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Current concepts in the planning and performance of musculoskeletal biopsies

Conceptos actuales en la planeación y realización de biopsias musculoesqueléticas

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Abstract

Before performing a musculoskeletal biopsy, we are obliged to carefully analyze the clinical, laboratory and imaging elements of our patients. Once this information has been obtained and analyzed, we must generate a presumptive diagnosis that allows us to adequately plan the biopsy. For this purpose, we must consider the probable treatment and its surgical approach; based on this, choose the corresponding access route for biopsy. The type of biopsy depends on the clinical picture, the presumed diagnosis and the experience of the members of the multidisciplinary team related to each case.

Keywords: musculoskeletal biopsy, soft tissue tumor, bone biopsy, bone tumor.

Resumen

Antes de realizar una biopsia musculoesquelética estamos obligados a analizar cuidadosamente los elementos clínicos, de laboratorio y de imagen de nuestros pacientes. Una vez obtenida y analizada esta información debemos generar un diagnóstico de presunción que nos permita planear adecuadamente la biopsia. Para tal efecto debemos considerar el tratamiento probable y el abordaje quirúrgico de éste; con base en ello, elegir la vía de acceso correspondiente. El tipo de biopsia depende del panorama clínico, del diagnóstico de presunción y de la experiencia de los integrantes del equipo multidisciplinario relacionado a cada caso.

Palabras clave: *biopsia musculoesquelética, tumor de tejidos blandos, biopsia ósea, tumor óseo.*

Introduction

In musculoskeletal lesions, obtaining a sample of tumor tissue for histological examination by the appropriate specialists is necessary for establishing the correct diagnosis and planning further management.[1,2] It may be considered that biopsy itself is a simple technical procedure, but it can have the potential of adversely affecting the outcome of the patient.[2] This procedure, that must be done by surgeons that will perform the definitive surgery or by the interventional radiologist of the team, and always planned and based on previous imaging studies,[3] is labeled as biopsy.

A multidisciplinary study and management are crucial[4] in the field of musculoskeletal neoplasms. A definitive diagnosis without compromising subsequent surgery, is a key step in the care of those patients.[5] A poorly performed biopsy could become an obstacle to proper diagnosis and may have negative impact on future treatments.[6,7] Diagnosing bone and soft tissue tumors is a combination of the analysis of all the clinical and radiological elements, histological findings, and the experience of the medical team involved, which must be widely familiar with this type of pathological processes.[8,9] Biopsy is the concluding stage in the diagnosis of bone and soft-tissue tumors and should

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be delayed until clinical evaluation and completion of imaging studies.[10] Planning the biopsy requires a basic understanding of the many diseases that cause bone and soft tissue lesions and the ability to generate a differential diagnosis.[11] The goal of any biopsy is to provide adequate samples for the pathologist to arrive a definitive histopathologic diagnosis.[12] Diagnostic accuracy is assessed as the number of correct cases as a percentage of the total performed.[2]

The present paper arises from the need initially not observed by a good part of the orthopedic community, to clearly establish the principles for a procedure erroneously classified as simple and therefore with a significant negative impact in many cases. Firstly, we expose the lesions that do not require biopsy, then we describe the different modalities of this with their advantages and disadvantages emphasizing the increasingly important role of the interventional radiologist as part of a multidisciplinary team, we continue analyzing anatomical aspects by region and their applicability to correctly planned procedures, and finally we tried to collect in an orderly manner in terms of its evolution (planning and performance), a significant number of recommendations issued at different times by internationally recognized authors.

Musculoskeletal «don't touch» lesions

The presence of a bony or soft tissue lesion does not automatically imply the need for histology. Clinical information, laboratory findings, and imaging features may be sufficient to provide high diagnostic confidence for certain lesions.[13]

Clyde Helms defined as don't touch lesions to those processes that are radiographically so characteristic that biopsy or additional diagnostic tests are unnecessary.[14] The most representative bone lesions of this group of neoplasms are non-ossifying fibroma, fibrous dysplasia, osteoma, bone island, unicameral bone cyst, osteoid osteoma, enchondroma and osteochondroma.[15] In soft tissue masses, lipomas, synovial cyst, Morton neuroma and superficial fibromatosis are the classical lesions with these features.[16] Every effort should be made to exclude biopsy of don't touch lesions.[12]

