



# *Tissue biopsy from osteolytic lesions*

*An illustrated guide to perform a biopsy of an osteolytic lesion of the bone and a base for a scientific paper.*

## **Introduction**

The bone marrow biopsy is usually regarded as an extremely painful procedure which is difficult to master. However, with the proper tools and with a concise method successful procedures can be repeatedly performed with

minimal discomfort to the patient. This paper is intended to described the proper use of the Spirotome Bone, a new tool in the biopsy of soft tissues within bones. The paper can be useful as a template and invitation to combine clinical experience in the preparation of a manuscript for publication in a PEER reviewed international journal.

### **Notice:**

This paper describes a new medical procedure and is intended only for medical personnel. Only trained, experienced, and credentialed individuals are permitted to perform the biopsy.

The differential diagnosis of osteolytic lesions in the axial skeleton in absence of a primary tumor

**Figure 1: Osteolytic lesion left sacrum**



remains a challenge. Metastatic disease from the breast, prostate, colon, stomach, lung etc statistically should be considered first. Most of these solid tumors will produce distant metastases in the bone and some of them appear very early in the disease. Primary lesions are

plasmacytomas and myeloproliferative diseases, including Hodgkin disease and non-Hodgkin lymphomas (See Figure 1). Tumors of bones and muscles are frequently found in children. Sometimes a non-malignant disease might resemble osteolysis.

There are only a few contraindications to the bone biopsy procedure. Acquired or congenital coagulation factor deficiencies and other coagulation abnormalities are considered a contraindication by some physicians. Factor replacement therapy prior to the bone examination and hospital observation for 24 hours after the procedure may be indicated in these patients. Patients receiving anticoagulants should have prothrombin time (PT) or activated partial thromboplastin time (aPTT) values within the normal range. Isolated thrombocytopenia is not a contraindication to the bone marrow examination if the procedure is properly performed and technical difficulties are not encountered. Other contraindications include infection or previous radiation therapy at the sample site and poor patient cooperation. Sternal bone marrow biopsy is completely contraindicated in patients with diseases associated with bone resorption, including multiple myeloma or plasmacytoma.

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## ***Bone biopsy needle***

Osteolytic lesions need a diagnostic workup including a biopsy for proper diagnosis and subsequent treatment. The surgical biopsy remains in some hospitals still the method of choice but needs hospitalization and general anesthesia. Percutaneous needle biopsies use *tru-cut systems* that work only in soft tissues. The tru-cut needs ballistics to get the sample in the notch. However, they are not designed to enter the bone cortex and often will fail to produce any tissue material. Hence, the tru-cut needles can only be considered when the osteolytic lesion has grown through and outside the bone cortex. Even then, the shooting might be hazardous.

*The Jamshidi needle* for bone marrow biopsy is much more dedicated in view of the strong materials this is made of. The needle typically has a trocar and a cutting cannula (See Figure 4: Jamshidi parts) that are combined to penetrate the skin up to the cortex of the bone. Here the trocar is removed and the cutting cannula is twisted in the bone. With a final twist and inclination of the needle the sample is severed at its distal site. Subsequently, the needle with the bone marrow sample inside is retracted and the bone marrow is removed through a stylet insertion in the needle.

Where the Jamshidi needle is efficient and safe for bone marrow, it is not for osteolytic lesions. Vice versa, the tru-cut works in soft tissues but not in bone marrow. As a result, many interventional radiologists, neurosurgeons and orthopedic surgeons felt the need for a new device. MedInvents has studied for a long time this problem and finally came up with *the Spirotome Bone*. In this white paper, we will describe more in detail the Spirotome Bone and its application in the diagnostic work-up of osteolytic bone lesions.

**Order information :**

LOCAL DISTRIBUTOR

or

MEDINVENTS NV  
 Klein Hilststraat 5  
 3500 Hasselt  
 Belgium

Spirotome Bone 8 G	SS-08-BO
Spirotome Bone 10 G	SS-10-BO

On set includes a trocar, cutting cannula, receiving needle, stylet and release element. All parts are sterile at delivery and packed in boxes of 5 sets.

In case if urgent information,  
 please call: + 32 475 650541 or  
 MedInvents at + 32 11 271557.

