Original Research Paper

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Radiology

UNVEILING THE MAGNETIC RESONANCE ENIGMA: DECODING DISTINCTIVE IMAGING FEATURES IN OSTEOFIBROUS DYSPLASIA, FIBROUS DYSPLASIA, AND NONOSSIFYING FIBROMA ACROSS LONG BONES

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ABSTRACT **Background & Objectives:** The distinctive magnetic resonance imaging (MRI) characteristics associated with osteofibrous. The purpose of this study is to distinguish between OFD, FD, and NOF in long bones using MRI characteristics.

KEYWORDS : MRI - Osteofibrous dysplasia - Fibrous dysplasia - Nonossifying fibroma

INTRODUCTION

The distinctive magnetic resonance imaging (MRI) characteristics associated with osteofibrous dysplasia (OFD), fibrous dysplasia (FD), and nonossifying fibroma (NOF) remain unclear.

Navigating the intricacies of musculoskeletal imaging, this research endeavors to decipher the magnetic resonance enigma associated with osteofibrous dysplasia, fibrous dysplasia, and nonossifying fibroma—a trio of distinct pathologies impacting long bones.

Through a comprehensive analysis of imaging features, the study aims to refine diagnostic approaches and therapeutic interventions, shedding light on the nuanced characteristics exhibited by these bone disorders across diverse clinical presentations.

AIMS AND OBJECTIVES

This study aims to identify and differentiate the MRI features among OFD, FD, and NOF in long bones

MATERIALS AND METHODS

Study Area: Department of Radiology, Dr.Kailash Narayan Singh Memorial Institute of Medical Sciences, Barabanki, Uttar pradesh

Study Type: Retrospective Study

Sample Size: 26

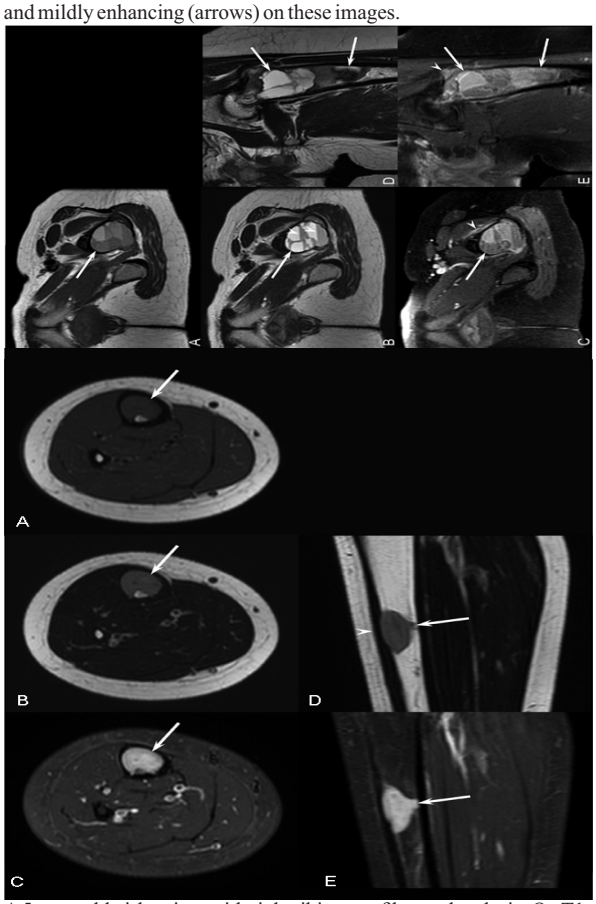
METHOD

Informed consent was taken because of the retrospective nature of this study. Using the electronic medical chart system of our university hospital, we searched for patients with histopathologically confirmed OFD, FD, and NOF of the long bone who underwent preoperative MRI between January 2023 and December 2023.

This study included 26 patients including 6 OFD, 7 with FD, and 13 with NOF of the long bone.

