressings may need to be used, if the patient has an allergy to Elastoplast.

Should a patient have a known allergy to lidocaine, **advice should be sought from the referring consultant.**

PRIOR TO THE PROCEDURE.

See General Principles for All Procedures

	PRINCIPLE	RATIONALE
1	Correctly identify patient using medical notes and verbal questioning.	To ensure correct identification of patient.
2	Check that blood parameters are within safe limits, ▪ INR<1.5 (if a patient is warfarinized, they should stop their warfarin 3 days prior to procedure under the direction of a doctor) ▪ Thrombocytopenia is not a contraindication. A patients platelet count should be above 50x10 E9/L: (if the platelet count is lower advice should be sought from the Haematologist	To decrease the risk of haemorrhage, which has been identified as the most common and most serious adverse event associated with bone marrow examination (Bain, 2006)

3	Ensure a request form is fully completed and signed by the requesting consultant (see appendix 1)	To ensure correct samples are obtained.
4	Discuss the procedure with the patient including, ▪ Information about the procedure ▪ What test(s) are being done and why, i.e. aspirate and or trephine. ▪ Relevant medical history, i.e (bleeding disorders, previous radiotherapy, to iliac crest, osteomyelitus, Paget's disease of the hip. ▪ Any allergies, i.e. latex, dressings, local anesthetic. ▪ Relevant drug history, e.g. anticoagulant therapy.	To ensure that the patient is properly informed about the procedure (DH 2005) In addition to the patient understanding the procedure, the practitioner needs to ensure that the correct samples will be taken. This may influence which side of the iliac crest will be used to obtain the samples needed. To protect the patient from avoidable hypersensitive reactions. The patient may be at higher risk of bleeding and therefore need to apply pressure on the biopsy site for longer.
5.	Complete the consent form with the patient, and ask them to sign.	To enable patients to actively participate and comply with their treatment (DH 2001, NMC 2008)
6.	Assemble the equipment needed on a cleaned procedure trolley. Check all packaging and expiry dates.	To ensure that time is not wasted and that the procedure goes smoothly without unnecessary interruptions. To check that equipment is in date

		and not damaged
7.	Ask the patient to undo or remove clothing below the waist to allow access to the iliac crest. Ask the patient to lie on their side with their knees bent up as far as possible.	To ensure no clothes are touching the biopsy site, to maintain sterility. To ensure the patient is in the correct position.
8.	**Wash hands using soap and water, and apply alcohol hand gel. Dry thoroughly.** **Check hands for any broken areas, and cover with an occlusive dressing**	To reduce the risk of cross infection. Trust Hand hygiene policy. (Derby Hospitals NHS FT 2015)
9.	Open sterile pack and place all equipment needed on to it. **<u>Maintaining aseptic technique.</u>**	In preparation for undertaking the procedure. To maintain asepsis throughout the procedure to minimize the risk of infection (DH 2005)
10.	Carefully palpate the patients back to identify anatomical landmarks, and the correct site for the procedure.	To ensure the correct area is used to obtain optimum samples.
	Put on a disposable plastic apron. Wash hands again with soap and water and apply alcohol hand rub. Put on sterile gloves.	To reduce the risk of cross infection. Derby Hospitals NHS FT Hand Hygiene policy (2015)

Best Practice: GLOVE USE

Sterile gloves are to be used when undertaking bone marrow aspirates and or trephine biopsies. This will help prevent cross infection and contamination from blood spills, but does not prevent needle stick injuries.

PERFORMING THE PROCEDURE**.**

	PRINCIPLE	RATIONALE
1	Soak the gauze swabs in the antiseptic solution. –Hydrex-pink (chlorhexidine gluconate20%) Wash the skin in a circular motion, beginning in the centre and moving outward approximately 4 inches.	To ensure the area is thoroughly cleaned.
2	Draw up the lidocaine, using a green needle. Detach the green needle, attach an orange needle to the syringe and inject an initial 0.5-1ml directly under the skin, raising a wheal.	To anesthetise the skin.
3	Using a green needle, inject the rest of the lidocaine deeper into the subcutaneous tissue and underlying periosteum.	To anesthetise the deeper tissue and the surface of the bone. To minimise pain.
4	Allow the lidocaine at least three minutes to take effect. Gently prod the anesthetised area with the tip of the green needle to determine the adequacy of the anaesthetic.	To ensure the area is numb prior to obtaining the aspirate/trephine biopsy.

