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ROLE OF RADIOGRAPHS IN THE EVALUATION OF BENIGN AND MALIGNANT BONE TUMOURS WITH SUSPECTED CLINICAL HISTORY.

Radiodiagnosis

Dr. Jangam Anil Kumar Postgraduate Department of Radio- diagnosis Alluri Sitarama Raju Academy of Medical Sciences Eluru, Andhra Pradesh 534005. India.

Dr. Bhgavalli Venkata Rao Professor Department of Radio- diagnosis Alluri Sitarama Raju Academy of Medical Sciences Eluru, Andhra Pradesh 534005. India.

Dr. Suresh T* Professor Department of Radio- diagnosis Alluri Sitarama Raju Academy of Medical Sciences Eluru, Andhra Pradesh 534005. India. *Corresponding Author

ABSTRACT

OBJECTIVE: The purpose of the study is to evaluate the role of Radiographs in the evaluation of Bone tumours.
MATERIALS AND METHODS: A prospective study was conducted over a period of 18 months (August 2019 to February 2021) on 50 patients aged between 10-80 years who were with clinical suspicion of bone tumours. The bone tumours evaluated Primarily with Radiographs and were correlated with histology.
RESULTS: Out of 50 cases I have studied,12(24%) cases were osteosarcomas , 8(16%) were Ewing's sarcomas,6 (12%) were Osteoclastomas (GCT),6 (12%) were Chondrosarcomas,5 (10%) were Simple bone cysts, 4 (8%) were Aneurysmal bone cysts,3 (6%) were Enchondromas , 2 (4%) were Fibrous dysplasias,2 (4%) were browns tumours,1(2%) was Osteoid osteoma,1(2%)was Multiple myeloma.28 (56%) were malignant,22 (44%) were benign.Cortical destruction noted in 30 (60%) cases.Joint involvement noted in 6 (12%) cases.31 cases were operated 19 were not .
CONCLUSION: Radiographs are very sensitive in detecting Tumour margins, Cortical expansion, periosteal reaction, tumour matrix mineralisation in comparison to MRI .Although MRI and CT provide superior soft tissue assessment and free from structural overlap, the unique information afforded by Radiography is optimal for efficient formation of Initial diagnosis of Bone tumours.

KEYWORDS

INTRODUCTION:
Radiography is the optimal initial imaging modality for evaluating undiagnosed primary bone tumors. Radiograph is 2D image with unique anatomical details. The resulting unique anatomic information allows the efficient evaluation of characteristics such as lesion margins, periosteal reaction, cortical expansion, thinning, and destruction,matrix mineralisation which reflect the biologic activity or growth rate of primary bone tumors. With the proper idea of radiographic features of bone tumours and it's correlation with history any bone tumour can be diagnosed initially which help in management protocol.

AIMS OF STUDY:
- To understand radiographic characteristic features of the margins of bone tumors which reflect biological activity or growth rate of bone tumours[1,2].
- To identify the secondary role of cortical expansion and periosteal reaction, zone of transition in the characterization of bone tumors.
- To correlate the radiographic appearance of mineralized matrix with histologic type.
- To understand the advantages and limitations of radiography in the initial evaluation of bone tumors.

MATERIALS AND METHODS:
- A total number of 50 patients who were referred with a history of bone tumours and fulfilling selection criteria were studied with radiographs over a period of 18 months (August 2019 to February 2021).

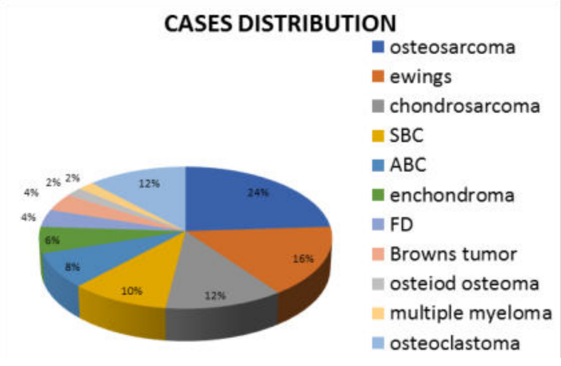
- It was a observational study.

Source of data: Patients referred from orthopaedic department of Alluri Sitarama Raju Academy of Medical Sciences Hospital with a history of bone tumours.

SELECTION CRITERIA:
INCLUSION CRITERION:
Patients with a history of bone tumours.

EXCLUSION CRITERIA:
1. All patients who did not give consent to be a part of the study.
2. Pregnancy and lactating women.

