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MUSCULOSKELETAL IMAGING

TECHNICAL NOTE

Fluoroscopy-guided bone marrow aspiration and biopsy: technical note

Anderanik Tomasian
Jeremiah Long
Jack W. Jennings

ABSTRACT

Bone marrow aspiration and biopsy is a valuable procedure commonly utilized for evaluation of hematologic abnormalities, nonhematologic malignancies, metabolic abnormalities, tumor treatment response, and suspected infection in patients with fever of unknown origin. Imaging guidance with computed tomography (CT) is commonly utilized to improve safety and effectiveness of the procedure. Considering progressively increasing volume of complex CT-guided procedures as well as diagnostic CT imaging in most practices potentially resulting in limited availability of CT, a technique for fluoroscopy-guided bone marrow aspiration and biopsy is described with focus on advantages, which could be beneficial to most busy practices in modern era radiology.

Bone marrow aspiration and biopsy (BMAB), typically performed together in clinical practice, is a valuable diagnostic procedure most commonly utilized for evaluation of hematologic abnormalities (cytopenia and hematologic malignancies), nonhematologic malignancies, metabolic abnormalities, disease treatment response (bone marrow transplant and chemotherapy), and suspected infection in patients with fever of unknown origin (1). BMAB has been proven safe with a high diagnostic yield, and is typically performed at the posterior iliac crest (1–3). Computed tomography (CT) guidance is commonly used to improve safety and effectiveness of the procedure (3). However, considering progressively increasing volume of complex CT-guided procedures as well as diagnostic CT imaging in most practices potentially resulting in limited availability of CT, along with several advantages of fluoroscopy such as real-time guidance and subsequent time savings, low radiation dose, and widespread availability, a technique for fluoroscopy-guided BMAB is described in this report which could be beneficial to most busy practices in modern era radiology. While use of fluoroscopy for imaging guidance for BMAB has been described (4), and this technique is used in practice, the technical details of this intervention have not been described in the literature.

Technique

During fluoroscopy-guided BMAB, the patient is placed prone on the fluoroscopy table and a C-arm fluoroscopy unit is used to maximally profile the posterior iliac bone utilizing an oblique anterior-posterior projection with the image detector obliquely inclined towards the contralateral iliac bone (Fig.). Once the posterior iliac bone is profiled, a skin needle entry site (osseous target site) is selected and marked along the middle third posterior iliac bone at the central medullary space (Fig.). Once subcutaneous and periosteal anesthesia is achieved, intermittent fluoroscopy is used to ensure that the biopsy needle follows a "bull's eye" trajectory, parallel to the X-ray beam, into the posterior iliac bone at the planned osseous entry site and then along the long axis of the iliac bone in anterior-posterior plane (Fig.). In our practice, an 11-gauge needle with a battery-powered drill system (OnControl, Arrow) is utilized to perform BMAB. Once adequate osseous purchase is achieved, bone marrow aspiration is performed through the existing introducer cannula and followed by core biopsy using the battery-powered drill. The procedure may also be performed in oblique prone or lateral decubitus position if a patient is not able to tolerate prone positioning.

From the University of Southern California (A.T. ✉ *tomasian.andy@gmail.com*), Los Angeles, California, USA; Mayo Clinic Hospital (J.L.), Phoenix, Arizona, USA; Mallinckrodt Institute of Radiology (J.W.J.), St.Louis, Missouri, USA.

