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Original Research Paper

Radiodiagnosis

COMPUTED TOMOGRAPHY IN EVALUATION OF MUSCULOSKELETAL TUMOURS

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ABSTRACT

BACKGROUND: musculoskeletal tumors requires a multimodality approach for diagnosis,management and follow-up. It includes radiography, computed tomography (CT), magnetic resonance imaging (MRI),ultrasonography ,PET-CT scan

OBJECTIVE : To evaluate the effectivness of CT in accuracy of diagnosis and management of musculoskeletal tumors.

METHODS: Prospective stuy of bone and soft-tissue tumors with radiography and CT scan .

RESULTS: 40 cases was studied out of which 30 cases of bone tumours and 10 cases of soft –tissue tumours , including both benign and malignant masses.

CONCLUSIONS: Conventional radiography and CT scan imaging techniques can provide noninvasive methods to diagnosis, evaluation and surgical managements musculoskeletal tumors.

KEYWORDS :

INTRODUCTION

In the nearly 100 year since Withelm Conrad Roentgen discovered the X-ray, physicians have been intrigued by the radiographic appearance of musculoskeletal tumours.The five basic edicts – essential to accurate diagnosis – remain much the same, and are : Age of the patient , involved bone, the area of the bone involved, appearance of lesion and adjacent soft-tissues (35)

Computed Tomography serves as greater tissue contrast resolution, depict cross-sectional anatomy, detecting / characterizing bone destruction and soft tissue involvement in complex anatomy.

The usefulness of Computed Tomography in diagnosing the lesion and best treatment option may be made available to the patient.

MATERIALS AND METHODS

The present study was conducted in the tertiary medical institute over period two year duration.All clinically suspected patients of musculoskeletal tumours were taken up for roentenological and CT evaluation. Patients of all ages and both sexes attending the outdoor clinics or admitted in the wards were the subjects of this study.

Computed Tomography was performed in all patients and obtained at 5-10 mm intervals. It was ensured that at least one scan above and one scan below must be normal. Intravenous contrast was administered all patients.

Most patients had histological confirmation.
The reviewed scans were evaluated for the following information:-

1 Presence of lesion
2. Maximum tumour dimensions.
3. Pattern of cortical transgression
4. Characeristics of soft tissue lesions
5. Relationship of tumour to major neurovascular structures:
6. Involvement epiphyseal plate, epiphysis and joint
7. Staging of the tumours
8. Effect on patient's management.

RESULTS AND OBSERVATIONS

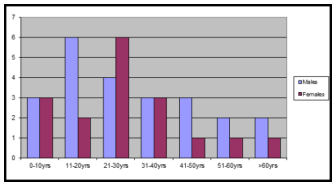
A total of 40 selected patient (30 bone & 10 soft tissue lesions) with clinical suspicion of musculoskeletal neoplasms were included in the present study.

TABLE I : AGE AND SEX DISTRIBUTION

Sl. No.	Age in years	Males	Females	Total number	% age
1	0-10	3	3	6	15%
2	11-20	6	2	8	20%
3	21-30	4	6	10	25%
4	31-40	3	3	6	15%
5	41-50	3	1	5	12.5%
6	51-60	2	1	3	7.5%
7	>61	2	1	3	7.5%
total		23	17		

The age of these patients ranged from 1yr7mon to 82 yrs.The maximum number of patients third decade (25%) followed by second (20%) .The male: female ratio being 3:2.

AGE AND SEX DISTRIBUTION



SEX DISTRIBUTION

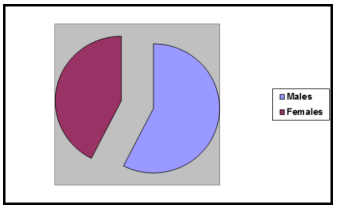


TABLE II: MODE OF PRESENTATION

Symptoms	No. of patients	Percentage
BONE LESIONS (30)		
Pain	30	100%
Swelling	26	86.6%
Restricted mobility	9	30%
SOFT TISSUE LESIONS (10)		
Painless swelling	4	40%
Swelling f/b pain	2	20%
Pain f/b swelling	4	40%
Restricted mobility	1	10%

Among bone lesions pain was the most common presenting and Among soft tissue lesions, swelling .

The most common clinical sign was swelling (90%).