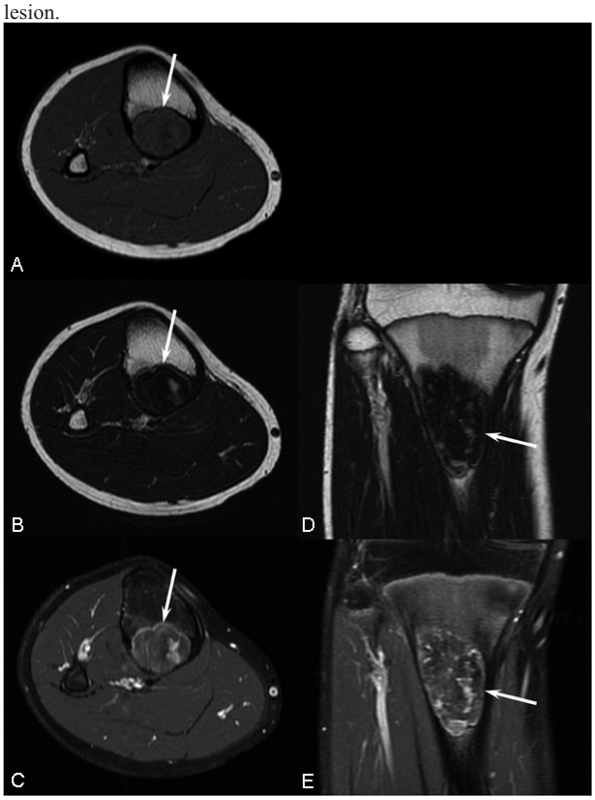
All patients underwent preoperative MRI and histological examination. We retrospectively reviewed the MRIs and compared the imaging findings among the three pathologies

A woman, 27, whose left femur has fibrous dysplasia. Using fat-suppressed contrast-enhanced T1-weighted images (C/E), a multi-loculated, cystic, heterogeneous lesion appears hyperintense (arrow) on T1-weighted image (A), hypo- to hyperintense (arrows) on T2-weighted images (B/D) with fluid-fluid level formations (arrowheads), and mildly enhancing (arrows) on these images.



A 5-year-old girl patient with right tibia osteofibrous dysplasia. On T1-weighted image (A), mildly hyperintense (arrows) on T2-weighted

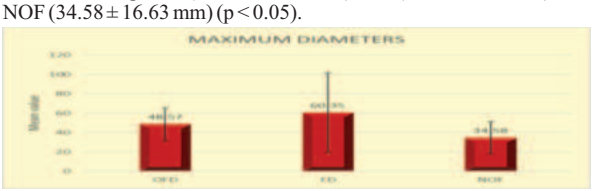
images (B/D) with cortical thinning (arrowhead), and intensely enhancing (arrows) on fat-suppressed contrast-enhanced T1-weighted images (C/E) are images of a well-demarcated, eccentric, homogenous lesion.



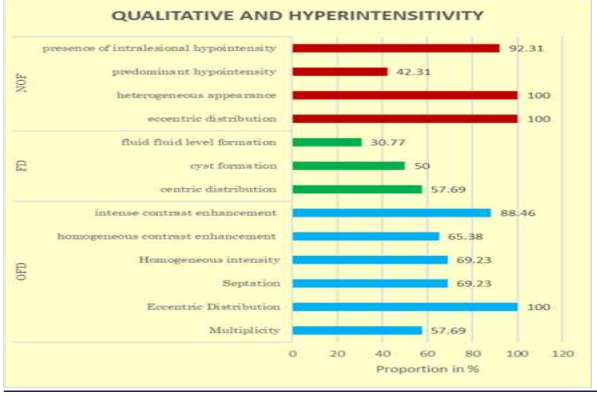
A 12-year-old boy with a right tibia Non ossifying fibroma. Using magnetic resonance imaging, a well-defined, eccentric, homogeneous lesion can be seen on T1-weighted images (A) that are isointense (arrow), primarily hypointense (arrows) on T2-weighted images (B/D) with a hypointense rim, and mildly enhancing (arrows) on T1-weighted images (C/E) that are fat-suppressed convolutionally enhanced.

RESULT

Statistical analysis revealed noteworthy distinctions in the maximum diameter among OFD (48.57 ± 17.24 mm), FD (60.35 ± 41.0 mm), and NOF (34.58 ± 16.63 mm) ($p < 0.05$).



Various imaging features exhibited significant differences among these entities. OFD exhibited higher frequencies of multiplicity (57.69%, $p < 0.01$), eccentric distribution (100%, $p < 0.05$), septation (69.23%, $p < 0.01$), homogeneous intensity on T2-weighted images (69.23%, $p < 0.01$), homogeneous contrast enhancement (65.38%, $p < 0.05$), and intense contrast enhancement (88.46%, $p < 0.01$).