Classes of biopsy

The different procedures such as fine needle aspiration (FNA), core needle biopsy (CNB) or open biopsy are all associated with specific advantages and disadvantages and their goal is to gain a representative tissue sample with minimal trauma, considering the correct surgical approach for a later resection to facilitate limb-sparing procedures.[17,18] Incision in biopsy should follow the longitudinal axis on the planned surgical approach. The biopsy tract must be included as part of the block in wide and radical resections.[4] Biopsy is a crucial step in the diagnosis of musculoskeletal tumors *(Figure 1)*.[6,19]

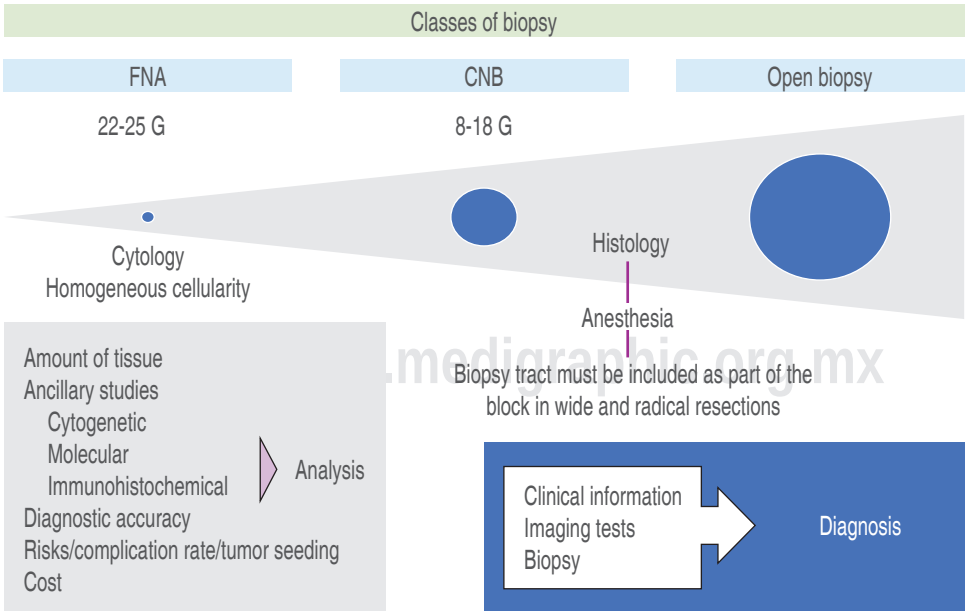

Figure 1:

Advantages and disadvantages of the different types of biopsy. FNA = fine needle aspiration. CNB = core needle biopsy. G = gauge needles.

Fine needle aspiration

In this technique, a fine hollow needle is inserted into the lesion and a syringe applied and aspirating material for pathological examination of the cells (cytology and/or culture).[2] FNA is performed with 22 to 25-Gauge needles[20] and does not include incision.[10]

This study has accuracy in homogeneous tumors as the case of multiple myeloma and metastatic carcinoma.[10] In FNA the incidence of false negatives is high. Even when positive, the diagnosis cannot always be precise.[6]

FNA is performed in the office without anesthesia. Obvious benefits include faster diagnosis, a lower burden for the patient and the hospital resources,[21] and the lowest complication rate.

The main limitation of FNA biopsy is that it does not permit the evaluation of tissue architecture, and in addition, cytologic specimens are not always adequate for ancillary, cytogenetic, molecular or immunohistochemical studies.[6]

This type of biopsy can be performed when the diagnostic suspicion is towards a lesion with homogeneous cellularity. It must be analyzed by pathologists familiar with cytology and musculoskeletal lesions. It is available only for relatively superficial lesions. Diagnosing any other type of lesion by this means would imply a classical clinical and radiological picture and proven experience of the pathologist and the rest of the medical team involved.