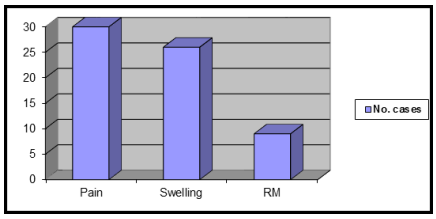


TABLE III DURATION OF ILLNESS

DURATION OF ILLNESS	NO. OF PATIENTS	PERCENTAGE
0 – 3 months	1	2.5%
4 – 6 months	13	13.25%
7 – 12 months	21	50.25%
13 – 24 months	3	7.5%
25 – 36 months	2	5.0%

The maximum duration of illness was 2.5 years seen in a patient with haematoma and minimum was 2-3 month in a child diagnosed to have Ewing's sarcoma.

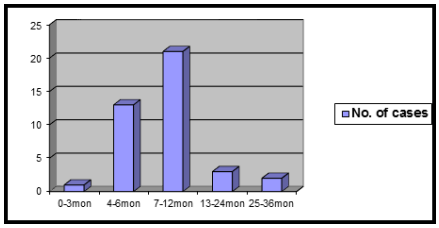


TABLE IV : ANATOMICAL DISTRIBUTION OF LESIONS BONE LESIONS

Long bones (56.6%)			Flat bones (26.6%)		
	No. of cases	Percentage		No. of cases	Percentage
Femur	9	30	Scapula	1	3.3
Tibia	4	10.33	Vertebra	3	10
Radius	2	6.6	Skull	3	10
Fibula	2	6.6	mandible	1	3.3

TABLE V: PATTERN OF DESTRUCTION OF PLAIN SKIAGRAMS

Sl. No.	Pattern of destruction	Number	Percentage
1	IA	1	3.3
2	IB (geographic lytic type)	6	20
3	IC	1	3.3
4	II (Moth eaten)	9	30
5	III (permeative type)	13	40.33

TABLE VI: TYPE OF PERIOSTEL REACTION

PERIOSTEAL REACTION	NO. OF CASES	PERCENTAGE
Continuous	3	30
Interrupted	5	50
Complex	2	20

TABLE VII: SOFT TISSUE LESIONS ON PLAIN SKIAGRAMS

PLAIN SKIAGRAM	NO. OF CASES	PERCENTAGE
Water density shadow	7	70
Bone destruction	2	20
Calcification	1	10

TABLE VIII : HISTOPATHOLOGICAL DIAGNOSIS AMONG BONE LESIONS

Type	No. of cases	Percentage
Osteogenic sarcoma	5	16.6
Giant cell tumour	5	16.6
Chondrosarcoma	1	3.3
Osteochodroma	2	6.6
Ewing's sarcoma	5	16.6
Reticular cell sarcoma	2	6.6
Osteod-osteoma	2	6.6
Metastases	3	10
Fibrous dysplasia	1	3.3
Enchondroma	2	6.6
Ameloblastoma	1	3.3
Bone cyst	1	3.3

Osteogenic sarcoma ,giant cell tumour and Ewing sarcoma (50%).

10% of bone tumours were Metastasis. Malignant tumours constituted 50% of soft tissue lesions.

COMPUTED TOMOGRAPHY

Computed tomography was performed in all 40 patients and results are summarized below: -

1.PRESENCE OF LESION

CT demonstrated presence of the lesion in all cases .

2. EXTENT OF DISEASE

The extent of the tumour was significantly better demonstrated by CT than by conventional radiography..

3. PATTERN OF CORTICAL TRANSGRESSION

Based on cortical transgression, tumours were classified into three types : Type 1, Type 2 and Type 3.

TABLE IX: PATTERN OF CORTICAL TRANSGRESSION AMONG BONE TUMOURS

DIAGNOSIS	TYPE I	TYPE 2	TYPE 3
Round cell tumours			
Ewing's sarcoma	0	0	5
Osteogenic sarcoma	1	3	1
Giant cell tumour	0	5	0
Osteochodroma	0	0	3
Metastases	0	3	0

4. CHARACTERISTICS OF SOFT TISSUE TUMOURS ON CT

TABLE X: SOFT TISSUE TUMOURS CHARACTERISTICS ON CT

CT characteristics	Number of cases	Percentage
Homogeneity		
Homogenous	2	20
Heterogenous	8	80
Margins		
Well defined		
Regular	4	40
Irregular	4	40
Ill defined	2	20
Enhancement	8	80
No enhancement	2	20
Calcification	1	10
Bone destruction	2	20

Out of 10 soft tissue tumours, 8(80%) were heterogeneous and 2 (20%) were homogenous. 5(62%) proven malignant soft tissue tumour heterogenous lesion.