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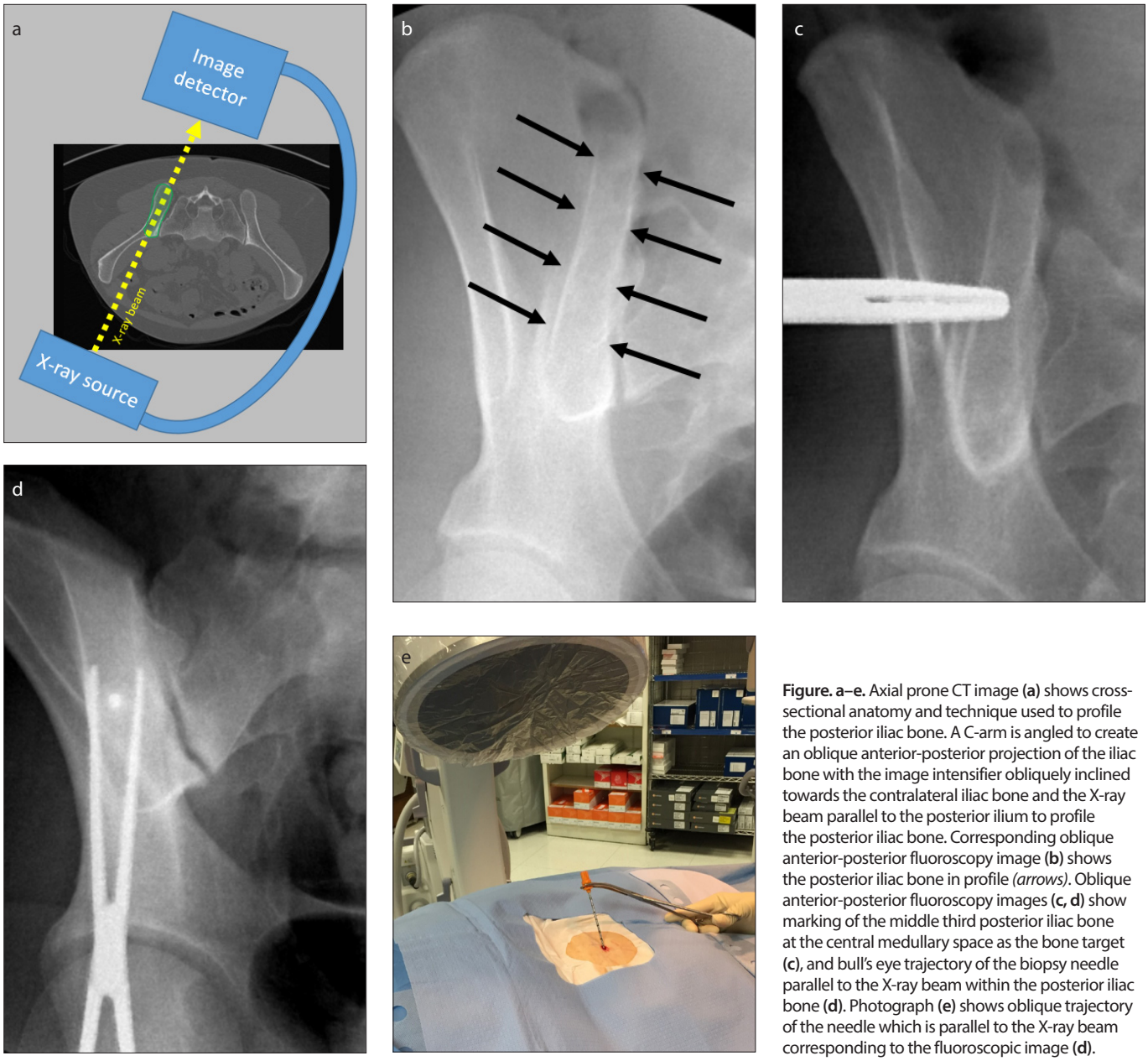

Figure. a–e. Axial prone CT image **(a)** shows cross-sectional anatomy and technique used to profile the posterior iliac bone. A C-arm is angled to create an oblique anterior-posterior projection of the iliac bone with the image intensifier obliquely inclined towards the contralateral iliac bone and the X-ray beam parallel to the posterior ilium to profile the posterior iliac bone. Corresponding oblique anterior-posterior fluoroscopy image **(b)** shows the posterior iliac bone in profile *(arrows)*. Oblique anterior-posterior fluoroscopy images **(c, d)** show marking of the middle third posterior iliac bone at the central medullary space as the bone target **(c)**, and bull's eye trajectory of the biopsy needle parallel to the X-ray beam within the posterior iliac bone **(d)**. Photograph **(e)** shows oblique trajectory of the needle which is parallel to the X-ray beam corresponding to the fluoroscopic image **(d)**.

Discussion

Although CT is most commonly utilized in clinical practice to safely perform and improve efficacy of BMAB, fluoroscopy can be a valuable additional option in the armamentarium to serve as imaging guidance for such interventions. There are several benefits of fluoroscopic guidance for BMAB including availability, technical ease, near real-time monitoring of the needle trajectory which commonly results in shorter procedure times particularly in large patients, and generally low patient and operator radiation dose. In addition, in cases of "dry tap" when no bone marrow aspiration can be obtained such as in patients with advanced myelofibrosis, it is technically unchallenging and time-efficient to modify the needle obliquity under fluoroscopic guidance to target a different region along the posterior iliac bone, from the same skin entry site, to attempt to obtain tissue.

In conclusion, BMAB is a valuable diagnostic procedure in modern clinical medicine. Fluoroscopic guidance for BMAB is safe and effective and can be a valuable addition to the procedure armamentarium and practice of radiologists.

Conflict of interest disclosure

The authors declared no conflicts of interest.

References

1. Bain BJ. Bone marrow aspiration. J Clin Pathol 2001; 54:657–663. [Crossref]
2. Marti J, Anton E, Valenti C. Complications of bone marrow biopsy. Br J Haematol 2004; 124:557–558. [Crossref]
3. Liu B, Limback J, Kendall M, et al. Safety of CT-guided bone marrow biopsy in thrombocytopenic patients: a retrospective review. J Vasc Interv Radiol 2017; 28:1727–1731. [Crossref]
4. Ridgeway JA, Tinsley S, Kurtin SE. Practical guide to bone marrow sampling for suspected myelodysplastic syndromes. J Adv Pract Oncol 2017; 8: 29–39. [Crossref]