ID: IJARS/2015/10739:2040

Postgraduate Education

Radiology Section

Imaging of Osteochondromas Suspected of Malignant Transformation

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ABSTRACT

Osteochondroma is regarded as the most common benign osseous neoplasm, which is a developmental anomaly, rather than a true neoplasm. Findings such as increase in size of a previously stable osteochondroma, irregular or indistinct margins, development of areas of lysis or erosions, or a soft tissue mass with or without foci of calcifications on radiography or Computed Tomography (CT) are suggestive of malignant transformation. Magnetic Resonance Imaging (MRI) is useful in demonstrating pressure effects on adjacent soft tissues and in detection and characterization of cartilaginous cap, which when measures more than 2cm in thickness is highly suggestive of malignant transformation.

Keywords: Bone, Cartilaginous cap, Exostosis, Malignant tumour

INTRODUCTION

Osteochondroma is the most common benign osseous neoplasm. It may occur as a single or multiple lesions, the latter as a hereditary syndrome [1].

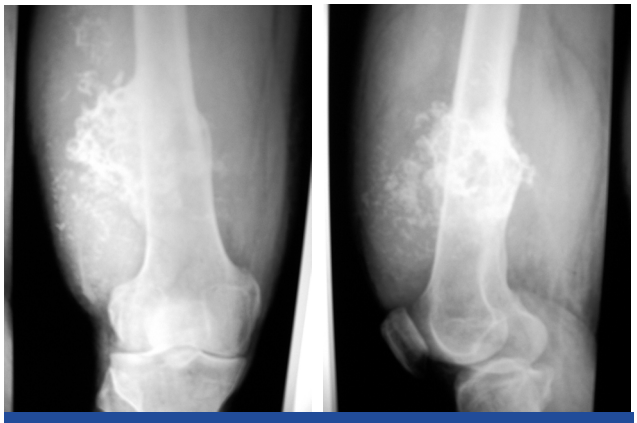
It represents 10-15% of all osseous neoplasms and 50% of all benign lesions. It is a developmental anomaly rather than a true neoplasm. The lesion comprises of cortical and medullary bone, which is in direct continuity with the parent bone and is covered by a hyaline cartilaginous cap. The age of presentation may be anywhere from 2 to 60 years, but the most common age at presentation is 11-20 years [2]. There is no sex predilection in case of solitary osteochondromas. However, Hereditary Multiple Exostosis (HMO) syndrome commonly affects males than females and Caucasians are the most common race affected, approximately 0.9-2 individuals per 100,000 of population. 65% of the affected individuals have family members with autosomal dominant transmission of HMO genes [3]. The long bones around the knee joint are most common sites of involvement. Among flat bones, ilium and scapula are commonly involved.

The common complications include cosmetic or osseous deformity, fracture, neurovascular compromise, bursa formation and malignant transformation [4]. Malignant transformation is the most serious and feared complication, occurring in approximately 1% of the solitary lesions and 3-5% of cases of HME.Chondrosarcoma arising from the cartilaginous cap is the reason for malignant transformation. Pain, swelling and enlargement of osteochondromas after skeletal maturity must be viewed with suspicion [5,6]. In majority of cases there is development of secondary chondosarcoma, however rare cases of secondary osteosarcoma have been reported [7]. Malignant degeneration of osteochondromas comprise of 8% of all chondrosarcomas.

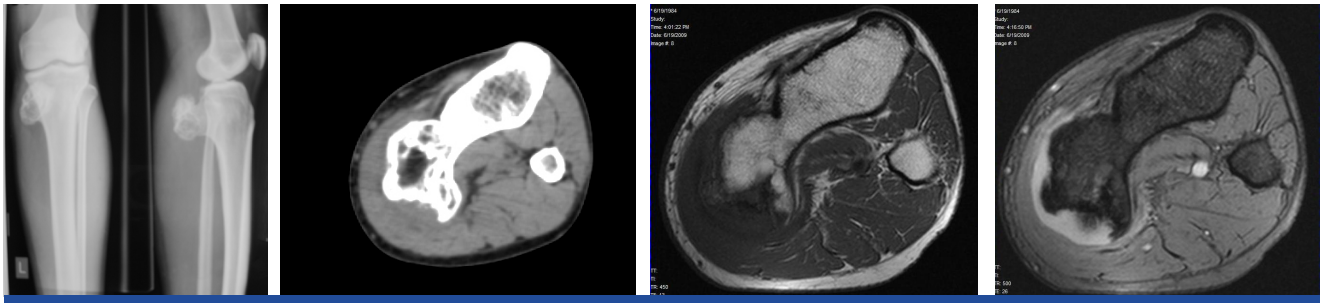
Radiological features [Table/Fig-1]: Radiographic features include increase in size of a previously stable osteochondroma