5. RELATIONSHIP OF TUMOUR TO MAJOR NEUROVASCULAR BUNDLE

TABLE XI :TUMOR RELATIONSHIP TO MAJOR NEUROVASCULAR BUNDLE

CT FINDING	No. cases
Separated by normal tissue	22
Tumour contiguous to NVB	18
Tumour encases NVB	0

6. EPIPHYSEAL PLATE EPIPHYSIS AND JOINT INVOLVEMENT

CT however missed involvement of wrist joint in a case of giant cell tumour arising from lower end of radius.

(7) STAGING MUSCULOSKELETAL NEOPLASMS.

Bone tumours were staged according to Enneking system whereas American Joint Commission Staging protocol was used for soft tissue sarcomas

TABLE XII

BONE TUMOURS		SOFT TISSUE TUMOURS	
Enneking staging	Number of cases	AJC System	Number of cases
IA	0	IA	0
IB	1	IB	0
IIA	0	IIA	0
IIB	5	IIB	2
IIIA	0	IIIA	1
IIIB	0	IIIB	0
		IVA	0
		IVB	0

All malignant musculoskeletal tumours except round cell tumours and rhabdomyosarcoma were staged.

8) INFLUENCE PATIENT'S MANAGEMENT

All CT results were assessed before establishment of a diagnosis and surgical treatment..

TABLE XIII: INFLEUCNE OF CT ON PATIENT MANAGEMENT

Musculoskeletal lesions	Number of patients	CT useful in primary diagnosis	CTuseful inassessing extent	CT useful in management planning
BONE LESIONS				
Osteogenic sarcoma	5	0	5 100%	4 80%
Giant-celltumour	5	0	4 80%	3 60%
Ewings sarcoma	5	2 40%	4 80%	3 60%
Osteochodroma	2	0	2 100%	2 100%
Chondrosarcoma	1	1 100%	1 100%	1 100%
Reticular cell	2	0	1 50%	1 50%
Metastases	3	1 33%	2 66%	2 66%
Osteod-osteoma	2	2 100%	2 100%	2 100%
Fibrous dysplasia	1	0	1 100%	0
Enchondroma	2	0	2 100%	2 100%
Ameloblastoma	1	0	1 100%	1 100%
Bone cyst	1	0	1 100%	0
Soft tissue lesions				
Soft-tissue tumours	9	7	9 100%	5 55.5%
Chrnonic haematoma	1	1	1 100%	1 100%
Total	40	14 35%	36 90%	27 67.5%

1. CT was considered useful in primary diagnosis in 14 lesions (35%).
2. Plain skiagrams were sufficient in primary diagnosis in 26 (65%) bone tumours. Plain skiagrams in combination with CT provided accurate diagnosis in all bone tumours except one (97.5%) GCT at lower end radius came out osteosarcoma.
3. CT provided accurate histological diagnosis only in one soft tissue tumours (lipoma).
4. Of the 40 patients, CT had profound influence on management planning in 27 patients (67.5%).

DISCUSSION

Diagnostic radiology has an important role to play in the identification of the lesion in providing its differential diagnosis. Histopahtological examination is confirmatory.

A good radiographic evaluation of musculoskeletal tumours sets out to achieve two primary goals :- One, to establish diagnosis and two, to make an accurate assessment of the extent of intra and extra-asseous spread of the tumours. (16)

In the present study -The pattern of cortical transgression is an extremely useful piece of information available on CT scan, (14). Our study showed a close agreement between the type of cortical transgression on CT and the plain skiagrm bone/tumour margin when classified according to the system of Lodwick which confirms the impression that the margin analysis predicts the degree of aggressiveness of the lesion. (22)

Tumours were considered benign if they had a very smooth, well defined border did not involve multiple muscle groups and had no blurring of surrounding fat. Tumours were considered malignant if there was poor margination, areas of diminished density, blurring of adjacent fat, multiple muscle group involvement and bony invasion.

The development in recent years of en-bloc surgical procedures to replace amputation in many cases and the concomitant dramatic improvement in survival rates of extremity bone and soft tissue tumours, had led to need for precise preoperative evaluation of the tumour to determine if en-bloc surgery is feasible.(4).

