*Section A-Research paper*

# Brief Notes on Solitary Bone Tumor Imaging Reporting And Data System (BTI-RADS)

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**Article History:** Received 10th June, Accepted 5th July, published online 10th July 2023

**Abstract**

**Background:** Primary bone tumors are uncommon and this has certainly contributed to the scarcity of data about their relative frequency, and to the limited understanding of the risk factors. Overall, bone sarcomas account for 0.2% of all malignancies, and the adjusted incidence rate for all bone and joint malignancies is 0.9 per 100,000 persons per year, while the 5-year overall survival rate is 67.9% .Although the incidence of benign bone tumors is higher than the incidence of primary malignant tumors, it is likely that benign lesions are underestimated because they often are asymptomatic and not clinically recognized. In addition, primary bone tumors are outnumbered by metastases from carcinomas, melanoma, or hematologic malignancies, such as plasmacytoma. Imaging characterization of focal bone lesions can be challenging. Focal bone lesions have a broad differential diagnosis, including benign and malignant neoplasms, metabolic disorders, degenerative changes, and tumor-like conditions . The accurate differentiation between benign and malignant bone tumors is paramount for optimal patient management, with a considerable impact on prognosis and survival rates. The relapse-free survival of sarcoma patients is significantly better when treatment is guided by a multidisciplinary committee

**Keywords:** Solitary Bone Tumor Imaging Reporting And Data System

## Introduction

Imaging characterization of focal bone lesions can be challenging. Primary bone sarcomas are rare, representing 0.2% of all malignancies occurring at a rate estimated to be one-tenth of that of soft tissue sarcomas [1]. Focal bone lesions have a broad differential diagnosis, including benign and malignant neoplasms, metabolic disorders, degenerative changes, and tumor-like conditions. The accurate differentiation between benign and malignant bone tumors is paramount for optimal patient management, with a considerable impact on prognosis and survival rates. The relapse-free survival of sarcoma patients is significantly better when treatment is guided by a multidisciplinary oncologic committee [2]. Furthermore, surgical treatment in reference centers reduces the risk of recurrence and death [3].

Due to the rarity of primary malignant bone neoplasms and the varied imaging presentation of focal bone lesions, radiologists outside oncology centers tend to have little experience in reporting this type of anomaly. Thus, imaging reports might be unclear and misleading, increasing the risk of misdiagnosis

and suboptimal patient management [4]. Previous studies have extensively addressed specific imaging features of bone tumors [5,6,7,8], and a systematic approach to bone tumor evaluation has been recommended [9,10]. However, there is little information on how to combine these imaging findings and on which are the most pertinent for lesion characterization. We hypothesize that a systematic multimodality analysis of focal bone lesions would allow the identification of the most relevant criteria for the differentiation between non-aggressive (benign) and aggressive (malignant) lesions with a potential impact on patient management.

