European Journal of Radiology 90 (2017) 234–244

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Review

The role of ultrasound-guided fine needle aspiration biopsy in musculoskeletal diseases

Marco Sperandeo[a], Francesca Maria Trovato[b], Nadia Melillo[c], Lucia Dimitri[d], Giuseppe Musumeci[e], Giuseppe Guglielmi[f,g,*]

[a] Unit of Intervenional Ultrasound of Internal Medicine, Scientific Institute Hospital "Casa Sollievo della Sofferenza", Viale Cappuccini 1, San Giovanni Rotondo, FG, Italy
[b] Department of Clinical and Experimental Medicine, Internal Medicine Division, School of Medicine, University of Catania, Italy
[c] Rheumatology Unit, Department of Medical Science, University of Foggia, Italy
[d] Histology and Pathology Unit, Scientific Institute Hospital "Casa Sollievo della Sofferenza", Viale Cappuccini 1, San Giovanni Rotondo, FG, Italy
[e] Department of Biomedical and Biotechnological Sciences, Human Anatomy and Histology Section, School of Medicine, University of Catania, Italy
[f] Department of Radiology, University of Foggia, Viale Luigi Pinto 1, Foggia, Italy
[g] Department of Radiology, Scientific Institute Hospital "Casa Sollievo della Sofferenza", Viale Cappuccini 1, San Giovanni Rotondo, FG, Italy

ARTICLE INFO

Article history:
Received 7 July 2016
Received in revised form 22 February 2017
Accepted 27 February 2017

Keywords:
Ultrasound
Percutaneous biopsy
Musculoskeletal diseases
FNAB

ABSTRACT

Ultrasonography (US) is a readily available non-invasive tool useful for the detection of musculoskeletal and soft tissue masses. Although X-Ray is often the first imaging study for evaluating both bone and soft tissue lesions, and magnetic resonance imaging and computed tomography are mandatory in lesions staging, US is increasingly used for the early assessment of musculoskeletal and soft-tissue masses and for guiding procedures and biopsies. Surgical biopsy or fine needle aspiration biopsy (FNAB) is needed to ascertain the nature of any lesion. FNAB is a low cost technique, safer and less traumatic than an open surgical biopsy. Significant complications are rare, mostly related to the site of biopsy. Knowledge of indications, limitations, anatomical and pathological access, adequate technical expertise in US imaging and in intervention skills are the critical factors of the appropriate and safe use of FNAB. By now, the role of FNAB in musculoskeletal diseases is controversial and there is still a heated debate in the scientific community.

1. Introduction

Ultrasonography (US) is a readily available non-invasive tool useful for the detection of musculoskeletal and soft tissue masses. US is crucial in the definition of the size and feature of a lesion, mainly because it allows the differentiation between cystic and solid structure. US may help to differentiate between localized and diffuse lesions, identify the relationship with surrounding structures, and define intra- or extra-articular localization. Often X-Ray is the initial imaging study for evaluating both bone and soft tissue lesions, while magnetic resonance imaging (MRI) and computed tomography (CT) are fundamental in staging bone-soft tissue lesions. Nonetheless, US is increasingly used for the early assessment of musculoskeletal and soft-tissue masses and for US-guided biopsy, due to its availability and to relatively low and sustainable costs. When histopathology is needed to modify patient management choices, surgical biopsy or fine needle aspiration biopsy (FNAB) is mandatory. FNAB is a low cost technique, safer and less traumatic than an open surgical biopsy. Moreover, novel and emerging tools are developed which allow the use of small specimens for the diagnosis due to new molecular and genetic analysis.

Significant complications are usually rare, and depend on the biopsy site. Knowledge of indications, limitations, anatomical and pathological access, adequate technical expertise in US imaging and in intervention skills are the critical factors of the appropriate and safe use of FNAB [1]. Unless proven otherwise, all lesions should be managed as if they were malignant lesions, such as sarcomas, and thus require a diagnostic workup with biopsy [2].

