

# Cytology of Bone



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## KEYWORDS

• Bone • Cytology • Osteosarcoma • Osteomyelitis

## KEY POINTS

- Aspiration of bone lesions can be rewarding and is beneficial in differentiating inflammatory from neoplastic processes.
- Cytology is a component of the diagnostic process and should be combined with signalment, history and radiographic findings to come to a final diagnosis.
- Different techniques and imaging modalities are available to assist with successful aspiration of lesions.

## INTRODUCTION

Fine-needle aspiration of bone lesions is becoming a more common diagnostic technique in human and veterinary medicine. Indications for aspiration include evidence of cortical lysis or periosteal proliferation. Occasionally, these lesions also consist of a palpable soft tissue mass. Imaging is necessary to confirm the presence of boney involvement.

## CYTOLOGY VERSUS HISTOPATHOLOGY

Cytology has some significant advantages but is not without its limitations. Cytology is less expensive than biopsy on multiple levels. The biopsy procedure itself is more expensive because it requires specific equipment and sedation or general anesthesia. The biopsy testing performed by the laboratory is more expensive because significant tissue processing is involved. The turn-around time for cytology is quicker, particularly with bone samples, because the tissue preparation of bone often requires a decalcification process, which can take several days depending on the size of the tissue submitted. Biopsies are more invasive with larger pieces of tissue being removed compared with aspirates; therefore, there is a greater risk for complications such as pathologic fracture and wound infection. There are also significant limitations to cytology. Bone can be challenging to aspirate, so there is a risk of low cellularity samples or aspiration of reactive bone instead of the primary lesion. The level of diagnosis may not be as specific as can be obtained with biopsy. For instance, cytology may

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result in a diagnosis of sarcoma, whereas biopsy may be able to provide a more-specific diagnosis, including the type of tumor, based on the architecture of the tissue and the constitution of the background matrix. Often the amount of tissue removed with a biopsy is small enough to limit these advantages, however. Several studies compared the accuracy of cytology with histopathology as the gold standard. In human pathology, cytology was correctly able to identify malignant neoplasia in soft-tissue, musculoskeletal tumors, and bone tumors 98% of the time.<sup>1</sup> In a second study focused on only bone tumors, cytology findings agreed with those of histopathology 80% of the time.<sup>2</sup> Both benign and malignant tumors were evaluated in this study. In a study specifically focused on osteosarcoma, cytology correctly diagnosed osteosarcoma in 83% of cases with 17% of cases considered nondiagnostic with cytology.<sup>3</sup> In dogs, cytology was able to differentiate sarcoma from benign lesions with 97% sensitivity and 97% accuracy.<sup>4</sup> In a retrospective study of histologically confirmed osteosarcoma, cytology had 70% partial or full agreement with histopathology,<sup>5</sup> suggesting that cytology is a worthwhile diagnostic tool in the diagnosis of bone neoplasia (**Table 1**).

### ASPIRATION OF BONE

There are multiple techniques available for bone aspiration, and the equipment necessary is limited and inexpensive. A range of needle sizes can be used depending on the level of lysis in the lesion. In highly lytic lesions, a 22-gauge needle can be used with success.<sup>6</sup> Generally, however, larger-gauge needles such as 16 or 18 gauge are more commonly used. True fine-needle aspiration, with a needle attached to a 6- or a 12-mL syringe is effective. The fenestration technique, with a needle only or a needle attached to a syringe with the plunger extended, is also a useful technique (**Fig. 1**). Neoplastic and inflammatory bone lesions often have a proliferative response of healthy osteoblasts, attempting to stabilize the bone. Therefore, it is important to aspirate bone masses or lytic lesions in the center of the lesion rather than at the periphery. This procedure can generally be done using radiographs and anatomic landmarks to identify the best area. If additional imaging is needed, ultrasound guidance and computed tomography may be beneficial. In one study, using ultrasound guidance, a diagnostic sample was obtained in 32 of 36 cases.<sup>4</sup> Computed tomography guidance was also evaluated for bone aspiration; however, this was done in a postmortem

**Table 1**

**Advantages and disadvantages of cytology versus histopathology**

	<b>Cytology</b>	<b>Histopathology</b>
Expense and equipment	Inexpensive, minimal equipment needed	More expensive than cytology, specialized equipment needed
Effect on patient	Minimally invasive, minimal risk of complications, sedation may not be required	Sedation required, risk of possible infection or fracture at biopsy site
Diagnostic quality	Can be excellent but risk of low cellular sample or aspiration of reactive bone rather than primary lesion	Can be a very specific diagnosis, but if sample size is too small, may not be enough architecture or cellular product for specific diagnosis
Turnaround time	Can be quick, within 24 h	Decalcification of sample may be required, which could delay results by 1–2 d

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