5	Whilst giving the anaesthetic time to work, pick up the aspirate needle, remove the plastic guard from the needle, loosen and remove the introducer and relock. Repeat with the t-lok needle if a trephine biopsy is indicated.	To check for any signs of manufacturing defects.
6	Hold the aspirate needle with the index finger near the needle tip. Palpate the bone again to identify the area to be used.	To control the depth of penetration. To ensure correct sampling point.
7	Hold the needle horizontally to puncture the anesthetised skin. Advance the needle with steady pressure and a slight twisting motion until the cortical bone is penetrated and the marrow cavity is entered. (a slight give in pressure is experienced when the marrow cavity is entered)	To access the marrow cavity safely.
8	Advise the patient that you are in the correct position and that you are ready to take the sample/s. Explain that they may experience a very brief, sharp, dragging sensation when the marrow is aspirated	To minimise patient movement, and to keep the patient fully informed.
9	Once within the marrow cavity, remove the introducer, attach a 5ml syringe to the needle and aspirate a volume of 0.2-2.0ml (Perkins, 2003).	Some patients may notice pain if the stylet is not removed carefully. A volume larger than 1ml dilutes the specimen with peripheral blood. (Perkins, 2003)
10	Disconnect the syringe and re-introduce the stylet quickly.	To minimise the risk of bleeding whilst spreading slides.

11	A small drop of marrow should be placed about 1cm from the end of the slide, and spreading should be towards the frosted end. Five slides should be made.	This ensures that it will be possible to examine the thinnest part of the film, where cytological details are optimal. (Bain, 2001)
12	Obtain further marrow samples as needed, (depending on tests required.)	To provide material for flow cytometry, cytogenetics, culture, or other special studies as required (Provan, Singer, Baglin, et. al.2004)
13	If a trephine is not required, remove the aspirate needle and apply pressure to the site until any bleeding has stopped. Apply an adhesive sterile dressing and ask the patient to lie flat for 10 minutes. During this time, label the samples and dispose of equipment used safely and appropriately.	To reduce the risk of haemorrhage. To prevent any infection getting into the aspirate site. To minimise the risk of sharps injury, by not disposing of equipment properly.

Best Practice ATTEMPTS AT PRACTICE

There should be no more than 2 attempts made by the same practitioner on any one patient.
If the attempts are unsuccessful, the patient must be reassured, and a more experienced
practitioner should undertake subsequent attempts. (with the patients consent)

14	If a trephine biopsy is required, remove the aspirate needle and insert a t-lok trephine needle, (through the same skin incision) Using steady pressure, advance the trephine needle	To ensure that the trephine is taken in a different

	to the bone. About 1cm or more away from the aspiration site. (Bain, 2001)	part from where the aspirate was obtained so that the bone structure is intact.
15	Using firm pressure, slowly rotate the needle in an alternating clockwise-counter clockwise motion. Advance the needle through the cortex; remove the stylet when the needle is firmly anchored in the bone. Advance the needle 1-2 cms more with continued rotating movements. (to determine the length of the biopsy specimen the sylet can be carefully re-inserted into the needle)	
16	Once you have determined the core length, break off the biopsy specimen from the surrounding bone, using the cutter as per the t-lok needle technique Slowly withdraw the needle, apply pressure to the biopsy site until bleeding and oozing stops. Ask patient to lie flat on their back for 10 minutes.	An ideal biopsy core is 2cms or greater in length. (Bain, 2001)
17	If a bone marrow aspiration was found to be impossible, a trephine roll should be made. This is done by placing the trephine core on the bottom edge of a slide, place another slide on top of the core, and roll the core to the top of the slide, making an imprint on the slide**. (This should always be done before placing the core in formalin)**	This permits a differential count similar to that performed on aspiration films.