Adequate surgery as described by (20) is a surgical procedure with sufficient margins of healthy tissue all round the tumour. For extra compartmental lesions, where no natural barrier against tumour growth exist, adequate surgery is more difficult and often means amputation.

Our findings confirm that CT is extremely used in assessing the extent of musculoskeletal tumors. In the present series, no formal comparison was made between CT and other imaging modalities (19) due to limitation of resource.

CT did accurately determine the proximal extension of tumour in medullary cavity (the accuracy rate being more than 94%) even when the matrix was not ossified or calcified. This was possible because the tumour tissue has a higher attenuation coefficient than the normal marrow tissue in the medullary cavity..

En-bloc resection of long bone giant cell tumour is considered the best surgical procedure resulting in permanent cure (10). If extra-osseous extension is demonstrated this is regarded as a sign of aggressive tumour. CT proved to be extremely useful in this regard.

CT had profound influence in management planning of 67.5% of these marrow cell tumours which included modifications in both surgery as well as centering of irradiation.

The role of CT in assessment and subsequent management of patients with soft tissue sarcomas. The accuracy rate of CT in localization of compartments among soft tissue tumours and soft tissue components of bone tumours was 90%.

The demonstration of neurovascular bundle is crucial to adequate visualization of these tumours.

Finally, the value of any diagnostic technique is determined by its impact on the clinical management. In the present study, CT had profound impact on management planning in 27 out of 40 patients (67.5%). Of these 27 cases, in 14 patients (35%), CT was responsible for a major change in the treatment policy.

CONCLUSIONS

Computed Tomography does not replace conventional radiographs but rather complements in diagnosis among bone tumours.

The extent of soft tissue components of osseous abnormalities and primary soft tissue masses are well demonstrated on CT. this provides the surgeon with vital information as to whether an en-bloc resection or amputation would prove necessary.

I.V. Contrast study is useful in identifying relationship of the tumour of the surroundings soft tissues and in particular to the neurovascular bundle.

Computed Tomography, at the present time, is a fairly widely available and cost effective imaging modality. With excellent image

resolution and rapid scanning time, it can serve as an ideal comprehensive imaging modality for the patients with musculoskeletal tumours.

IMAGES OF MUSCULOSKELETAL NEOPLASM

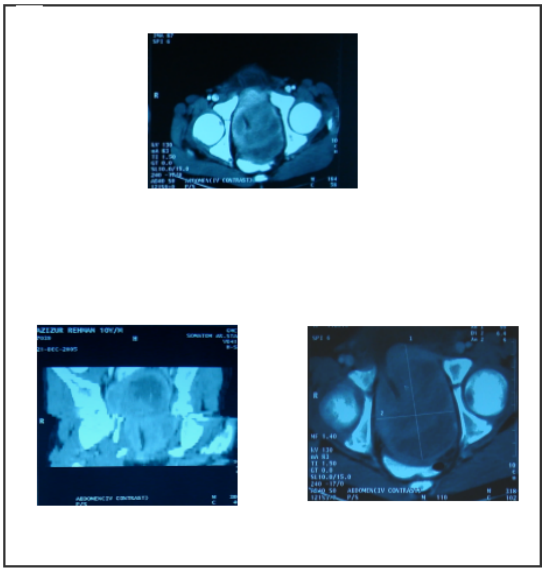


Fig1. Case of rhabhdomyosarcoma presented with - heterogenous enhancing soft-tissue mass lesion in relation to prostate .

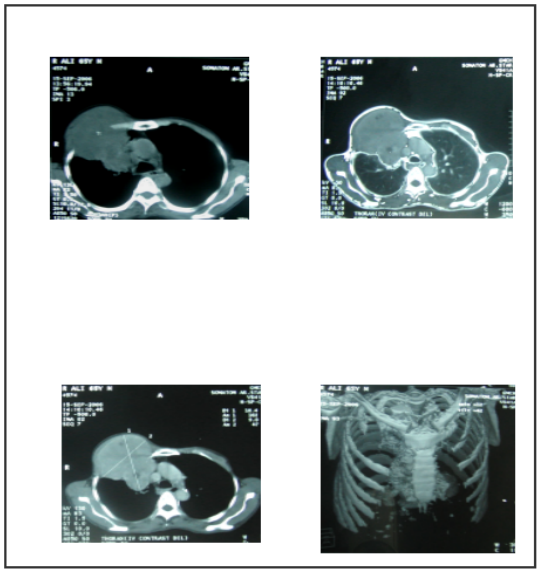


Fig2. Case of Fibrosarcoma with feature of large heterogenous enhancing soft-tissue mass lesion in relation to right 2nd rib anteriorly extending intercostals spaces ,extra & intra-thoracic space.