Biopsy tracks from FNA do not pose a significant risk of tumor seeding.[20]

Core needle biopsy

CNB provides a cylinder of tissue for histological examination by a pathologist.[2] In these cases a needle is inserted via a small puncture wound into the palpable mass directly or with the guidance of fluoroscopy, ultrasonography (US) or computed tomography (CT). The site of insertion of the needle should be in the line of definitive surgical incision, and multiple cores in different directions should be obtained.[10]

In the CNB the architecture of the tissue is preserved and is considered a valuable tool in lesions where the histological study of small sample of tissue is sufficient to confirm the clinical-imaging appearance.[6] CNB allows histological diagnosis and ancillary analysis.[10] Presently, it is the most frequently used technique in the diagnostic work-up of soft tissue and bone lesions. It usually uses systems of Gauge 8 to 18.[2]

The false negative rate of CNB is lower than FNA biopsy[6] and CNB is associated with less morbidity and fewer complications compared to open biopsy.[17]

Disadvantages in CNB are a limited sample of tissue for histological analysis and immunohistochemistry,[17] and also a lower rate of accuracy compared with open biopsy. The diagnostic accuracy of CNB is usually higher for bone tumors than for soft tissue masses.[19]

It is mandatory that the CNB must be made following the planned surgical incision site.[6] This is a safe procedure if performed by skilled hands.[19] If a CNB were to pass through tissues outside the planned incision plane, the surgical procedure may have to be altered to include the potentially contaminated tissue in the resection and the alternatives for the patient would consist of either a wider irradiation field (if the tumor is radiosensitive) or a greater chance of local tumor recurrence at the biopsy site.[20]

The technique of CNB for obtaining diagnostic samples in musculoskeletal lesions is favored over FNA mainly because of the difficulty in obtaining adequate samples through this last.[22] In the case of a non-diagnostic procedure, the CNB can be easily repeated or followed by an open biopsy.[6,10,19]

Open biopsy

Until recently, open biopsy has long been considered to be the gold standard for the diagnosis of malignant and uncertain tumors of the musculoskeletal system.[2,12,17,19,22-24] It can be incisional in which case only a representative specimen is removed from the lesion, or excisional in which case the lesion is completely removed.[14]

Incisional biopsy

Incisional biopsy is the term used to describe the procedure in which the biopsy involves directly cutting into the tumor to remove a sample without excising the entire lesion. During this procedure, all tissue touched or manipulated by surgeon is potentially contaminated with tumor cells, including suture and drain sites.[11]

Incisional open biopsy is preferred in difficult cases or the sample obtained from CNB is inadequate and a large specimen is necessary for diagnosis.[10]

Hematoma formation in biopsy increases the risk of local spread of the tumor cells and logically increases the rate of local recurrence.[2,10] A drain is

usually not used, but in the uncommon case where a drain is required, it should be exit near the skin incision and following the planned surgical approach for the definitive surgery. The drain path is considered contaminated and has to be excised with the surgical specimen in the same manner of the biopsy tract.[6]

Disadvantages associated with this procedure have included spillage and sowing of tumor cells, wound complications,[6,19] potential morbidity, and time consuming.[19] Disrupting the cortex in incisional open biopsies of bone also increases the risk of pathologic fracture, and only when a lesion is purely intraosseous, a cortical window has to be made and the shape should be considered carefully to minimize the risk of secondary fracture.[10] An oblong window with rounded ends provides the lower risk of pathologic fracture.[25]

Excisional biopsy

Excisional biopsy describes the technique of removing an entire lesion at the time of biopsy. This type of procedure is usually classified as a marginal resection; however, when done leaving a surrounding cuff of normal tissue, this may be considered as primary wide resection.[11]

Open biopsies are criticized because of the increased risk of complications, which may include iatrogenic injury to blood vessels or nerves, complicated wound healing, wound infection, and tumor cell contamination along the biopsy tract and subsequent local recurrence.[14] Open biopsies have an increased rate of diagnostic accuracy compared with needle biopsies,[11] but also, compared to these other types of biopsy, open biopsy has a higher anesthetic risk.[26]

The interventional radiologist

Since the description of percutaneous biopsy for diagnosis by Coley in 1931,[27,28] and fluoroscopic-guided procedures by Lalli in 1970,[29,30] image-guided bone biopsy has developed significantly led by innovations in imaging and intervention.[13]