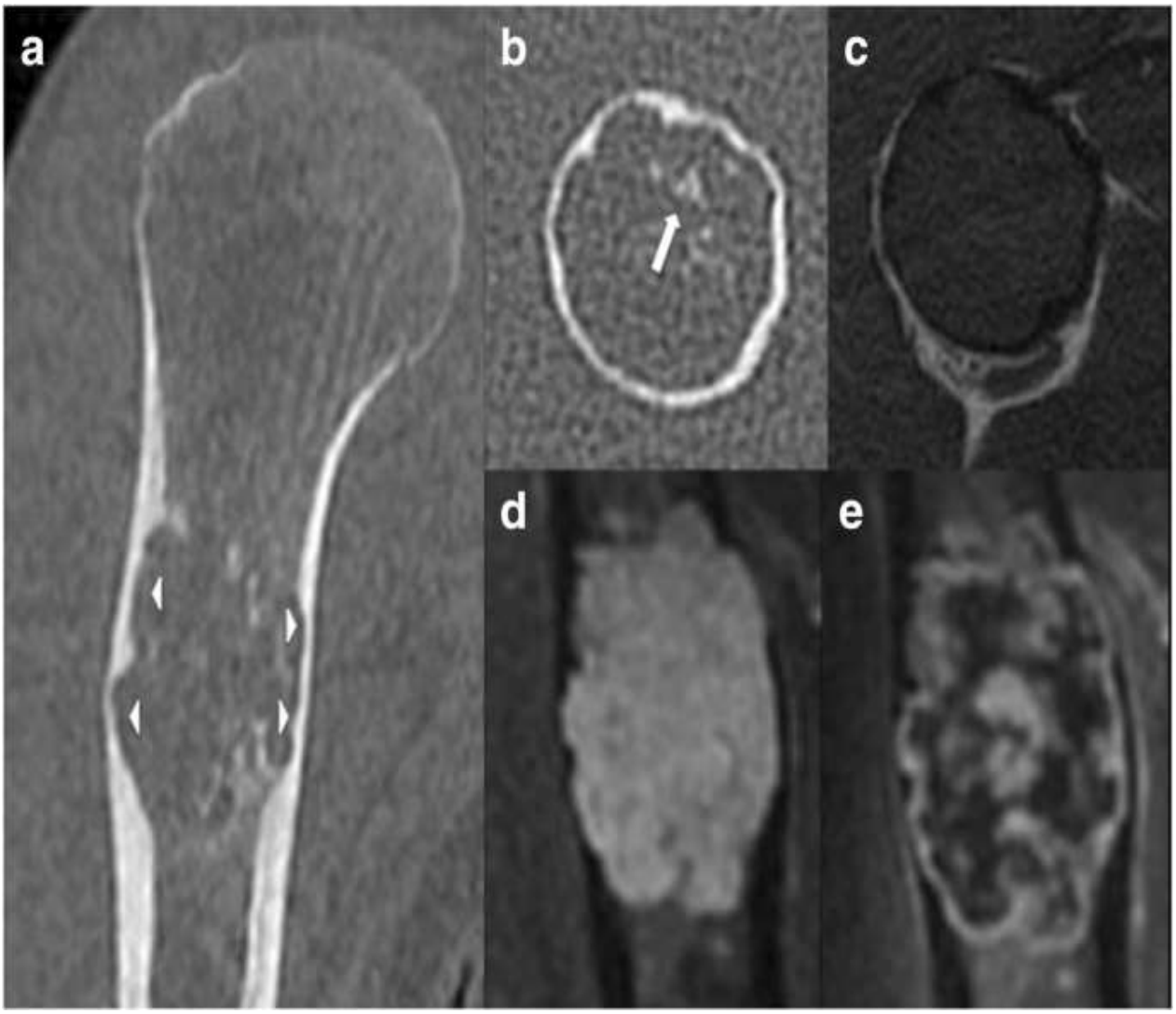


Figure 1: Example of chondrosarcoma grade I classified as BTI-RADS II. Chondrosarcoma grade I in the right proximal humeral diaphysis in a 26-year-old patient with history of pain. Coronal reconstructed (a) and axial (b) non-enhanced CT of the proximal right humerus show a solitary, intramedullary centered, osteolytic, and well-defined 40-mm bone lesion, with a narrow transitional zone and endosteal scalloping (arrowheads in a). Chondral calcification matrix is seen (arrow in b). Axial FSE T1-weighted (c), coronal FSE T2-weighted fat-saturated (d), and FSE T1-weighted fat-saturated contrast-enhanced (e) reveal a lobulated-shaped intramedullary lesion with internal zones of contrast enhancement and no soft tissue component. The application of the established criteria classified this lesion as BTI-RADS II, presenting two benign indicators (*Lodwick-Madewell grade I* and *no soft*

*tissue invasion*) and one minor malignant indicator (*intramedullary centered transverse location*)