FD, on the other hand, demonstrated higher frequencies of centric distribution (57.69%, $p < 0.01$), cyst formation (50%, $p < 0.01$), and fluid-fluid level formation (30.77%, $p < 0.01$).

NOF presented with significantly higher frequencies of eccentric distribution (100%, $p < 0.01$), heterogeneous appearance on T2-weighted images (100%, $p < 0.01$), predominant hypointensity on T2-weighted images (42.31%, $p < 0.01$), and the presence of intralesional hypointensity on T2-weighted images (92.31%, $p < 0.01$)

DISCUSSION

OFD is typically an intracortical, well-marginated, lytic lesion with variable degrees of osteolysis and osteosclerosis and often with sclerotic margins.[8] [9] [10] OFD can present with a ground-glass appearance.[8] Scattered patchy sclerotic areas are often present within the lesion.[11] Osteolysis may present as a single focus, multiple bubble-like, or elongated linear foci interspersed with reactive bone [10].

According to a histopathological study, secondary changes such as hyalinization, hemorrhage, xanthomatous reaction, and cystic change were observed in only two of 20 (10%) OFD cases.[12] Because pathological secondary changes are rare in OFD, MRI features of OFD must depend on the amount and degree of fibroblast-like spindle cells, fibrous stroma, and bone trabeculae (woven bone) if pathological fracture does not occur. Although we believe that OFD usually exhibits homogeneous signal intensity on T2-weighted images and homogeneous contrast enhancement on contrast-enhanced T1-weighted images, further investigation is needed. In addition, a study has reported that all 24 (100%) OFD cases exhibited diffuse and intense enhancement on contrast-enhanced T1-weighted images, as with our results (intense contrast enhancement, 88%).[2]

The radiological features of FD can be classified into three primary bony patterns: cystic, sclerotic, and mixed. FD typically appears as a radiolucent ground glass matrix, which is usually smooth and homogeneous, not centrally located within the medullary bone.[6] Although endosteal scalloping and cortical thinning may be present, a smooth outer cortical contour is always maintained. A thick layer of sclerotic bone is known as a rind sign.[6] The sclerotic margins can vary in thickness and may be interrupted or incomplete. MRI features of FD are usually nonspecific and variable and thus indicate that the diagnosis of FD cannot be based on MRI alone.[5] On T2-weighted sequences, FD displays variable signal intensities, consistent with the amount of degree of fibrous tissue, bone formation, and cystic or hemorrhagic changes.[3] [13] [14] Recently, a cloudy pattern on contrast-enhanced T1-weighted images has been reported as milk cloud appearance.[4]

NOF is typically an eccentric, well-delineated, multi or uniloculated, radiolucent lesion with sclerotic margins that are usually scalloped and slightly expansile.[7] The external outline of the cortical layer at the level of the lesion may be poorly visible or completely invisible.[15] MRI features of NOF depend on the relative amounts of hypercellular fibrous tissue, collagen, foamy histiocytes, hemorrhage, hemosiderin, and bone trabeculae.[7] Hypointense regions on T1- and T2-weighted images, which are characteristic MRI features of NOF and were observed in 15 of 19 (79%) NOF cases, have been correlated pathologically with hemosiderin and fibrous tissue elements.[7]

LIMITATIONS

This study had several limitations. First, this was a single-center retrospective analysis. Second, the cohort size was relatively small. Third, the management of OFD is usually consists of conservative measures, involving observation until the bone stops growing (skeletal maturity). The management of FD, including observation, conservative surgery, and radical surgical excision and reconstruction, depends on the age of the patient, growth rate, extent and location of the lesion, cosmetic deformity, and functional impairment. NOF is regarded as a "do not touch" lesion. Therefore, selection bias was definitely present because most of histologically proven cases included in this study were symptomatic and did not undergo surgery until they were symptomatic. Fourth, MRI findings were acquired with three different MRI scanners due to the retrospective nature .

CONCLUSION

The study delineates distinct MRI features among OFD, FD, and NOF in long bones. Significantly varying characteristics, including maximum diameter, multiplicity, distribution patterns, septation, and

contrast enhancement, were identified, providing valuable insights for accurate differentiation.

These findings underscore the importance of MRI in distinguishing these entities, aiding clinicians in precise diagnosis and informed treatment decisions for patients with bone lesions.

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