For other contacts:

[Magda.buttiens@medinvents.com](mailto:Magda.buttiens@medinvents.com)

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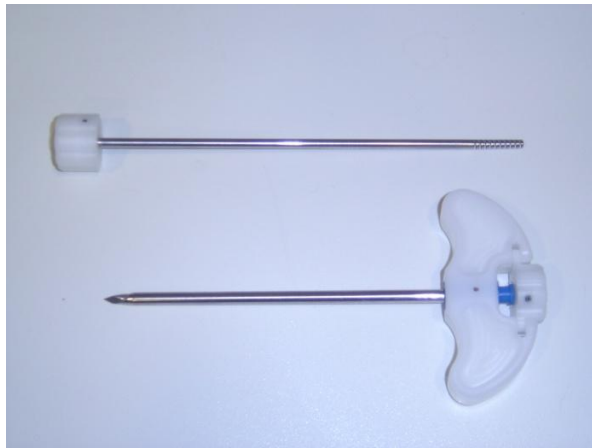
FAX: + 32 11 283677

TEL: + 32 11 271557

***The Spirotome Bone***

The Spirotome bone combines the virtues of a Jamshidi bone biopsy needle with those of a regular Spirotome. The basic system contains a *typical Jamshidi needle* (See Figure 4: Jamshidi parts) including a trocar and cutting cannula. The *Spirotome* is depicted on top of Figure 2. The set is completed with *a plastic stylet* to remove bone marrow from the Jamshidi needle and *a release element* to remove the soft tissue sample from the Spirotome.

**Figure 2: Spirotome and Jamshidi needle**



All parts are sterilized before use. The package will contain further a plastic stylet to remove the bone marrow from the cutting cannula, and the releasing element.

## ***Patient preparation***

The procedure must be explained, all questions answered to the satisfaction of the patient and family members, and written consent obtained if the institution or the situation requires this. Some institutions require a written permission in all instances. Individuals performing a bone marrow procedure must also be thoroughly familiar with and follow all institutional policies regarding consent for medical procedures.

A continuing conversation should be began with the patient and continued throughout the entire procedure. This is necessary to inform the patient about anticipated discomforts, to assess the patients feeling of pain, and to obtain early warning of complications such as a vasovagal reaction.

Much attention has to be paid to *the fear for the procedure*. The fear comes often from the misconception that the procedure can not be stopped at any time and that suffering is a necessity for proper diagnosis. Most of the patients will hardly feel pain or discomfort if anesthesia is properly applied. Much of the fear vanishes by stressing that the procedure can be interrupted at any time on simple request from the patient and that additional anesthesia always can be applied. In some patients, a sedative can be useful to reduce anxiety.

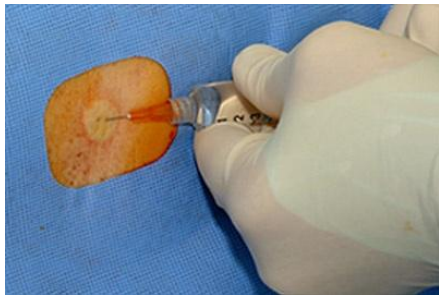
During the take-in communication the physician asks about the medication of the patient. Of highest consideration is the thrombolytic medication that some patients use. In difficult procedure, blood clotting tests might be performed to guarantee safety.

A general pain medication can be useful before the procedure starts e.g. 1 gram of oral or IV paracetamol.

## ***The basic procedure***

The Spirotome Bone procedure is indicated in case a soft tissue tumor is expected. The lesion is visualized under X-ray imaging (CT scan) as an osteolysis inside a bony structure. Most of them are seen in the pelvis and larger vertebrae but they may appear everywhere in the skeleton.

The lesions is localized through CT scan or standard X-ray imaging. The shortest and safest route to the skin is evaluated and a marker is placed in the skin as penetration point. The area is well disinfected (e.g. 2 per cent Iodine in 70 per cent alcohol) and a fenestrated sterile drape is applied. The anesthesia



**Figure 3: Skin anesthesia**

is first applied to the skin. This is best performed with a small Intra-dermal needle (26 Gauge).

In a second part of the anesthesia the route between the

skin and the cortex of the bone is properly anesthetized with high attention for the periost since this is the most sensitive part

of the biopsy route. Usually 10 to 15 ml of anesthetic (1 to 2 % xylocaine in water if possible with 1 to 2 % epinephrine) is applied for proper anesthesia. Don't use more than 20 ml of lidocaine in view of the neurologic and cardiovascular side effects. During the anesthesia step it is of outermost

Caution! Adverse reactions of a neurologic, cardiovascular, and allergic nature can occur to lidocaine. The maximum recommended dose of lidocaine with epinephrine for healthy adults is approximately 20 ml.

importance that the direction of the needle is verified. A virtual point on the wall of the room can be helpful to reproduce the direction. During the bone biopsy procedure this direction will be maintained to keep the biopsy needle within the anesthesia tract. Leaving the anesthesia tract might cause pain and a erroneous site of cortex entrance.