The different imaging methods provide us with valuable elements to improve the diagnostic effectiveness of a biopsy and to reduce the risks inherent to the procedure. Targeting the most aggressive portion of a heterogeneous lesion is critical to ensure proper staging and treatment. Aggressive tumors often have necrotic or hemorrhagic components that do not contain viable tissue for analysis.[12]

Being orthopedic oncology a multidisciplinary specialty, the radiologist involved in the study and diagnosis of patients with musculoskeletal neoplasms, must be acquainted with the various steps involved in such interventions and their important role in patient management.[31]

Knowledge of such biopsy approaches to avoid uncontaminated anatomic compartments and neurovascular bundles is crucial for radiologists performing imaging-guided percutaneous bone and soft tissue biopsies. Information obtained from preprocedural imaging workup is used to guide biopsy planning and the approach selected should be reviewed with the referring surgeon.[31]

Image-guided percutaneous biopsy of musculoskeletal lesions is a safe and useful procedure for diagnosing and managing of patients who have suspected bone and soft tissue lesions.[13] The primary imaging technique used for guiding percutaneous musculoskeletal biopsy procedures depends on the lesion characteristics as well as the radiologist's personal experience and preference.[22]

Imaging guide for percutaneous biopsies

Percutaneous CNB is an important tool in the evaluation of musculoskeletal lesions. Its accuracy, safety and cost-effectiveness have been well documented.[22,31,32] The imaging methods most used for this purpose are fluoroscopy, US and CT.[22,26]

US is an ideal modality for percutaneous sampling of superficial soft tissue lesions. It is easy to handle, it has the benefit of real-time imaging without radiation exposure, and it is usually quicker than any other guidance modality.[24] Neurovascular structures can be identified with US and avoided. Intralesional vascularity can be diagnosed with color Doppler US.[12]

For lesions in the bones, deep soft tissues, or extensive subcutaneous fat superficial to the lesion, CT is the preferred modality for imaging-guided biopsy.[12] CT-guided CNB is generally an accurate and effective tool in the diagnosis of musculoskeletal lesions, but there may be some inherent limitations in its evaluation of benign and low-grade soft tissue neoplasms.[32] Percutaneous CT-guided CNB of bone and soft tissue lesions has become the method of choice for obtaining tissue for diagnosis in musculoskeletal tumors and tumor-like lesions.[33,34]

Although MRI provides excellent characterization of soft tissue tumors and bone marrow involvement, MRI-guided biopsy is not typically feasible or

necessary.[12] PET/CT images can help guide biopsy in the target areas, which may result in a higher diagnostic yield by indicating the metabolic activity of a lesion.[24]

Platelet count, hemoglobin, prothrombin time, and activated partial thromboplastin time should be performed before most procedures.[13]

Intraoperative biopsy

Interpretation of intraoperative pathological consultation is a complex process that requires specialized histomorphologic knowledge which must be complemented by clinical, laboratory, and radiographic information.[35-37] Due to the characteristics of the musculoskeletal tissue, the intraoperative consultation with the pathologist should be to find out if the sample obtained is adequate for a complete histological study, however the two most common reasons for an intraoperative consultation is to rule out malignancy and to determine the adequacy of the resection margins. Other reasons for consultation are to make or confirm diagnosis, to determine the extent of disease spread locally and beyond the local resection field, to assess an unsuspected finding at time of operation, to determine the presence or absence of residual or recurrent tumor after previous surgery, and to obtain fresh tissue for special studies. Intraoperative pathological consultation can be done by techniques such as frozen section and cytology (touch, imprint, crush, or scrape), each having its own advantages and limitations,[35] It is important to recognize that intraoperative diagnosis is preliminary and warrants confirmation.[36]

CNB could be considered as the new gold standard for diagnosis of musculoskeletal tumors.