18	Use the small blunt obtrurator (included with the biopsy needle) to remove the biopsy core. Hold the needle vertically over the formalin pot, insert the obtrurator through the distal end of the needle and safely force the biopsy core through the hub, into the formalin pot.	To ensure that the trephine biopsy remains intact.
19	Dispose of equipment used safely and appropriately (in accordance with local policy)	To help prevent sharps injuries.
20	Record site and samples taken in patients medical notes. File signed and dated consent form in medical notes.	To maintain accurate records (NMC, 2005) To ensure clinical coding have all the relevant information.
21	Check the patient feels ok, ensure dressing is intact. Ask the patient to keep the dressing in place for 24hours. Ensure patient has appropriate contact numbers if they have any concerns post procedure. If they experience severe pain more than 24 hours after the procedure, persistent bleeding, or a temperature of 38, or above, or any inflammation at the biopsy site, should also be reported.	To help prevent infection. To ensure any problems encountered are dealt with appropriately.
22	Ensure the patient has a clinic appointment, to receive the results.	

Best Practice PAIN RELIEF.

As the procedure is performed under a local anaesthetic, pain relief is not usually required prior to, or immediately after. However, as the local anaesthetic begins to wear off, an analgesic such as paracetamol should be suggested to alleviate any subsequent discomfort and pain.

3. References

Bain B, J (2006) Morbidity associated with bone marrow aspiration and trephine biopsy – a review of 2004. Haematologica, 91, 1293-4.

DH (2005) Creating a patient-led NHS – delivering the NHS improvement plan. Department of Health, London.

DH (2001) Good practice in consent implementation guide: consent to examination or treatment. HSC 2001/023. Department of Health, London.

Derby Hospitals NHS Foundation Trust (2013); Trust Policy and Procedures for Safe Management and Handling of Sharps

Derby Hospitals NHS Foundation Trust (2014); Trust Policy and Procedures for Aseptic Non-Touch Technique

Derby Hospitals NHS Foundation Trust (2015); Trust Policy for Hand Hygiene

H.P. Lovedaya*, J.A. Wilsona, R.J. Pratta, M. Golsorkhia, A. Tinglea, A. Baka,

J. Brownea, J. Prietob, M. Wilcoxc epic3 (2013) National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England.Journal of hospital infection.8651.S1-S70.

Knowles S Hoffbrand A, V (1980) Bone marrow aspiration and trephine biopsy. British medical journal. 281. 204-205.

NMC (2008) A-Z Advice sheet consent. . http://www.nmc-uk.org/Nurses-and-midwives/Regulation-in-practice/Regulation-in-Practice-Topics/consent/

NMC (2005) Guidelines for records and record keeping. Nursing and Midwifery Council, London.

Oraz1 A, O'Malley D, P and Arber D, A (2006) Illustrated pathology of the bone marrow. Cambridge. Cambridge university press.

Parapia, L, A (2007) Trepanning or trephines a history of bone marrow biopsy. British journal of haematology. 54. 14-19.

Pedersen, L, M Jarner D, and Winge, J (1993) Bone marrow biopsy of the iliac crest bone followed by severe retroperitoneal haemorrhage. European journal of haematology. 52.17-19.

Perkins, S. (2003) Bone marrow examination. In: Wintrobe's clinical hematology (eds J. Greer et al.), 11th edn. Lippincott, Williams and Wilkins, Philadelphia, 3-22.

Provan, D. Singer, C.R.J. Baglin, T. and Dokal, I. (2004) Oxford handbook of clinical haematology. Oxford university press, oxford.

Trewhitt K, G (2001) Bone marrow aspiration and biopsy; collection and interpretation. Oncology forum. 28.1409-1415.

4. Monitoring

SUGGESTED AUDIT POINTS.

1. Patient satisfaction.

2. Has there been a reduction in waiting times?

3. Has consent been obtained from every patient?

4. Are request forms being filled in fully by medical staff?

5. Are the samples of satisfactory quality?

6. Are the samples being obtained at first attempt, or subsequent attempts?

7. How many patients are returning to the unit with complications following the procedure?

8. Has the procedure been documented correctly in the patients' medical notes?

5. Documentation Controls

Guidelines for Bone Marrow Aspiration and Trephine Sampling.

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Training and Dissemination: PDM's, Clinical Leads, matron's,Clinical Quality, Risk and safety manager, Trust Intranet, Haematology Consultants				
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