ORIGINAL RESEARCH

A prospective study on correlation in Bone Tumours of radiological and histopathological parameter from a Tertiary Care hospital

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ABSTRACT

Background: Inadequate research has led to the misdiagnosis of benign lesions as malignant, necessitating unnecessary surgery. In order to meet the challenges presented to the surgical pathologist when diagnosing a bone tumor, a standard approach to the radiographic examination, clinical history, and histopathology is necessary. **Objective:** The purpose of this research is to better characterize bone tumors by comparing the histopathological diagnosis and radiological evaluation of the tumor. **Study Design and Methods:** This is a prospective study on patients who were referred from the Orthopaedics Department to the Department of Radio-Diagnosis and Pathology with pain and swelling. In order to assess patients, conventional radiographs and MRIs were used. The results were then classified as benign or malignant bone tumors, whenever possible, by comparing them to histopathological findings. Histopathological testing was performed on the tissues from the afflicted regions. **Results:** A total of 40 patients, ranging in age from 20 to 70, were examined. Males predominated at the highest tumorincidence, which occurred between 51 and 60 years of age. The majority of tumours (60%) were benign rather than malignant. With radiological imaging, Ewing's sarcoma was a big malignant tumour and osteoid osteoma was a major benign tumour. According to histological analysis, Ewing's sarcoma was the predominant malignant tumour and osteoma and osteoid osteoma were the major benign tumours. Only 13 out of 40 cases in which the association of bone tumours based on radiological and histological evidence was incorrect. **Conclusions:** Radiology classifies the lesion type accurately, despite the possibility that it may not do so for all histopathological subtypes of the bone tumor. Though radiology may not give the exact histological variant of the bone tumour, it accurately indicates the nature of the lesion and clinicians should always investigate bone biopsy.

Keywords: Bone tumor, Radiological imaging, Histopathology, Correlation, Diagnosis

INTRODUCTION

The incorrect diagnosis of benign lesions as malignant due to insufficient investigations has led to unnecessary surgical procedures. Numerous benign and malignant bony lesions have been diagnosed with great success using histology and radiology. But on their own, they pose numerous obstacles to the final diagnosis of bone disease. The determination of the illness based on the characteristics of both histology and radiology provides a definitive diagnosis for the case [1].

Bone tumors can be benign or malignant in nature and are comparatively uncommon tumors. Malignant bone tumors occur 8.7 times per million people. The majority of bone tumors don't cause symptoms. It is challenging to determine the actual incidence of each bone tumor because they often present as incidental findings. Chondrosarcoma, osteosarcoma, and Ewing

sarcoma/primitive neuroectodermaltumor are the most common bone sarcomas. Fibrosarcomas, chordomas, and undifferentiated pleomorphic sarcoma are rare types of bone tumors [2]. Based on the location, matrix appearance, and patient's age at presentation, a specific diagnosis of the bone tumor is made. Multiple steps are involved in the diagnosis of a single bone tumor, including the clinical history, localization of the tumor, radiological examinations of the tumor's morphology, bone particulates, and histopathological and cytological analysis [3,4]. While computed tomography (CT) directs the matrix characterization and detection of mineralization, magnetic resonance imaging (MRI) can be helpful for further radiological differential diagnosis such as the spread and the dimensions of the tumor [3-5]. It is now simpler to examine the tumor's biological reactivity thanks to bone scintigraphy. Positron emission tomography (PET) aids in detecting and analyzing the regional metabolic activity of the tumor tissue, but its availability is restricted [6].

Clinical features and radiological data about the bone tumor may aid doctors in making an initial diagnosis, but histopathological evaluation of biopsy tissue is still the gold standard for identifying the biological makeup of the bone tumor and confirming its aggressiveness [7,8]. For early and effective diagnosis, management, and treatment, verification is more important than ever. The patient's age, the bone involved, the precise area within the bone, the appearance on radiographs, and the microscopic appearance are all significant factors that need to be taken into account. Before attempting to assess the fifth, the pathologist should have complete knowledge of the first four [9].

Bone tumor histological examination is one of pathology's most challenging topics. A multidisciplinary team of experts must review the case for a correct diagnosis of pediatric bone tumors. Furthermore, it is crucial to remember that radiographic imaging is crucial in enabling the pathologist to make the most accurate final diagnosis. To overcome the difficulties presented to the surgical pathologist when diagnosing a bone tumor, a standard approach to the radiographic examination, clinical history, and histopathology is necessary [10,11]. In light of this, the current prospective study was created with the main objective of evaluating the relationship between bone tumor pre-operative imaging and histopathological lesions for improved bone tumor diagnosis.