Anatomical considerations

Different authors have emphasized the importance of anatomical compartments in understanding the potential contamination that a biopsy path can produce.[38] Generally, skin and subcutaneous fat, bone, paraosseous spaces, and joint spaces are regarded as intracompartmental. For the upper extremity the periclavicular region, axilla, antecubital fossa, wrist, and dorsum of the hand, and for the lower extremity the groin, popliteal fossa, ankle and dorsum of the foot are considered extracompartmental. These authors have generated reasoned suggestions for

Recommended approaches for musculoskeletal biopsy

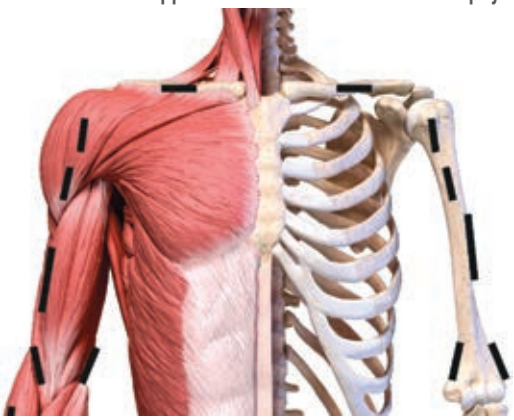

Figure 2: In the shoulder avoid deltopectoral groove and distally neurovascular structures.

biopsy access that is useful to analyze. Biopsy planning must be careful.

There are anatomic spaces defined by tissues that act as a barrier to the local spread of pathologic processes, and therefore have a prognostic and therapeutic value. Natural barrier tissues are cartilage, periosteum and bone cortex, major fascial septae, synovium capsule and the tendinous insertions.

Sarcomas respect anatomic borders. Local anatomy influences tumor growth by setting natural barriers to extension of the lesion. Initially they grow within the anatomic compartment in which they arose, but in a later stage the walls of the compartment are violated, and the tumor breaks into a surrounding compartment.[14]

Considering the path of definitive surgical access, the shortest route to the lesion, crossing only one compartment and avoiding neurovascular structures, we can achieve a controlled risk of neoplastic contamination when a biopsy is performed.

Shoulder and humerus

Biopsies of the humerus are performed with the patient in the supine position with arm rotation varying depending on the location of the neoplasm. The lesions are approached through the anterior one-third of the deltoid muscle, just lateral to the cephalic vein.[12,39,40] The deltopectoral groove is to be avoided because this approach may compromise the use of pectoral muscle for reconstruction and may contaminate the main neurovascular bundle of the upper limb.[39] Biopsy of the middle upper arm is

typically performed with the arm in internal rotation. The lesions are approached anterolaterally, posterior to biceps musculature and preferably through distal deltoid muscle. Upper epicondyle should be approached through the brachialis muscle, anterior to the radial nerve. Lesions of the distal humerus are approached directly through either the medial or lateral epicondyles *(Figure 2)*.[12,20]

Forearm

For biopsies of the radial head and neck, the approach is typically through the lateral/posterolateral forearm, just lateral to anconeous muscle. Olecranon is approached directly. For lesions of the radial diaphysis, the approach varies, but a lateral approach through extensor carpiradial longus muscle is typically used; for ulnar lesions, directly posteromedial. The interosseous membrane should not be crossed, because it functions as a natural barrier to the spread of disease between the extensor and flexor compartments.[12,39] For biopsies of the distal radius, the preferred approach is directly lateral. For biopsies of the distal ulna, a direct medial approach is used *(Figure 3)*.[12]

Hip and pelvis

Patient positioning depends on the location of the lesion. For an iliac bone biopsy, the lesion is targeted with an anterior or posterior approach,[12] generally along the iliac crest. In this anatomical circumstance, open biopsies are transverse continuing with the trajectory of the iliac crest. If at all possible, avoid traversing the gluteal muscles posteriorly[39,40] and the rectus femoris anteriorly.[39]

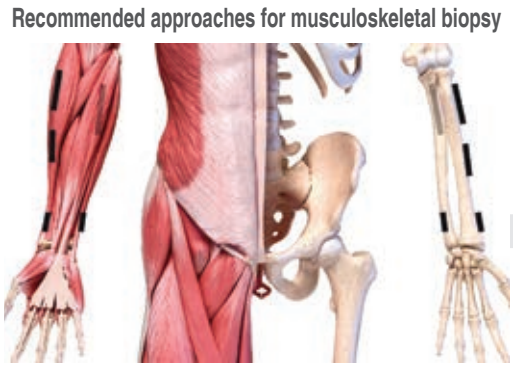

Figure 3: Generally ulna is approached directly, and radio posterolateral for head and neck, lateral through extensor carpiradial longus muscle in the diaphysis, and directly lateral in its distal aspect.