The operator makes a cross incision in the skin. The width depends on the diameter of the Spirotome Bone. Often 2 x 5 mm is necessary with a stitch cutter. A 1 to 2 minute pressure at the site

of this cross incision will minimize bleeding from the skin. The cross incision is an excellent time to verify the quality of the local anesthesia.

Basically, the cutting cannula is mounted on the trocar and locked. The instrument penetrates the

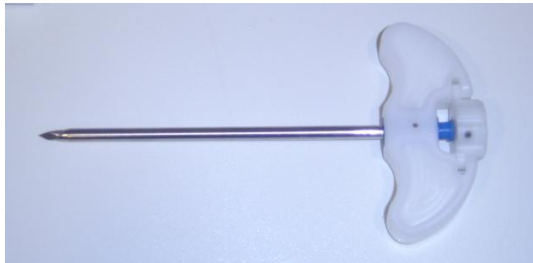


Figure 4: Jamshidi parts

skin and the subdermal layers up to the cortex of the bone (periost). Here the trocar is removed and the cutting cannula is ready to penetrate the cortex of the

bone (if existing). Entering the bone is done manually

and by twisting the needle to guarantee enough space between the needle and the bone channel to easily rotate the cutting cannula and for easy removal. Hammering the bone marrow needle into the bone is not advisable since the needle may stick into the bone channel and difficult to remove and operate.

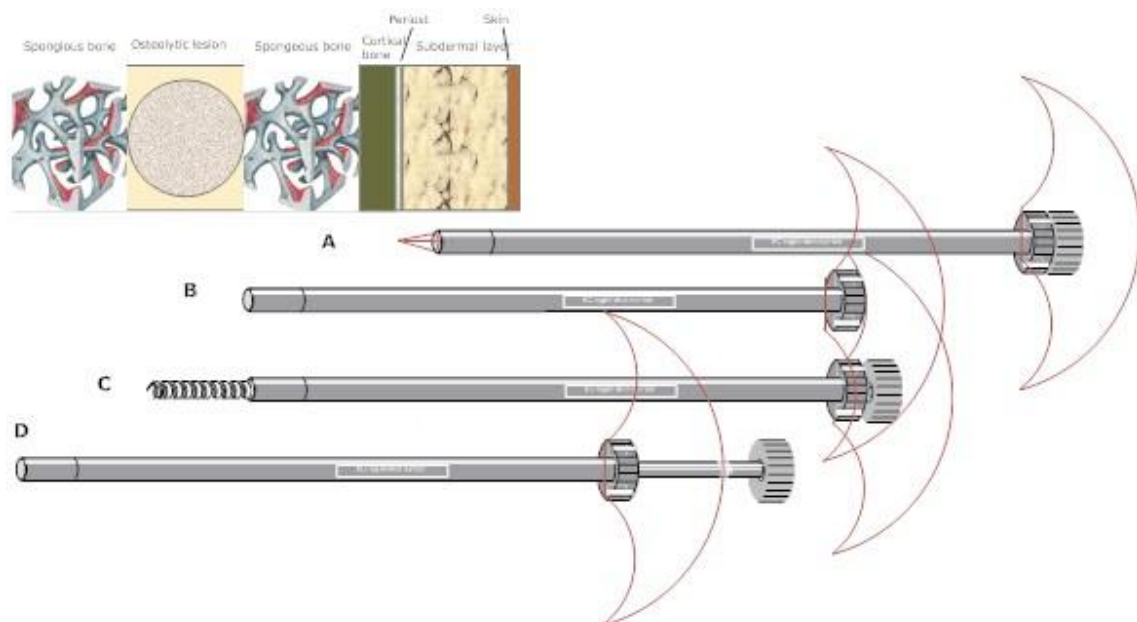


Figure 5: Schematic steps of a biopsy for an osteolytic lesion: A: the cutting cannula is guided to the periost with the trocar;

B: the cutting cannula is twisted through the cortex and spongy bone up to the osteolytic lesion – the bone marrow is removed (prebiopsy);

C: the cutting cannula is guided into the previously created bone channel and the helix (receiving

needle) is turned into the osteolytic lesion up to a maximum of 20 mm (indicated with marks on the receiving needle), the

cutting cannula then cuts the sample from the surrounding lesion. The releasing needle can be retracted at this moment to

harvest the sample. The sample is released from the helix by the releasing element. The helix can be used several times to harvest soft tissues; D: the helix is turned into the soft tissue up to the distal spongy bone (when necessary). Then the cutting cannula is turned over the helix but can further be turned into the spongy bone. Both helix and cutting cannula can now be retracted and the mixed sample (soft tissue and spongy bone tissue) can be removed from the helix and cutting cannula.