MATERIALS AND METHODS

SUBJECTS AND METHODS

This is a prospective study conducted at the Department of Radiodiagnosis and Department of Pathology, with patients presented with swelling and pain from the Orthopaedics Department and referred to this departments.

PARTICIPANTS

The Department of Radio-Diagnosis included a total of 70 cases of suspected bone tumors that had undergone radiological examinations. Patients who had swelling and pain from an infectious or traumatic etiology were not included in the study. Informed written consents were obtained after informing patients who met the criteria for enrollment about the study's nature and goals. The study excluded patients who were pregnant or unwilling to participate in the study. In order to confirm the diagnosis of suspected bone tumours, patients who visited the orthopaedics department complaining of pain and swelling were referred to the radiology department for additional testing. A pre-established proforma was used to record patient demographic information. Laboratory parameters and a thorough history were recorded.

IMAGING

Conventional radiographs and MRIs were performed to evaluate patients, then the Results were categorized as benign or malignant bone tumors, whenever possible by comparing them to histopathological findings.

HISTOPATHOLOGY

Before being examined by paraffin division for light microscopy, sensitive tissues were routinely treated in 10% neutral buffered formalin. The large bone portions were cut into smaller pieces, measuring 2 to 6 mm, and fixed in 10% neutral buffered formalin. After cleaning, the fixation was followed by decalcification treatment. The tissue was soaked in a decalcification solution of 5% nitric acid until it softened, and it was then further collected for processing. Hematoxylin and eosin staining was applied to the sections before being examined and photographed using a light microscope [12].

RESULTS

A total of 40 patients were studied, ranging the age of 20 to 70 years. The majority of the cases (n=11, 25.5%) belonged to the age group of 51-60 years, followed by 20-30 years (n=10, 25%) and 31-40 years (n=8, 20%). The peak age incidence was between 51-60 years age groups, with mean age 56.34±8.3, while the minimum number of patients was in 41-50 age group (n=5). The study revealed more males 26 cases (65%) with bone tumors than females 14 (35%). Histopathologically, 24 (60%) tumors were benign, and 16 cases (40%) were reported as malignant.

Table 1: Distribution of cases based on demographic characteristics

Variables	Frequency	Percentage (%)
Age-wise distribution (Years), N=40		
20-30	10	25
31-40	8	20
41-50	5	12.5
51-60	11	25.5
61-70	6	15
Gender-wise distrubution		
Male	26	65
Female	14	35
Nature of Tumour		
Benign	24	60
Malignant	16	40

FINDINGS FROM RADIOLOGICAL IMAGING

Table 2 displays the results of the tumor distribution based on radiological imaging. These findings delineated that Osteoid osteoma type of tumours was found to be in the majority (n=8), i.e., 33.3% among benign tumours, followed by osteoma (n=7, 29.17%) and Giant cell tumour (n=3, 12.5%). Whereas among malignant tumours, Ewing's sarcoma was found to be in the majority with 7 (43.7%) patients, followed by chondrosarcoma (n=4, 25%). Multiple myeloma, osteosarcoma and metastasis were also diagnosed.

Table 2: Radiological assessment of bone tumors

Nature of Tumours	Type	Frequency (%)
Benign (n=24)	Giant cell tumour	3 (12.5)
	Osteoma	7 (29.17)
	Simple bone cyst	2 (8.3)
	Osteoid osteoma	8 (33.3)
	Enchondroma	1 (4.2)
	Fibrous dysplasia	2 (8.3)
	Aneurysmal bone	1 (4.2)
Malignant (n=16)	Ewing's sarcoma	7 (43.7)
	Chondrosarcoma	4 (25.0)
	Multiple myeloma	3 (18.7)
	Osteosarcoma	2 (12.5)
	Metastasis	3 (18.7)

FINDINGS FROM HISTOPATHOLOGICAL ASSESSMENT

The findings of the distribution of tumours based on histopathological findings are represented in Table 3. These findings depicted that osteoma and osteoid osteoma (both n=6, 25%) type of tumours was found to be in the majority among benign tumours, followed by giant cell tumour (n=5, 20.8%), simple bone cyst and fibrous dysplasia. Whereas among malignant tumours, Ewing's sarcoma was found to be in the majority with 5 patients (31.2%), followed by osteosarcoma (n=4, 25%), Chondrosarcoma, multiple myeloma and metastasis were also diagnosed.