Thick, bulky cartilaginous cap (>2 cm).
Development of a soft tissue mass with or without soft tissue calcifications.
Dispersed calcifications within the cartilaginous cap.
Bone destruction.
Altered appearance on sequential studies.

[Table/Fig-1]: Radiological features of malignant transformation



[Table/Fig-2]: Plain radiographs (A,B) in frontal and lateral views showing the bony exostosis with multiple calcifications and soft tissue swelling



[Table/Fig-3]: Plain radiographs showing osteochondroma arising from the posterior surface of proximal tibia (A), CT shows the exostosis surrounded by a hypodense cartilaginous cap (B). T1w spin echo and T2 gradient axial images (C,D) showing the bony exostosis and a 10mm thick cartilaginous cap, which is hypointense on T1 and hyperintense on T2W images

[Table/Fig-4]: T1W and T2W axial images (A,B) showing the bony exostosis surrounded by a 6cm thick, multilobulated cartilaginous cap seen as an area of high signal on T2W images, suggestive of malignant degeneration. Sagittal and coronal (C,D) images showing the full extent of the exostosis and the cartilaginous cap

in a patient with mature skeleton, irregular or indistinct margins, development of areas of lysis or erosions within the lesion, development of a surrounding soft tissue mass with or without foci of calcifications [Table/Fig-2].

Computed tomography is useful in detection of the lesion, its extent, soft tissue evaluation and has the advantage of superior detection of small fractures, fine calcific foci. It is also useful in detection of the cartilaginous cap, most prominently the mineralized portion of it [4,8]. However, some studies revealed that Computed Tomography (CT) is not reliable in depicting cartilaginous caps measuring less than 2.5 cms [9]. Though ultrasonography can be used for measuring cartilage thickness, it is operator dependent and has poor sensitivity in obese patients and suboptimal utility in evaluating osseous structures [10].

Magnetic Resonance Imaging (MRI) is useful in demonstrating the continuity between the lesion and the native bone. The osseous cortex remains hypointense on pulse sequences and the signal intensity of medulla corresponds to that of yellow marrow [3]. MRI is considered to be the best imaging modality in diagnosing malignant transformation. It detects the pressure effects of the exostosis on adjacent soft tissues because of its superior soft tissue contrast [Table/Fig-3]. Compared to the other modalities discussed above, MRI is most accurate in demonstrating the characteristics of the hyaline cartilaginous cap [11] [Table/Fig-3].

The mineralized foci of the cartilaginous cap remain hypointense on both T1 and T2W sequences, whereas the unmineralized portions because of their high water content appear hypointense on T1W and hyperintense on T2W images [12] [Table/Fig-4]. On post gadolinium images, nodular enhancement of the tumour may be seen [13]. Cartilage cap less than 1cm is considered to be benign, whereas more than 2cm is malignant in nature and must be recommended for resection [Table/Fig-4]. Using 2cm as cut off for differentiating benign from malignant osteochondromas, the sensitivity and specificity for MR imaging was found to be 100 and 98% [14]. Poor visualization of soft tissue calcifications when compared to CT is a known drawback of MRI.

Osteochondromas, especially multiple and hereditary must be on a regular follow-up for malignant transformation. Surgery is the treatment of choice once malignancy is confirmed [15].

CONCLUSION

Osteochondroma is regarded as the most common benign osseous neoplasm and its malignant transformation is considered to be the most serious and feared complication. Plain radiograph and CT are helpful in confirming the presence of osteochondroma and are useful in giving an indication of its extent and signs of probable malignant transformation. MRI is considered to be the best imaging modality in diagnosing malignant transformation. It detects pressure effects of the

exostosis on adjacent soft tissues. Osteochondroma with cartilaginous cap of thickness more than 2cm confirms malignant transformation and must be recommended for resection.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Publishing: **Apr 10, 2015**