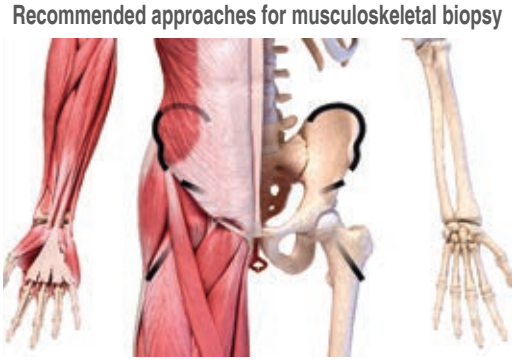

Figure 4: In pelvis we recommend biopsies along the iliac crest, in the acetabulum through the anterior inferior iliac spine, and in the proximal femur with a lateral subtrochanteric approach angled through the femoral neck.

Figure 5: In the thigh biopsies should be done through the posterior aspect of the *vastus lateralis*, and distally (lateral or medial) directly to the condiles.

Acetabular biopsies are performed through the anterior inferior iliac spine.[41] For biopsies of the femoral head and neck, a lateral subtrochanteric angled through the femoral neck approach is used. The hip joint capsule, and femoral neurovascular bundle should be avoided *(Figure 4)*.[12,20]

Thigh

A lesion in the femoral diaphysis is approached with a posterolateral skin entrance just anterior to the lateral intermuscular septum, through the posterior aspect of the vastus lateralis. The structures to avoid are rectus femoris, vastus intermedius, sciatic nerve and the profunda femoris artery.[12,20] This approach is often more ergonomically feasible and avoids the medial neurovascular structures.[39] Distal femoral

diaphyseal lesions should be approached laterally; the anterior quadriceps muscles and superficial femoral neurovascular bundle in the adductor canal, should be avoided.[12,39] Distal femoral metaphysis biopsies should be approached laterally or medially, targeting the lateral or medial epicondyles. Care should be taken to avoid the popliteal neurovascular bundle, geniculate arteries, quadriceps tendon, saphenous and common peroneal nerves, and knee joint capsule *(Figure 5)*.[12,20,40]

Lower leg

Tibial lesions can be accessed with a direct anteromedial approach avoiding the lower leg compartments and interosseous membrane.[12,20] The interosseous membrane between the tibia and fibula is a natural barrier to tumor spread.[39] Biopsies of fibular lesions are usually performed with the leg internally rotated. Proximal and distal fibular lesions are sampled with a direct approach through the subjacent skin and subcutaneous fat.[12,20] Common peroneal nerve courses around the neck of the fibula just caudal to the knee.[20] Mid fibular diaphyseal lesions should be approached anterior to the posterior intermuscular septum through the posterior aspect of the peroneus longus muscle *(Figure 6)*.[12]

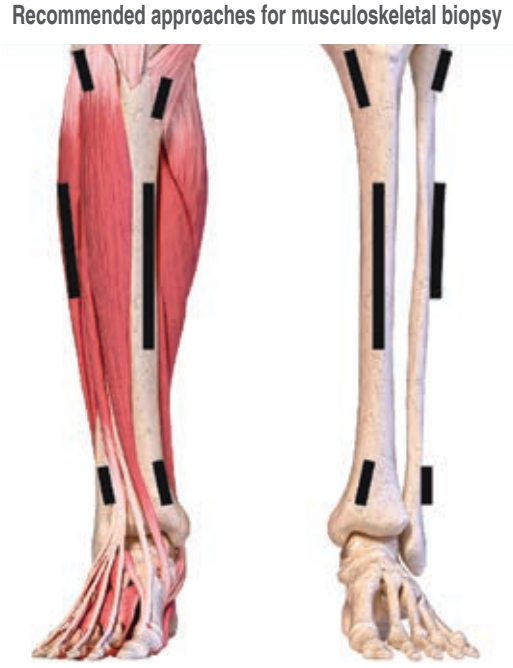

Figure 6: In the leg the recommended approach is anteromedial for the tibia, directly for proximal and distal fibula, and through the posterior aspect of the peroneus longus muscle for fibular diaphysis.