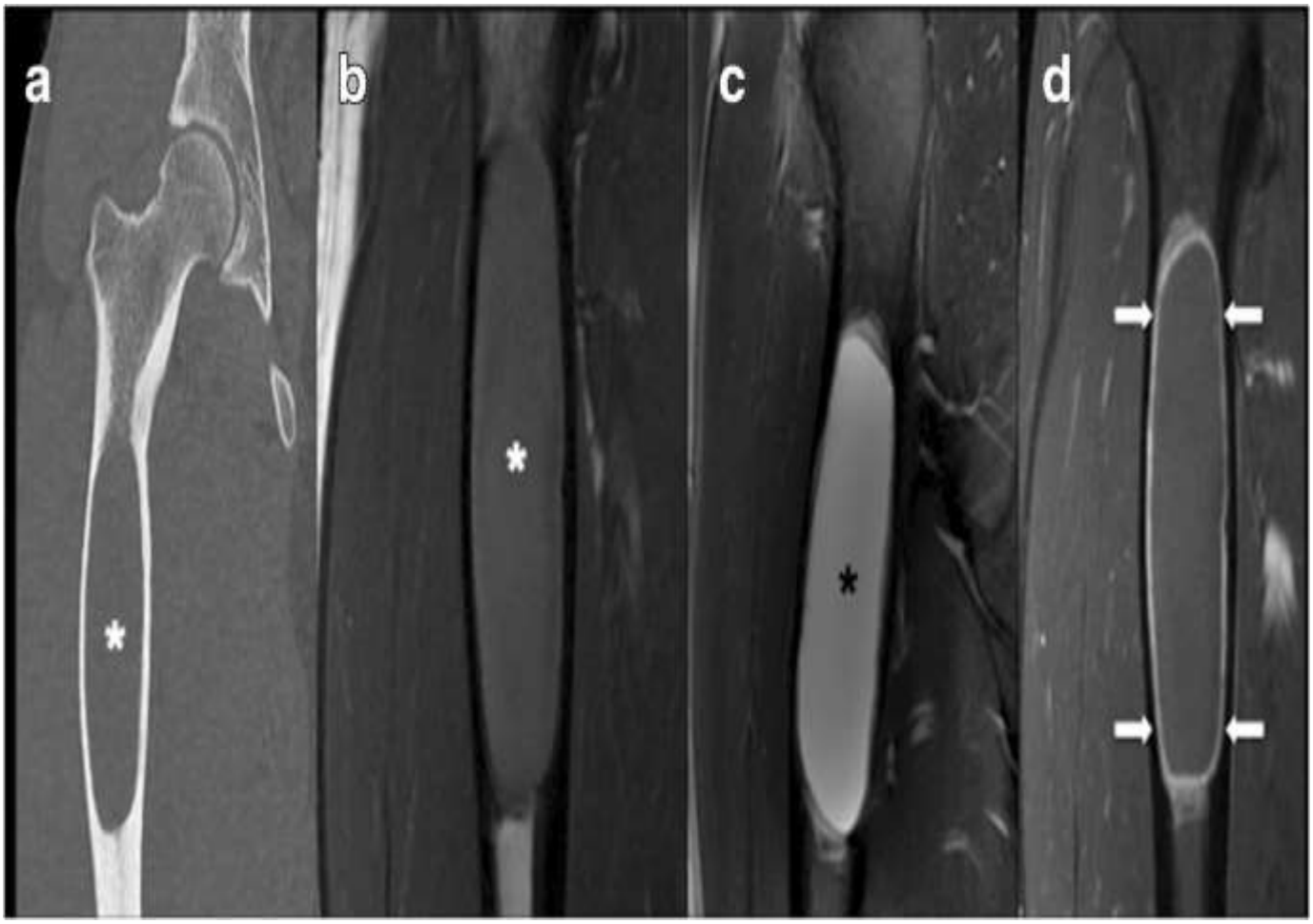


Figure 2: Example of "do not touch" lesion classified as BTI-RADS III. Incidentally discovered simple bone cyst ("do not touch" lesion) in the right proximal femoral diaphysis in a 29-year-old male without relevant clinical history. Coronal reconstructed non-enhanced CT of the proximal right femur (a) shows a 110-mm oval, well-defined, intramedullary centered osteolytic lesion with a narrow zone of transition (*). Coronal FSE T1-weighted (b), sagittal FSE T2-weighted fat-saturated (c), and coronal FSE T1-weighted fat-saturated contrast-enhanced (d) confirm the liquid matrix (* in b and c) with peripheral contrast enhancement (arrows in d). The application of the established criteria classified this lesion as BTI-RADS III, presenting four benign indicators (*oval shape*, *Lodwick-Madewell grade I*, *no contrast enhancement*, and *no soft tissue invasion*) and two minor malignant indicators (*size* and *intramedullary centered transverse location*)