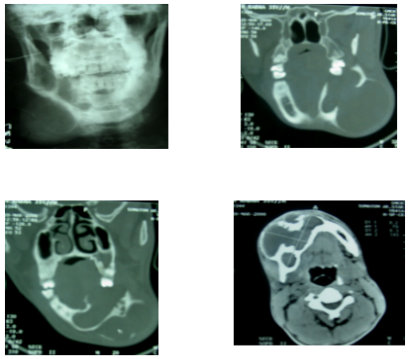


Fig 3.Expansile, multilocular lesion with internal septation + cortical break + soft-tissue involvement. ----- Ameloblastoma

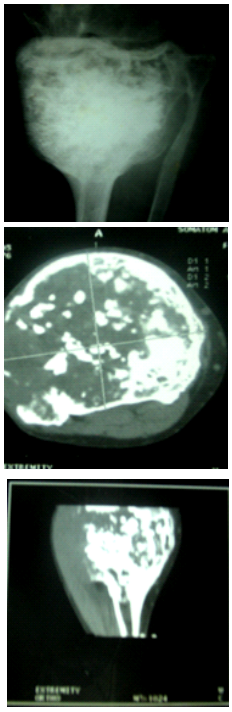


Fig 4 .Large expansile mass-lesion noted in relation to upper end of right tibia .there area of ossification and area of cortical break-down . on biopsy high grade sarcomatous changes.

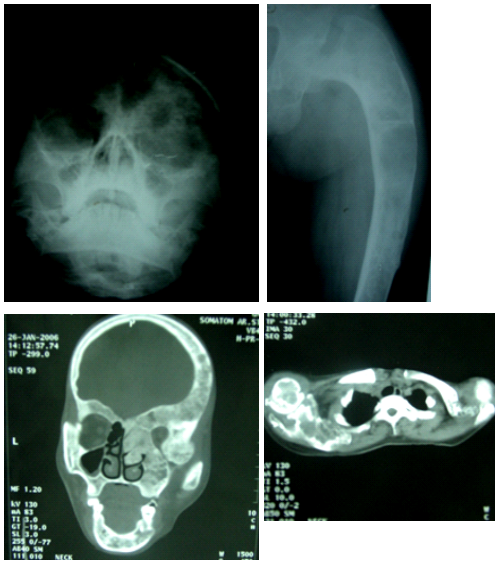


Fig 5. A case of polystotic type fibrous-dysplasia – multiple site of expansile soft-tissue density (ground-glass opacity) with surrounding increase bone density.

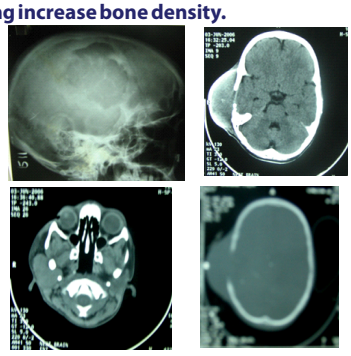


Fig 6.A round cell tumour present with large soft-tissue density with lytic bone-lesion in relation to squamous part of right temporal bone.

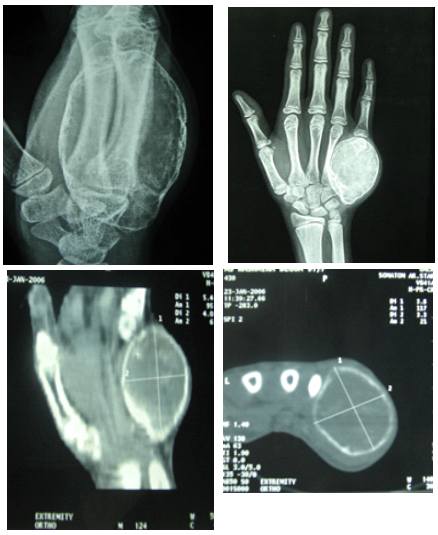


Fig 7.A case of enchondroma – a large expansile soft-tissue density lesion replaces medullary fat density with area of calcification and cortical thinning.

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