A cylinder of bone cortex and bone marrow is taken up until the osteolytic lesion is reached. In this way the channel is made through the more healthy bone structures up to the osteolytic lesion. The cutting cannula is then removed to free the bone marrow from the needle with the stylet. This is the prebiopsy that can be shipped to the pathology department as a "prebiopsy". Most of the time this prebiopsy contains already scattered tumor cells.

Then the cutting cannula is placed again in the same tract up to the soft tissue part (the osteolytic lesion). The Spirotome receiving needle is now put in the cutting cannula instead of the trocar. When the first marker is close to the entrance of the cutting cannula, the tip of the helix and the tip of the cutting cannula meet. The helix is turned clockwise into the soft tissue up to a maximum distance of 2 cm (length of the helix) until the second mark is at the level of the entrance of the cutting cannula (maximal helix exposure in the soft tissue). Then the cutting cannula is turned clockwise and pushed over the helix until the first marker is seen again. At this point the helix is now in the cutting cannula again and the Spirotome receiving needle can be removed.

The tissue is freed from the helix by the receiving element. The helix is placed on the teeth of the element and turned anti-clockwise. The sample is immersed in the fixator (e.g. 2 % buffered formol or Bouin solution) or physiological solution, depending on the requests of pathology. A second biopsy can be taken if necessary. Otherwise the cutting cannula can be removed simply by pulling the cutting cannula from the patient. A compress can be pressed on the skin to facilitate hemostasis. A proper sterile bandage now can cover the skin incision.

## ***Biopsy in a vertebra***



**Figure 6: Biopsy tract for a vertebral biopsy. A typical biopsy of a vertebral osteolytic lesion is done under CT scan. The biopsy tract passes the skin, the subdermal layer, the paraspinal muscle and enters the cortex of the pedicle. Through the spongy bone (bone marrow) the tract continues up to the osteolytic lesion where the core biopsy is taken.**

In figure 6 an example is given for the vertebra. Once the skin cross incision is made, the trocar and cutting cannula of the Jamshidi is twisted beneath the skin up to the cortex (or periost) of the pedicle of the vertebra. The trocar is removed and the cutting cannula is twisted into the bone (pedicle) up to the osteolytic lesion. Alternatively, penetration with the trocar inside of the cutting cannula can be done but this approach can compress the surrounding bone marrow and may damage the pedicle (breaking the cortex). The better solution therefore is to penetrate the bone with only the cutting cannula so that a channel is made that can be used during the rest of the procedure.

The other steps are similar to the basic procedure as listed above (See: The basic procedure).

## ***Results:***

Results can be tabulated with the following data series:

ID patient: reversed birth day with initials of family name and first name. For repeated biopsies a one or two digit number is added.

Date biopsy, hospital, ect.

N is the number of tissue cores harvested to make the diagnosis. L is the maximal length of the longest core. D is the largest diameter of the core.

Diagnosis made by the pathologist.

The result is OK when there is no complication of the procedure (patient safety) and when the pathological diagnosis is correct in view of the clinical course of the disease or by subsequent biopsy.

ID patient	Date biopsy	Hosp	N	L	D	Diagnosis	Result
<b>1949/06/03LM</b>	26/12/2007	HHT	1	1,0	5	NHL with normal bone marrow	OK
<b>19371005LR</b>	21/05/2008	HHT	1	1,0	4	Myelodysplasia	OK
<b>19600627MJ2</b>	1/02/2008	ZOL	1	1,5	5	Non Hodgkin Lymphoma	OK
<b>19380327MJ</b>	27/02/2008	HHT	1	1,4	4	Plasmacytoma	OK
<b>19401201NA2</b>	4/06/2008	HHT	2	1,2	4	Lung cancer adenocarcinoma	OK
<b>19290211VJ</b>	23/04/2008	HHT	2	1,6	5	Non Hodgkin Lymphoma	OK
<b>19590620VL</b>	15/02/2008	SSU	1	1,9	4	Normal hematopoietic tissue	OK
<b>To be completed....</b>							

The table is to be completed in preparation for a new publication.

### ***Therapeutic intervention: cementation of the osteolytic cavity***

Osteolytic zones diminish the stability of bones leading to pathological fractures. In order to prevent fractures based on osteolytic cavities, the area can be cemented. Various types of cements are available, most of them being injected through a needle with large diameter. The Spirotome Bone cutting cannula has diameters ranging from 3 to 5 mm. The 5 mm is particularly useful to inject cement into the osteolytic cavity (e.g. 4 to 6 weeks after radiotherapy). The cement is prepared in a syringe with Luer lock and placed on the proximal end of the cutting cannula. Here the cement is injected.

*(Prepared for MedInvents by Jaak Ph. Janssens – scientific advisor – June 2008)*