RESULTS:
- In our study, we tried to analyze prospectively the accuracy of Radiographs.
- We studied 50 cases with History of bone tumours. Out of them 12 cases were osteosarcomas, 8 were Ewing's sarcomas, 6 were Osteoclastomas (GCT),6 were Chondrosarcomas,5 were Simple bone cysts, 4 were Aneurysmal bone cysts,3 were Enchondromas , 2 were Fibrous dysplasias,2 were browns tumours,1 was Osteoid osteoma,1 was Multiple myeloma.
- The common clinical symptoms were pain in the region of tumour and swelling.
- All the patients were investigated with plain radiographs and MRI and were confirmed with gross surgical and histopathological findings.



There were 28 males and 22 females involved in our study.
- 28 (56%) were proven malignant,22 (44%) were benign.
- Cortical destruction was noted in 30 (60%) cases,but not seen in 20 (40%) cases.
- Joint involvement was noted in 6 (12%) cases.
- 31 cases were operated 19 were not due to distant metastasis.
- Most common malignant bone tumour in my study is osteosarcoma.Where as most common benign tumour is simple bone cyst.

Imaging Technique
- Radiographs are recommended as the initial imaging modality for the evaluation of bone pain3,4, and standard radiographic techniques are typically adequate for tumour imaging.
- The long bones should be imaged with frontal and lateral views,

whereas joint imaging benefits from the addition of oblique views. Rib imaging should also include oblique views.

- Radiography is limited in areas that are susceptible to large amounts of anatomic overlap and complex bony structures, such as the posterior iliac bones, acetabula, and the spine.
- CT with multiplanar reformations can be considered in those areas, and MRI is appropriate for determining the local extent of disease.

Case 1:

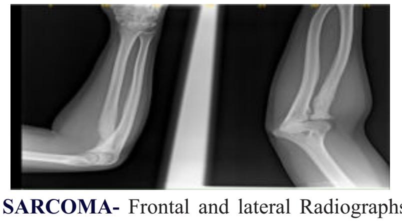
Gaint cell tumour –frontal Radiograph of knee joint of 51 year old man showing Ill defined eccentric radiolucent lesion with no sclerotic rim noted involving distal end of femur.

The lesion is showing broad zone of transition.
There is no matrix mineralisation within the lesion, cortex is thinned out and expanded showing few areas of discontinuity .

There is no periosteal reaction associated with the lesion.
The lesion is located in metaphysis and epiphysis of distal femur with involvement of tibio femoral joint space.

These features favouring a aggressive type of bone lesion.
Taking considering of all these radiographic features it is probably osteoclastoma on further correlation with histology the lesion was proven to be a Gaint cell tumour .

Case 2:



EWINGS SARCOMA- Frontal and lateral Radiographs of elbow with both bones of forearm of a 18 year old man showing evidence of Ill defined osteosclerotic lesion noted in proximal metadiaphyseal region of radius.

Which is showing wide zone of transition, intramedullarysclerosis, lamellated type of periosteal reaction, permeative type of bone destruction.

Small soft tissue component is noted adjacent to the lesion in the proximal metadiaphyseal region of radius.

These aggressive features of bone lesion suggesting a malignant type of bone lesion, most likely Ewings sarcoma.

On further correlation with histology it was proven as Ewings sarcoma.

Case 3:

OSTEOSARCOMA- Frontal Radiograph of right knee joint of a 17 years old female showing Illdefined osteosclerotic lesion noted involving proximal tibia.

The lesion is showing wide zone of transition , Matrix mineralisation is cloudy or ivory which is osteoid type.

Codman triangle type of periosteal reaction is seen along the lesion.
There is also a huge soft tissue component is seen adjacent to bony lesion with epicentre predominantly arising from intramedullary location noted in the proximal meta diaphyseal region of tibia.

These features favouring a malignant type of bony lesion.
Correlation with age,location and radiographic features it is most probably osteosarcoma of conventional type.

On further correlation with histology the lesion was proven to be conventional type of osteosarcoma.

Case 4:

OSTEOID OSTEOMA-
Frontal Radiograph of left knee joint of a patient aged 17 years who came with a chief complaint of knee pain which is increasing during nights. patient using NSAIDS for the relief of pain which is showing good response.

There is evidence of well defined osteolytic lesion with sclerotic rim noted in the proximal tibial meta-diaphyseal junction. central focal osteoid type of matrix mineralisation is noted.

zone of transition is narrow type.
solid type of periosteal reaction noted adjacent to the lesion on medial surface of tibia.

The epicentre of the lesion is noted in the cortex of proximal tibia.
There is no evidence of adjacent soft tissue component.

All these features favouring benign type of bone lesion.
Correlating patient history and radiographic features the lesion is most probably osteoid osteoma.

Later these findings were correlated with histology and the report came out as osteoid osteoma.

