The role of ultrasound-guided needle biopsy in the diagnosis of soft-tissue tumors

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KEYWORDS

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sonography.

Abstract Soft-tissue tumors are not very common, but their diagnosis can be very difficult. In the final analysis, their diagnosis requires a biopsy, which must furnish a sufficient amount of material to allow a reliable histological diagnosis. The authors evaluated the diagnostic efficacy of ultrasound-guided needle biopsy in the diagnosis of soft-tissue tumors of the musculoskeletal system. The aim of the study was to optimize the biopsy procedure, with particular emphasis on the choice of the biopsy needle (large-gauge manual versus semiautomatic) based on the characteristics of the neoplastic mass (consistency, depth, size, location). The results of the study showed that appropriate needle selection significantly reduced the frequency of biopsies that were insufficient for histological diagnosis. The method proved to be highly reliable for diagnosis of soft-tissue tumors but strongly related to the proper selection of the needle to be used.

Sommario I tumori delle parti molli, pur essendo neoplasie poco frequenti, pongono notevoli difficoltà di diagnosi che viene affidata, in ultima analisi, al prelievo biotico, che deve fornire materiale sufficiente per una corretta diagnosi istologica.

Gli autori hanno voluto verificare l'efficacia diagnostica dell'agobiopsia ecoguidata nei tumori delle parti molli dell'apparato muscolo-scheletrico per ricercare l'ottimizzazione della procedura, in particolare, per quello che riguarda l'ago biotico, da scegliere a seconda delle caratteristiche della massa neoplastica (consistenza, profondità, dimensioni, sede).

La revisione della casistica ha evidenziato come la scelta accurata dell'ago biotico (ago manuale grosso calibro, ago semiautomatico) ha consentito una significativa riduzione dei casi con prelievo di materiale insufficiente per una corretta diagnosi istologica.

La casistica ha evidenziato l'agobiopsia ecoguidata come metodica altamente affidabile per la diagnosi di lesioni delle parti molli, ma fortemente legata alla scelta accurata della tipologia dell'ago impiegato.

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Introduction

Soft-tissue tumors are not very common, but their diagnosis can be very difficult [1]. The final diagnosis requires a biopsy, which must provide sufficient material for a reliable histological diagnosis.

Ultrasound-guided needle biopsy can be used to collect samples of soft-tissue masses [2], even when the lesion is small or in a difficult location (close to blood vessels or nerves that might be damaged or in areas where maneuverability is limited, e.g., near joints or tendons).

To provide sufficient material for a reliable histological diagnosis, multiple biopsies must be collected from all potentially viable areas of the lesion.

The needle-insertion pathway should coincide with the surgical access pathway to eliminate the risk of neoplastic seeding. For this reason, it must be planned with the aid of the orthopedic surgeon.

To improve the percentage of diagnostic biopsies [3], the authors reviewed their experience over the past two years, evaluating the procedures used, the operative strategies adopted, and the instruments that proved to be most effective.

Materials and methods

Over a period of two years (June 2004 through July 2006), our staff performed 185 ultrasound-guided needle biopsies: 164 involved soft-tissue lesions (primary, metastatic, or recurrent) [4] and the remaining 21 involved lesions originating in the bone and extending into the adjacent soft tissues.

The latter 21 lesions were excluded from this study since they could not be fully examined with ultrasound.

We thus considered only the 164 patients with lesions originating in the soft tissues. Eighty-nine (54.2%) of these were males and the other 75 (45.8%) were females. The mean age was 48 years (range 5–84 years) (Fig. 1).

Each patient underwent a preliminary ultrasound study with color Doppler to define the characteristics of the lesion (location, depth, size, echostructure, vascularization, consistency). With the aid of the orthopedic surgeon, the insertion pathway for the biopsy needle (Fig. 2) was then selected so that it would coincide with that of the surgical access, thus limiting the risk of seeding. A sterile field was prepared, and the biopsy was collected using manual 14- and 18-gauge needles and semiautomatic 13–14-gauge needles

Fig. 1 Histogram showing age-group distribution of study patients.

Fig. 2 Sterile instrument stand with biopsy needle.

(Fig. 3); the site chosen for the biopsy was marked with a dermographic pen.

Ultrasound guidance was used to insert the needle for administration of anesthesia and that used for the biopsy in order to avoid damage to blood vessels and nerves and to ensure correct placement of the biopsy needle (Fig. 4a, b). At least 3–4 tissue samples were collected from each lesion (Fig. 5). Areas of necrosis were avoided to ensure that the pathologist would have abundant tissue to examine. (The diagnosis of soft-tissue tumors is, in fact, based on histology, not cytology) [4].

We analyzed the results obtained during two periods of the study (period 1, June 2004 through June 2005, and period 2, July 2005 through July 2006), which were distinguished by the types of biopsy needles being used [5].

Results

Sufficient material for histologic diagnosis was collected in 148/164 cases (90%) of soft-tissue tumors; in the remaining 16 cases (10%), the tissue collected was insufficient.

In the 148 cases in which histological diagnoses were possible, the lesion proved to be benign in 69 (47%) and

Fig. 3 Selection of the access pathway under ultrasound guidance.

Discussion

Fig. 5 Biopsy material collected.

A diagram of the human muscular system showing the percentage of total muscle mass for various muscle groups. The percentages are as follows:

- Neck: 0.6%
- Head and neck: 1.8%
- Trunk (upper): 0.6%
- Trunk (lower): 6%
- Upper arm: 7%
- Forearm: 6%
- Hand: 6%
- Thigh: 7%
- Shin: 5%
- Foot: 3%
- Leg (total): 37%
- Knee: 5%
- Ankle: 9%

Fig. 6 Distribution of soft-tissue tumors by location.

The needle was selected based on the type of lesion being examined [6]. Manual needles were used for firm, deep-seated, nonmobile lesions, while semiautomatic needles were preferred for softer masses with semiliquid contents or a mucinous component that were small and located close to the surface.

Conclusions

Ultrasound proved to be an effective tool for real-time visualization of the biopsy procedure. It allowed us to perform the biopsy without damaging arteries, veins, and nerves, including those that were immediately adjacent to the lesion, and to avoid the collection of necrotic tissues.

Ultrasound-guided biopsies are both rapid and repeatable, and patients are not exposed to any form of ionizing radiation. The only drawbacks encountered [7] are related to the presence of shadow zones in the vicinity of bones or extensive areas of calcification, or to difficulties arising in the study of deep-seated tumors with a high content of fibro-adipose tissue. In these cases, strong attenuation of the ultrasound beam results in poor visualization of biopsy maneuvers.

Based on our experience, we feel that ultrasound-guided needle biopsy is a highly reliable tool for the diagnosis of

soft-tissue lesions. The results are strongly dependent on the type of needle used: the choice (manual needles versus large-caliber semiautomatic needles) has to be based on the type of lesion being biopsied.

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