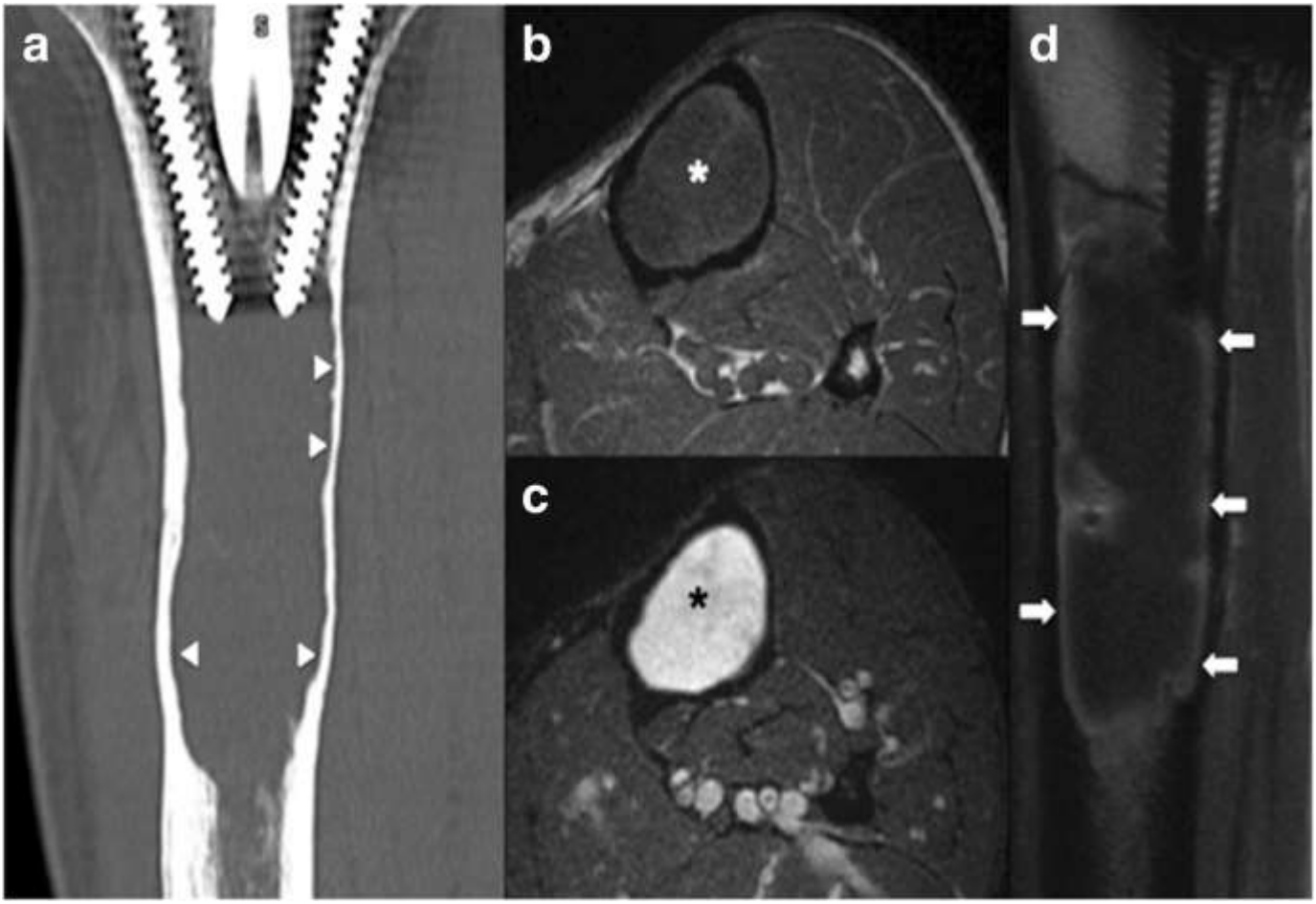


Figure 3: Example of "do not touch" lesion classified as BTI-RADS IV. Osteolytic bone lesion discovered in a 75-year-old male with right leg pain and a 3-year history of knee arthroplasty surgery. Coronal reconstructed non-enhanced CT of proximal right tibia (a) shows an osteolytic intramedullary bone lesion with asymmetrical endosteal scalloping (arrowheads). Axial FSE T1-weighted (b), axial FSE T2-weighted fat-saturated (c), and sagittal T1-weighted fat-saturated contrast-enhanced (d) confirm a lobulated intramedullary centered lesion with a liquid matrix (* in b and c) and a peripheral contrast enhancement (arrows in d). The application of the established criteria classified this lesion as BTI-RADS IV, presenting two benign indicators (*no contrast enhancement* and *no soft tissue invasion*) and three minor malignant indicators (*age*, *size*, and *intramedullary centered transverse location*). The final histologic diagnosis was that of a hemorrhagic bone cyst

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