Abbreviations: CIM, critical illnesses myopathy; CT, computed tomography; FISH, fluorescence in situ hybridization; FNAB, fine needle aspiration biopsy; FNAC, fine needle aspiration cytology; MRH, multicentric reticulohistiocytosis; MRI, magnetic resonance imaging; OS, osteosarcoma; PCR, polymerase chain reaction; RMS, rhabdomyosarcomas; US, ultrasonography.

* Corresponding author at: Department of Radiology, University of Foggia, Viale Luigi Pinto 1, 71100 Foggia, Italy.
E-mail addresses: giuseppe.guglielmi@unifg.it, guglielmi_g@hotmail.com (G. Guglielmi).

http://dx.doi.org/10.1016/j.ejrad.2017.02.042
0720-048X/

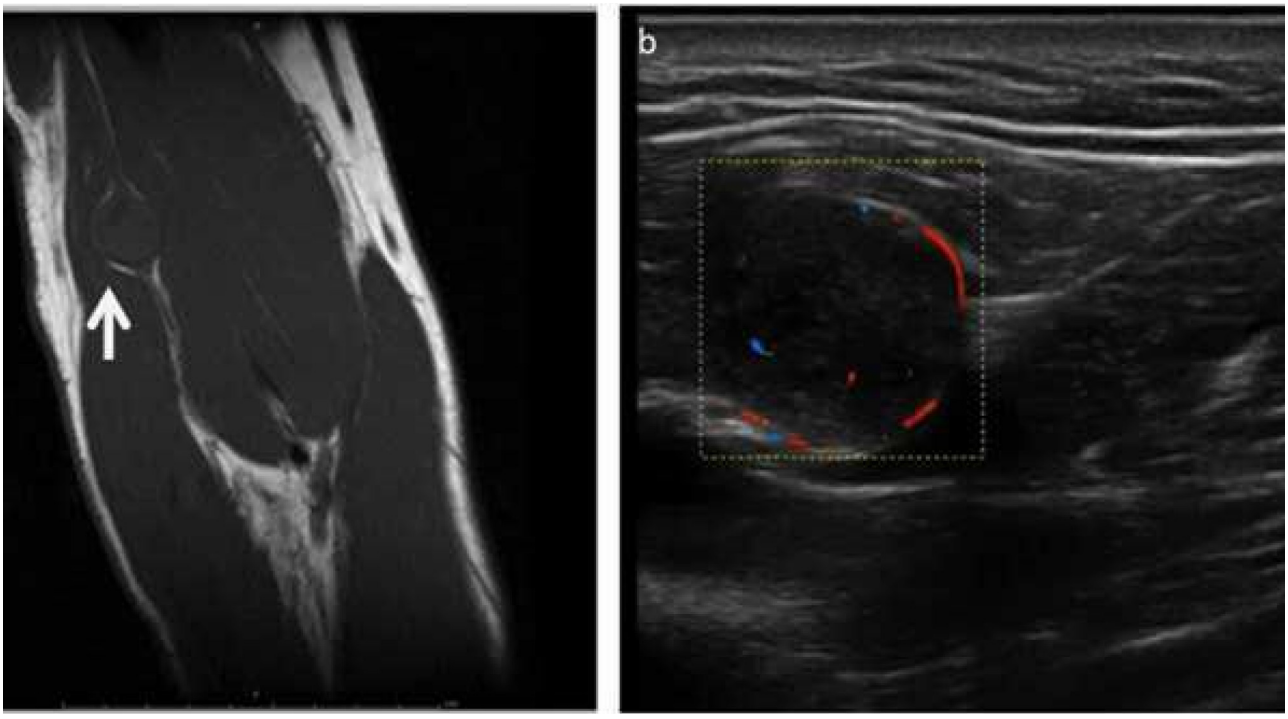

Fig. 1. Nodular lesion localized between the muscles of the arm (arrow), at the radial neurovascular bundle: a) MRI imaging; b) US imaging: mass was subcutaneous although limited and homogeneous, ovoid and well encapsulated. Finally diagnosis with surgery biopsy: benign schwannoma.

