ULTRASOUND GUIDED SKELETEL BIOPSIES

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Abstract:

Objective: Percutaneous biopsy (PB) of skeletal lesions is a widely used diagnostic technique that involves fluoroscopìc or computerized tomography guidance. The objective of this report is to describe the use of ultrasonography (US) in the guidance of PB in skeletal lesions.

Material and methods: We employed US to guide PB in 53 skeletal lesions in 52 patients (23 male and 29 female). Age ranged 1-82 year. Mean 47.2. The lesions were grouped into four categories: 32 were lytic with soft tissue mass, 15 lytic with disrupted cortical without soft tissue mass, 4 lytic with intact cortical and 6 sclerotic. Different techniques and materials were used in each group.

Results: Cytological assessment obtained the diagnosis in 40 cases, (success rate of 75.4%), histology in 47 cases (88.6%) and combining both in 50 cases (94.3%). There were not complications

Conclusions: US is a highly accurate and safe method of guidance in PB of bone lesions because can identify subtle changes in the cortical and the associated soft tissue component.

Key words: Skeletal lesion, Percutaneous biopsy, Ultrasound guidance.

INTRODUCTION

Biopsy is performed in order to determine accurately the composition of a tissue before instituting therapy. Because open surgical biopsy has greater morbidity, takes a longer time to perform, may delay institution of therapy and is more expensive, closed biopsy techniques have become popular for many organ systems (1).

Percutaneous needle biopsy is now a well-established radiographic procedure. Its value and safety have been demonstrated in the diagnosis of lesions of the respiratory and digestive tracts and of retroperitoneal structures mainly. The use of percutaneous biopsy for the diagnosis of musculoskeletal abnormalities is now becoming increasingly popular among radiologist (2).

The imaging modality chosen for biopsy guidance depends on the lesion characteristics and radiologist`s personal experience and preference. Improved resolution of current real-time equipment, particularly electronically focused phased-array transducer designs, have made real time ultrasound competitive with computed tomography, even superior in some situation (3,4).

Using ultrasonically guided percutaneous biopsy is widely performed with constantly increasing series in the diagnosis of various body locations. However the use of ultrasound as a guide of skeletal biopsies has been hardly used and only in lytic lesions. (5,6,7).

The purpose of this paper is to show our experience in skeletal biopsy guided with ultrasound, not only in lytic lesions, but also in sclerotic ones or lytic with intact cortex when the lesion can be seen with ultrasound.

MATERIAL AND METHODS

Among 60 percutaneous biopsies of skeletal lesions consecutively referred between January 1997 and December 1998 to our department, we performed 53 ultrasonically guided in 52 patients, (After an initial negative biopsy, one patient had a second biopsy positive for malignancy.)
There were 1-82 years old (mean age, 47.2 years), 23 men and 29 women.
Suspected skeletal lesions had sonografic view well enough to be biopsied ultasonographicaly guided
The biopsy sites were the ribs in 17, tibia, sacrum and iliac in 6, femur in 4, pubis and coxis in 2 and ischium, temporal bone, sternum, calota, clavicle, esterno-clavicular joint, cervical and dorsal spine, humero and sphenoid in one.
Twenty-nine biopsies (54.7%) were done as out-patient procedures; the remainder were performed on inpatients hospitalized for reasons other than the biopsy procedure.
According to radiological appearance the lesions can be divided into four groups: sclerotic(n=6), lytic with intact cortex (n=4), lytic with broken cortex without soft tissues mass, (n=15) and lytic with soft tissue mass associate (n=32). The technique used for the biopsy varied according to the group.
All examinations were performed using an ultrasonic unit model General Electric "Logiq" 400 MD, with 3.5-MHz convex and 7.5-MHz linear array probes, before and during the puncture. When we used the convex probe, a needle guide attachment was used and when we used linear array probe free-hands technique was preferred. In many cases we were assisted by Doppler duplex color to guide the biopsy in order to avoid large vessel or highly vascular areas in the target.
After informed consent and routine questioning regarding possible history of coagulopathy, we used standard aseptic and anesthetic technique. The patients were observed in the radiology department for 30-60 minutes after the biopsy to assess for any immediate complication.
Before the puncture, we studied the sonographic patterns of the lesion, including echogenity, margins, soft tissue mass, cortex irregularities and vascularization in order to find the best track and avoid dangerous structures and necrosis.
In each patient a single aspiration pass with fine needle was usually performed for cytologic analysis and one or two histologic core samples were obtained with different kind of needles, according to the type of the lesion.
In the group of lesions with broken cortex, we performed the biopsy as in other solid visceral organs. Firstly one pass for cytological examination was obtained by aspirating with a 22-gauge needle and immediately one or two passes for histologic analysis were carried out with a18-gauge tru-cut automatic