DISCUSSION:

- Imaging features which help in delineating bone tumours are initially type of lesion whether it is radiolucent or sclerotic
- Margins are used only for radiolucent lesions as sclerotic lesions are already well bordered.Lodwick classification used for margins of lesion[5].
- If there is a sclerotic margin for a radiolucent lesion it is geographic type 1 A type of bone destruction which is mostly benign (ex-.fibrous cortical defect, fibrous dysplasia, nonossifying fibroma/ fibroxanthoma).
- Lesions with type IB margins have no sclerotic rim, while remaining well defined with a narrow zone of transition. These margins indicate indeterminate biologic potential and may be seen with benign or malignant lesions (e.g., giant cell tumor, aneurysmal bone cyst, aggressive osteoblastoma, and low-grade chondrosarcoma).
- Type IC margins are ill defined and indistinct, with a wide zone of transition, corresponding to aggressive bone tumors. Most tumors with type IC margins are malignant, such as small/early chondrosarcomas or osteosarcomas. Aggressive benign lesions, such as giant cell tumors, can also show this appearance.
- The type II margin is described as moth-eaten and is composed of numerous foci of osteolysis that vary in size usually more than 2mm and shape on a background of relatively intact cortex.
- The type III margin corresponds to the most highly aggressive appearance and is described as permeative and is composed of numerous foci of osteolysis that are usually less than 2 mm in size.
- The margin types can be intermingled. Margins are the interface of the tumor with the bone and therefore are typically the most

sensitive radiographic indicator of lesion behavior.

- moth eaten and permeative type of bone destructions are usually malignant.
- The zone of transition is the most reliable indicator in determining whether an osteolytic lesion is benign or malignant.
- If a lesion margins are clearly delineated by drawing around it , it is showing narrow zone of transition so it is benign.
- If a lesion is not delineated it is showing wide zone of transition so it is malignant type of bone lesion .
- Periosteal reactions help us differentiating benign from malignant type of bone lesions[6] .solid type of periosteal reaction is usually benign. lamellated is intermediate type of aggressive periosteal reaction, codmanns triangle, sunburst are very aggressive type of periosteal reactions.
- Matrix mineralisation help us differentiating osteogenic tumours from chondrogenic tumours.lesions with matrix calcification in the form of ivory or cloudy it is osteogenic tumour.If it is showing ring and arc or stippled type of matrix mineralisation it is chondrogenic tumour[7].
- Cortical expansion is most commonly seen with benign tumors that grow slowly enough to allow the cortex to remain completely or partially intact. Although not all bone tumors expand the cortex, the degree of cortical expansion, when present, is reflective of the growth rate of the lesion. With a number of notable exceptions, such as low-grade chondrosarcoma and some metastases (e.g., renal cell and thyroid carcinoma), malignancies are more likely to progress rapidly and destroy rather than expand the cortex.
- Lesions that produce mild cortical expansion are typically well marginated and show IA margins (e.g., fibrous cortical defect, fibrous dysplasia).
- Lesions that produce a larger degree of cortical expansion are more likely to predispose to pathologic fracture (e.g., nonossifying fibromas/fibroxanthomas, unicameral bone cyst. Lesions that exhibit a marked degree of cortical expansion can produce severe local bone deformity or destruction, even if benign. For example, an aneurysmal bone cyst may grow across open physes, predisposing the patient to limb length discrepancy, and giant cell tumor may destroy the articular surface of bone, leading to the need for arthroplasty.

ADVANTAGES:

- The main advantages of radiography over CT and MRI include affordability, accessibility, and a concise method by which to assess the lesion on a limited number of images.
- It can be argued that cross-sectional imaging, even with reformations, cannot reproduce the perceived quality of depth that results from collapsing a 3D structure onto a 2D image.
- The margin classification system described in this study is designed primarily for use with radiography.

LIMITATIONS:

- Limitations of radiography include anatomic overlap that can obscure abnormalities and a limited capacity to evaluate soft tissue.
- Although mass effect may be detected on radiographs, they are limited for determining the degree of extraosseous tumor volume, relationship of extraosseous tumor to surrounding structures, and extent of disease in the intact marrow cavity.
- MRI is the modality of choice for simultaneously evaluating these relationships[8,9,10].
- Other considerations include lower sensitivity for the detection of mineralized matrix when compared with CT or for the detection of undisplaced fracture when compared with CT or MRI.

CONCLUSION:

- Radiography helps in evaluation of the margins which is the greatest contributing factor to assessment of the biologic potential of the lesions.
- Other features, such as cortical expansion and periosteal reaction, provide additional clues as to whether immediate biopsy is indicated or not.
- Identification of mineralized matrix may help to non invasively identify histologic type.
- Although the unique information afforded by radiography is optimal for the efficient formation of an initial differential diagnosis of primary bone tumors MRI is best in detecting intramedullary extension of tumour, neuro vascular and other soft tissue involvement.

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