In other cases infectious lesions (e.g. spondylodiscitis), unresponsive to conventional antibiotic therapy, require biopsy for microbial cultures. Moreover, in patients with known primary malignancy, FNAB can confirm or exclude metastasis, or to evaluate an underlying lesion causing a pathological fracture (Fig. 1).

2. Techniques

The imaging technique used to guide percutaneous musculoskeletal biopsy procedures depends on the features of the lesion as well as on the operator's personal choice. US is a valuable tool in controlling the biopsy needle, especially in small and superficial lesions of the soft tissue (Fig. 2). It has the main advantage of real-time visualization of the needle tip and relatively easy use. It has been reported that US-guided needle biopsy is a reliable and safe procedure for performing biopsies also in critical area of the body like the orbit [3]. Also the use of US contrast agent enhances the viable tumour region, identifying the target area and improving the diagnostic yield of the subsequent biopsy [4].

The decision to use FNAB or core biopsy (CNB) depends on several factors, including the pathologists' and oncologists' preferences, the experience and preference of the interventional radiologist, size and site of the lesion, suspected diagnosis, and probability of complications [5]. Several needles differing in caliber, length, tip configuration and mechanism are available for percutaneous biopsies [6]. Cutting needles can be manual, semi-automated, or fully automated. The fully automated biopsy devices, or biopsy guns, have become increasingly popular in recent years. They have been shown to yield more tissue than their manual counterparts thanks to the rapid firing mechanism that reduces the risk of needle deflection and minimizes patient discomfort [6]. Needle choice depends on the experience and preference of the interventional radiologist, the size and location of the target lesion and the estimated amount of tissue needed for diagnosis [7]. We use Menghini type semi-automatic biopsy device (BIOMOL, HS) that allows a vacuum core biopsy (Fig. 3). It is equipped with a spring that not only simplifies the biopsy procedure using only one hand, but allows a much faster performance. Even with 20–21 G needles, this technique allows to obtain perfectly suitable samples for histologic diagnosis but minimizes the occurrence of complications, which appear to be more frequent with 18-gauge needles [8]. In literature, often authors refer to FNAB technique, as a procedure performed with 22–23 G needle attached to a 20 mL disposable syringe fitted onto a syringe holder. In this review we refer to this technique as fine needle aspiration cytology (FNAC), that provides only sample useful for cytological analysis. Since, the cytological and histologic analyses are complementary, many radiologists routinely obtain both types of specimens, although other colleagues take histological specimens only if the cytological specimens are inadequate or if specifically required to a more detailed characterization of the malignant lesion [6]. A study on CT-guided core needle biopsy showed an accuracy of 80.8% for bone tumours with diagnostic error of 7.1% and undiagnostic rates of 12.1% [9]. Regarding soft-tissue tumour biopsy, an accuracy of 83.2% with diagnostic error of 10.5% and undiagnostic rates of 6.3% were reported. Moreover, biopsy of benign tumours has been shown to be more accurate (85.3%), than that of malignant tumours (75.8%) [9]. Other studies compared the diagnostic rate of CT-guided CNB and incisional biopsy without reporting significant differences (92.9% vs. 96.9%) [10] and of CNB and FNAC [11] reporting that the sensitivity of FNAC and CNB, for categorizing bone tumours into benign and malignant, is 94.7%. For soft tissue tumours, the FNAC sensitivity was 90.9% and CNB had a sensitivity of 100% [11]. The specificity of both the techniques, FNA and CNB for bone and soft tissue tumours was 100% [11]. For malignant bone tumours, cytological grade was concordant with CNB grade in 72.2% of the cases. Cytological grade was concordant with the grade on CNB in 81.8% cases for malignant soft tissue neoplasms [11]. Another study concluded that open biopsy had the highest diagnostic accuracy (89%), followed by FNA (82%) and core biopsy (78%) [12].

Different imaging techniques are used for guidance. Fluoroscopy provides real-time visualization, but it has the disadvantages of