needle gun. In the second group, which includes lytic lesions with broken cortex, we could easily observe the discontinuity in the cortical and introduce the needles through this discontinuity with ultrasound guidance. In the third and fourth groups, the technique was as follows: with a 14-gauge trephine needle the pathologic area was penetrated with ultrasound guidance, and the stylette removed then a 22-gauge needle in a coaxial manner was introduced to obtain cytologic sample. Subsequently the core biopsy with the trephine needle was performed in the traditional way. Sometimes, especially in lytic lesions with intact cortex, once the cortex had been penetrated with the trephine a core biopsy with an 18-gauge tru-cut automatic needle was performed coaxially.

A biopsy was considered successful when the pathologist had adequate material to give a histologic or cytologic diagnosis.

RESULTS

The final diagnosis were as follow: metastasis from different origin 26, peripheral bronchial carcinoma 5, plasmocitoma 4, cordoma 2, osteoid osteoma, condrosarcoma, osteosarcoma, osteoblastoma, amiloidoma, Langenhans cells granuloma, adamantinoma, chronic osteomielytis, non-osificant fibroma, rabdomiosarcoma, lymphoma, pleomorphic sarcoma, Ewing´s sarcoma, condroma and radionecrosis in one.

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The overall success rate of 53 biopsies including hystologic and cytologic samples was 94.3 % n= 50. There were only three cases with material no diagnostic corresponded with a non-osificant fibroma, and a radionecrosis according to the clinical and radiologic follow-up, and a metastatic adenocarcinoma in a second biopsy. The success rate with core biopsies was 88.6% n=47 and with aspiration biopsies 75.4 % n=40, in four cases the citologic sample were positive whereas the hystologic ones were non diagnostic, however, in general the results of cytologic samples were less specific than core biopsies. No complications resulted from any of the biopsy procedures.

The patients who underwent cutting bone biopsies reported mild discomfort in the area of the biopsy than resolved completely spontaneously in few hours. No outpatient required admission in the hospital or prolonged observation in the radiology department after biopsy.

DISCUSSION

Percutaneous biopsy under imaging guidance is one of the most common procedures performed by radiologists and is an usual method of obtaining tissue diagnosis. This procedure is performed in practically every location in the body (3), mainly in solid abdominal organs.

Percutaneous needle bone biopsy performed under fluoroscopic guidance has been used since the begging of this century; since then, many descriptions of this technique and percutaneous CT-guided bone biopsies have been published (8-14); however the ultrasonic guidance of this type of biopsies has hardly been reported. (5-7).

In recent years, the number of techniques, needle sets, and imaging guidance has improved, including cytologic and histologic innovations. Similarly, the diagnostic accuracy of percutaneous biopsy has also improved. Most large series report diagnostic accuracy ranging from 60% to 95%. The overall diagnostic accuracy in our study was X % which compares favorably with previous reports in which the guidance method was biplane radioscopy or CT (8,9,11-15)).

Our study included two biopsy techniques applied to four different groups of lesions according to its radiological appearance, in a variety of anatomical locations. Most previous reports were limited to a single technique, a specific pathology or location (2,9,10,12). The few reports, which included ultrasonic guidance, are limited to lytic lesions with broken cortex and soft tissue masses (5-7) and the papers that report biopsy of sclerotic lesions or lytic ones with intact cortex are guided with either biplane fluoroscopy or CT (1,2,7-13). To our knowledge, the biopsy of sclerotic or lytic lesions with intact cortex guided with ultrasounds, have not been described so far in the literature.