Hand and foot

The complex anatomy of the hand and foot necessitates discussion to identify the best site for biopsy. We try to avoid traversing the sole of the foot and the palm of the hand because these areas are more sensitive to pain.[39]

Spine

Typically, vertebral body lesions are biopsied using an approach through the pedicles. If the epicenter of the lesion is not accessible through the pedicles, a costovertebral approach may be considered.[39]

Biopsy of the ribs or sternum can be technically challenging because of respiratory motion, small intramedullary cavities, and the oblique orientation of the ribs. Before performing a biopsy in these locations, one should carefully review all relevant imaging studies, including staging examinations such as PET/CT or bone scintigraphy, to identify additional lesions that would allow a more straightforward biopsy approach that avoids the lungs and mediastinum.[12]

Indications[15,42]

Definitive diagnosis of bone and soft tissue lesions with indeterminate features.

Definitive diagnosis of lesions with aggressive features and to determine its subtype for choosing appropriate management.

Confirm/exclude metastasis in known primary malignancy.

Confirm/exclude mass lesion causing pathological fracture.

Contraindications[15,42]

Acute infection at the site of biopsy.

Bleeding disorders.

Inaccessible site.

Guidelines for musculoskeletal biopsy

Over the years, different authors have issued recommendations and established guidelines aimed at reducing complications generated from

musculoskeletal biopsies; then we will list some of them:[2,8,10,11,13-15,24-26,43,44-49]

1. Plan the biopsy as carefully as if it were the definitive treatment. This is not a simple procedure.
2. Pay special attention to asepsis, skin preparation, hemostasis and wound closure, as well as any other surgery.
3. Avoid transverse incisions.
4. Be certain that you have obtained a representative sample of the tissue to be analyzed.
5. If the surgeon, radiologists and pathologist are not familiar with the study and treatment of musculoskeletal neoplasms, and the hospital does not have the infrastructure for imaging, laboratory and histopathological studies, as well as for the definitive surgical treatment, the patient should be referred before the biopsy to the place that meets all these conditions.
6. Biopsy should always be performed after evaluating imaging tests.
7. Prior to biopsy, surgeon should have a tentative definitive treatment plan.
8. The surgical approach should not cross more than one anatomical compartment. The biopsy path should not open compartmental barriers, anatomic planes, joint spaces and tissue areas around neurovascular bundles.
9. The shortest distance to the lesion is not necessarily the optimal route unlike in other tumors.
10. Never expose the neurovascular bundle in a biopsy.
11. The incision should be made longitudinal to the axis of the affected limb. In the clavicle, longitudinal to its axis, and on the iliac crest, along it by small transverse incisions.
12. The biopsy should be as small as possible but as large as is needed to obtain material and make a diagnosis.
13. If the biopsy is open, do not perform exsanguination. Elevate the limb for 10 minutes and then inflate the ischemia cuff.
14. Plan site and tract according to the planned incision and tract of the definitive surgery.
15. No flaps should be raised.
16. If it is necessary to create a bone window, it must be oval and must be perfectly sealed after taking the sample, this prevents the exit of neoplastic material after the biopsy and consequently contaminates the surrounding tissue.
17. An oblong cortical window with rounded ends affords the greatest residual strength and is recommended for biopsy of purely intraosseous lesions. Oval bone windows reduce the risk of fracture.
18. Meticulous hemostasis with polymethylmethacrylate or bone wax is important.
19. Do not approach a biopsy through tendons.
20. After taking the biopsy, all the surgical instruments and gloves of the surgeons as well as those of the instrumentalist, must be changed before proceeding with the closure by planes.
21. The biopsy field must not be in continuity with any other surgical field on the same patient; if concurrent surgery is to be done, then surgical draping, gowns, gloves, and equipment must be changed to prevent cross-contamination and tumor seeding in a previously uncontaminated field.
22. The samples should be taken from the periphery of the tumors because of frequent central necrosis.
23. If a soft tissue component of bone exists, biopsy should be taken from it.
24. Obtain enough material and avoid crushing or distorting the specimen's texture.
25. Culture what you biopsy and biopsy what you culture.
26. If infection is suspected, patients on antimicrobials may need to stop taking them for about 48 hours before the biopsy to facilitate microbiological assessment.
27. When biopsy results do not match the results of clinical and radiologic evaluations, carefully reassess all three.
28. A multidisciplinary approach minimizes the realization of unnecessary or inappropriate biopsies, and allows a better diagnostic performance in each procedure.
29. When the obtained tissue arrives with the pathologist, regardless of the type of biopsy chosen, insist that all the previous study of the patient must be taken into consideration before issuing a final diagnosis.
30. The biopsy tract and immediate surrounding tissue be removed en bloc with the tumor at the time of resection.
31. Avoid taking biopsies in damaged skin areas or with the maximum cutaneous tension. This facilitates exposure of the neoplastic tissue.
32. Never perform skeletal biopsies by arthroscopy, except in cases of non-skeletal lesions located inside the joint itself, such is the case of pigmented villonodular synovitis, synovial chondromatosis or infectious processes. The degree of our diagnostic certainty in these cases must be high,