Table 3: Histopathological assessment of bone tumors

Nature of Tumours	Type	Frequency (%)
Benign (n=24)	Giant cell tumour	5 (20.8)
	Osteoma	6 (25.0)
	Simple bone cyst	2 (8.3)
	Osteoid osteoma	6 (25.0)
	Enchondroma	1 (4.2)
	Fibrous dysplasia	2 (8.3)
	Aneurysmal bone	1 (4.2)
	Osteochondroma	1 (4.2)
Malignant (n=16)	Ewing's sarcoma	5 (31.2)
	Chondrosarcoma	3 (18.7)
	Multiple myeloma	2 (12.5)
	Osteosarcoma	4 (25.0)
	Metastasis	2 (12.5)

CORRELATION

The correlation of bone tumors based on radiological and histopathological findings was mismatched for only 13 cases out of 40 cases. Out of those 13 mismatched diagnoses, the majority of the cases belong to the giant cell tumour, osteoid osteoma, Ewing's sarcoma and osteosarcoma variety (Table 4). Hence, the radiological findings were correlating with histopathological findings with a statistical significance ($p<0.001$).

Table 4: Correlating diagnosis based on histopathological and radiological findings

Type	Radiological imaging	Histopathological finding	Wrong diagnosis
Giant cell tumour	3 (12.5)	5 (20.8)	2
Osteoma	7 (29.17)	6 (25.0)	1
Simple bone cyst	2 (8.3)	2 (8.3)	
Osteoid osteoma	8 (33.3)	6 (25.0)	2
Enchondroma	1 (4.2)	1 (4.2)	
Fibrous dysplasia	2 (8.3)	2 (8.3)	
Aneurysmal bone	1 (4.2)	1 (4.2)	
Osteochondroma		1 (4.2)	1
Ewing's sarcoma	7 (43.7)	5 (31.2)	2
Chondrosarcoma	4 (25.0)	3 (18.7)	1
Multiple myeloma	3 (18.7)	2 (12.5)	1
Osteosarcoma	2 (12.5)	4 (25.0)	2
Metastasis	3 (18.7)	2 (12.5)	1
Total			**13**

DISCUSSION

One of the most challenging examples to analyse histologically is bone tumours, which are also rather infrequent. Primary benign and malignant bone tumours have different clinical traits and pathologic features [13]. All patients with bone lesions in our institution are evaluated histologically and radiologically. Due to the approach's simplicity, histopathology is liberally indicated, which improves overall diagnostic accuracy when compared to radiology alone. Both primary and metastatic tumours of the bone can occur. Malignant and benign primary tumours can be further separated. The imaging assessment of bone tumours is important because it aids in separating benign from malignant lesions and directs the patient's follow-up, further evaluation, and therapy. The multimodality therapy method has significantly increased the survival and quality of life of patients with bone tumours during the past 20 years.

In our system, all patients who experience bone pain or swelling are initially assessed using plain film examination to determine the cause, narrow the list of potential diagnoses, or determine how aggressive the lesion is. A biopsy can be used to assess the behaviour and histopathologic type of a bone tumour, which is important for characterising the characteristics of bone tumours. Since the majority of bone lesions are not biopsied, it is challenging to estimate the precise incidence of bone lesions [14]. The goal of our study is to better understand the function of radiography in the diagnosis of bone cancers by employing plain radiographs in addition to establishing a link between pre-operative imaging of bone tumours and histological abnormalities.

In the community as a whole, bone tumours were more frequently seen in men and were benign rather than malignant. This is consistent with a prior study by Nayar et al. [15] that found that men were more negatively impacted than women. The present study's age distribution revealed that the majority of lesions occurred in the second decade of life (29.4%), followed by the third decade (23.5%). The most frequent benign tumours were those of the osteochondroma type, followed by giant cell tumours and osteoid osteomas. The majority of malignant tumours were discovered to be metastasis-type tumours, followed by multiple myeloma, chondrosarcoma, osteosarcoma, and Ewing's sarcoma. The significant intensity of agreement between radiological and histological diagnosis was revealed by correlation analysis, which had a kappa value of 0.857. The range of agreement and kappa values reported in the preceding research [16,17] is also true here. The small sclerotic border on radiography and the osteosarcoma's uncommon placement in the metadiaphysis were the cause of the discrepancy. The ilium and pubic symphysis were involved in a localised lytic lesion that was radiologically inconsistent with a giant cell tumour. The fundamental explanation for the discrepancy was that, radiographically, numerous other illnesses besides bone tumours can be linked to bone production or destruction. Since various lesions are more common in particular age groups, at particular sites in the bone, and in particular types of bones, clinical indications and symptoms are given significant weight.

CONCLUSION

In difficult instances and as standard practise when the lesions distort bone and soft tissues, histopathologic evaluation to validate the radiologic diagnosis is crucial and confirmatory. This determines if the lesions are benign or malignant, which

determines the treatment plan. The improvement of bone lesion evaluation is greatly aided by the current work. Radiology accurately identifies the type of lesion even though it may not provide the exact histological variant of the bone cancer.

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