Most of the lesions in this series were lytic with broken cortical and soft tissue mass (figure 1) in this group the technique do not vary from other biopsies in solid abdominal organs. In lytic lesions with broken cortical (fig 2) we also used the same technique introducing the needle in the lesion through the broken cortex with ultrasound guidance. **Lytic bone lesions with intact cortex (fig 3) and sclerotic ones (fig 4) are sampled using a combination technique, that consists of cutting a window in the overlying cortex using a trephine needle, removing the estilette and 22G chiba needle is passed through the cannula and cortical window into the underlying tumor, multiples passes for cytological study can be done in a coaxial manner, finally the trephine was used in the traditional way.**

Our study supports the concept that aspiration and core biopsies are complementary in the percutaneous biopsy of suspected

skeletal neoplasm as in other organs and improve the overall results and specificity (16,17), for that reason we routinely performed passes with fine needle and core biopsy with tru-cut automatic gun or trephine needle, sometimes we used coaxial technique(10).

The absence of complications of the procedures was probably explained by the use of real-time images visualizing the tip of the needle during the whole procedure time ,which is one of main advantage of the utilization of US. Another reason can be the use of Doppler duplex color that can identify vessel or high vascular areas in the lesion and reduce the risk of bleeding (18) . Similarly the US has the capability to clearly depict the pleural surface and the lung avoiding puncturate it, and as result of that, reduce the probability of pneumotorax, specially when we are dealing with rib lesions(6).

Since obtaining necrotic material is one of the main causes of inadequate material is very important to avoid necrosis. The US can clearly depict the necrosis as an echoic area, however it is more difficult by using unenhanced CT and impossible with fluoroscopy.

Ultrasonography is excellent for imaging superficial structures and has many advantages over fluoroscopy or CT as a guidance procedure specially for superficial lesions(6,19,20). Ultrasound distinguishes subtle differences in acoustic impedance , not apparent in routine radiography even in CT scans, between normal and abnormal cortex, even in sclerotic bone abnormalities.(Fig5) These features of ultrasounds allow to identify small areas of broken or thin cortex(18,19) and to avoid use trephine needles in these cases, making the biopsy easier and less traumatic. Apart from the previous advantages mentioned, with ultrasound guidance we can use more easily automatic biopsy gun for core biopsy than with CT guidance.

At the previous mentioned advantages we can add the general advantages of the ultrasounds, such a ultrasound is cheap, easily available, portable, allow multiples incidences and do not use ionizante radiations (3,4).

Two main difficulties arise when skeletal biopsies are performed with ultrasound guidance. Firstly, there is some lesions which can not be assessed well enough to be sampled, as deep lesions, specially the locates in vertebral body and pelvis; and lesions that do not alter the cortical. And secondly very hard sclerotic lesions than can not be perforate with a manual trephine. In such kind of cases we used CT guidance. During the period of time of this study we performed 7 CT guided skeletal biopsies, five of them located in the spine, and none with fluoroscopic guidance.

Our series has however some limitations, although we included lesions in most anatomic sites, spinal lesions are underrepresented due to the deep lesions are difficult to assess with ultrasounds. Other limitation is the distribution of

metastasic and primary tumors; the success rate in obtaining a diagnosis by percutaneous biopsy is highest in metastasic bone lesion than in primary tumors, because this series comes from a general hospital the distribution of metastasic and primary lesions may be skewed in comparation to an orthopedic hospital where the percentage of metastasic bone tumors probably would be lower,.

In conclusion, we believe that the biopsy of skeletal lesions could be performed more often, based on the accuracy and safety of this low-cost technique without exposure to ionizing radiation. Different biopsy techniques is suggested depending on the radiological characteristic of the lesions.

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Captions for illustrations.