since the disposition of the portals and the subsequent contamination of their trajectories could make a wide extra-articular resection difficult or impossible, if malignancy is reported.

33. Diagnostic opinions that are not issued after a rigorous and objective clinical, radiological and histological analysis should be underestimated.

The guidelines presented in this article do not intend to be strictly applied to all bone and soft-tissue tumor biopsy cases, since individual patients, clinical situations and radiologists/surgeon preference.

Despite serious concerns regarding the potential of accelerated growth or metastatic dissemination of a malignant tumor after biopsy, there is no well-founded evidence that biopsy promotes either adverse event. The real risk of open and needle biopsies is that they may spread tumor cells locally and facilitate local tumor recurrence when performed inadequately.[14]

Complications

The incidence of complications varies in relation to the type of biopsy chosen. The different situations that can complicate a biopsy have negative repercussions from various perspectives generated by a longer hospital stay, higher cost, delay in starting neoadjuvant therapies, a higher risk of tumor contamination and consequent recurrence, or the need to perform radical procedures.

The incidence of infections after performing musculoskeletal biopsies is very low, however, its presentation would generate a delay in the initiation of neoadjuvant therapies and would make an immediate limb salvage procedure impossible.

Although there are a number of studies which have reported seeding in a biopsy tract,[7,50,51] to our knowledge the true incidence is unknown and is related to the type of biopsy performed. Soft tissue sarcomas seem to show higher biopsy tract contamination than bone sarcomas, and open biopsies above CNB.[50] Resection of the entire biopsy tract is indeed mandatory for surgical treatment of aggressive and malignant bone and soft tissue tumors.

Bleeding is a well-recognized risk of any biopsy technique and particular care should be taken with those tumors which have a particular vascular structure[2] and location. In general terms, musculoskeletal percutaneous image-guided biopsies of bone and soft tissue lesions (excluding those of the spine and retroperitoneum) are characterized as low-risk procedures of bleeding by the Society of Interventional Radiology.[52]

It is well recognized that neural structures can be damaged by cutting needle; however, pre-procedure planning and use of CT can usually avoid these problems.[2]

Great care has to be exhibited in lesions which are very lytic and on the verge of fracture. A biopsy can be the last straw in the integrity of bone.[2]

Prophylactic fixation of a bone lesion performed under false assumption that the lesion is not a sarcoma is potentially a devastating complication. Because the tumor is then extensively spread, amputation is often needed to control the local tumor.[46]

Post-procedure monitoring in the hospital may be required if there is increased risk of developing a complication of biopsy.[13]

Informed consent

Informed consent should be obtained from the operator who will carry out the procedure. The patients must be fully informed of the indications and benefits as well as of the risks and adverse events. Alternative options, when available, should be discussed. Finally, the procedure must be described thoroughly, including the need for peri-procedural medications, such as anesthetics.[42]

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Conflict of interest

The authors declare no conflict of interest.