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Indian Journal of Pathology and Oncology

Journal homepage: www.ijpo.co.in

Original Research Article

Clinico pathological spectrum of bone lesions in a five year study in a tertiary care centre

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Abstract

Background: Bone lesions exhibit a wide range of characteristics and their trends vary according to age, clinical features, and the frequency of the different histological types. The objective of our study is to investigate the clinical and pathological spectrum of bone lesions, focusing on their incidence, age, sex, anatomical distribution, and histomorphological features. This study provides an opportunity to uncover new insights regarding the incidence and distribution of bone lesions.

Objectives: To study the clinical and pathological spectrum of bone lesions over a period of five years in a tertiary care centre in North Karnataka.

Materials and Methods: Bone biopsies and resection specimens received from January 2019 to December 2023 at the department of Pathology, Karnataka Medical College and research institute, Hubli were included in the study.

Results: During a period of five years**,** a total of 185 cases of bone specimen were received, of which neoplastic lesions (n = 115, 62.2%) were more common than non-neoplastic lesions (n = 70, 37.8%). In the neoplastic lesions, majority of the tumours were benign, (69 cases, 60.0%), followed by malignant tumours (24 cases, 20.9%) and least common were intermediate grade tumours (22 cases, 19.1%). Chronic osteomyelitis was the most common histological diagnosis (23.2%) followed by Osteochondroma (18.9%). Osteosarcoma was the most common malignant bone tumour (7.0%).

Conclusion: The present study shows the clinicopathological spectrum of bone lesions. 23 different entities of bone lesions were reported in the pathology section of our college during a period of five years. Neoplastic lesions were more common. But chronic osteomyelitis was the single most common bone lesion followed by osteochondroma. Osteosarcoma was the most common malignant neoplastic lesion.

Keywords: Bone lesions, Histopathology, Osteochondroma, Giant cell tumour, Osteosarcoma.

Received: 13-03-2025; **Accepted:** 22-05-2025; **Available Online**: 19-06-2025

1. Introduction

Cartilage, osteoid, fibrous tissue, and bone marrow components make up bone. Any of these tissues have the potential to develop into benign or malignant tumour.[1] An array of pathological abnormalities can arise from any of these components including inflammatory and neoplastic lesions.[2] The clinical and morphological features of these lesions range from benign to extremely fatal.[3]

Primary bone tumours contribute only 0.5% of total world cancer incidence. They are relatively rare in comparison to other lesions.[4] Bone lesions can occur gradually as a slow-growing mass or may develop abruptly and can occur in children, adults, and even in the elderly.[4] Accurate diagnosis, proper staging, and treatment are essential for maximising patient survival and promoting optimal function of the involved part of the body.[3]

Jaffe in 1958 emphasized the value of cooperation between the surgeon, pathologist, and radiologist in diagnosing a bone lesion. Thus, to provide an accurate diagnosis and to ascertain the level of activity and malignancy in each lesion, an integrated approach incorporating radiographic, histologic, and clinical data is required.[4]

The present study was conducted to understand the clinicopathological spectrum of bone lesions received in the histopathology section of our centre.

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https://doi.org/10.18231/j.ijpo.2025.030

2. Materials and Methods

This was a three and half year's retrospective and one and half years prospective study conducted from January 2019 – December 2023 in Karnataka medical college and research institute, Hubballi. All the bone lesion specimens received in the histopathology section were included in this study. Tumours which were of odontogenic or hematopoietic origin were excluded from the study.

Relevant radiological and clinical information was gathered from patients or from the hospital medical reports. The received specimens were decalcified for two to three days in 5% nitric acid after being fixed in 10% buffered formalin. Hematoxylin and eosin was used to stain the sections, which were then viewed under a microscope for histological examination.

Data tabulation and analysis were done to know the relative frequency of all the observed parameters. Tumours which were of hematopoietic or odontogenic origin were excluded in this study.

3. Results

The present study included 185 cases of bone lesions. Of these, 115 cases (62.2%) were neoplastic lesions, while 70 cases (37.8%) were non-neoplastic lesions. **Table 1** shows that the majority of the tumours (69 cases, 60.0%) were benign, followed by malignant tumours (24 cases, 20.9%), and the least common intermediate grade tumours (22 cases, 19.1%).(**Table 1**)

Of the 185 cases studied, the majority of the subjects belonged to the age group of 10 – 19 years (54 cases, 29.3%). 20 – 29 years (40 cases, 21.6%) and 30 – 39 years (30, 16.2%) were the next most common age groups affected.

Table 1: Distribution of study subject based on the nature of lesions

Nature of Lesion		Frequency (N = 185)	Percentage (%)
Non-neoplastic lesions		70	37.8%
Neoplastic Lesions (62.2%)	Benign	69	60.0%
	Intermediate grade	22	19.1%
	Malignant	24	20.9%

Non neoplastic lesions were common in the age group between 40 – 49 years (21.4%) followed by 30 – 39 years (18.6%). Benign neoplastic lesions were observed more in the age group between 10–19 years (50.7%) followed by 20 – 29 years (27.5%). Intermediate bone lesions were more common between 30-39 years (36.4%) followed by 20 – 29 years (31.8%). Malignant neoplastic lesions were seen more between the age group 10 – 19 years (50.0%) followed by 30 - 39 years (16.7%), 50 – 59 years (12.5%) and 20–29 years (12.5%).(**Table 2**)

The most frequent histological diagnosis was chronic osteomyelitis (23.2%), which was followed by osteochondroma (18.9%), avascular necrosis (9.2%), giant cell tumour (8.6%), and osteosarcoma (7.5%). The majority of the subjects were males (67.5%), and the remaining were females (32.4%), with male to female ratio being 2.08: 1. But all three cases of metastatic deposits, chondrosarcoma and both cases of osteoblastoma were seen in females. (**Table 3**).

Pain was the most common symptom observed (78.72%) followed by pain (74.46%).

Femur (67, 36.2%) was the most common bone affected in the present study followed by tibia (41,22.1%). Tibia (37.5%) was the most common bone affected in malignant tumours followed by femur (33.3%).(**Table 4**)

Table 2: Incidence of bone lesions in different age groups

	Non-neoplastic lesions	Benign neoplastic lesions	Intermediate neoplastic lesions	Malignant neoplastic lesions
Age group	**N,%**	**N,%**	**N,%**	**N,%**
0 – 9	6,8.6%	9,13.0%	0	0
10 – 19	7,10.0%	35,50.7%	0	12,50.0%
20 – 29	11,15.7%	19,27.5%	7,31.8%	3,12.5%
30 – 39	13,18.6%	5,7.2%	8,36.4%	4,16.7%
40 – 49	15,21.4%	1,1.4%	3,13.6%	2,8.3%
50 – 59	6,8.6%	0	2,9.1%	3,12.5%
>/=60	12,17.1%	0	2,9.1%	0

Table 3: Histological diagnosis with respect to sex

Histological diagnosis		**Gender**	
	Female N, %	**Male N, %**	**Total N %**
Chronic osteomyelitis	9,15.0%	34,27.2%	43,23.2%
Osteochondroma	11,18.3%	24, 19.2%	35, 18.9%
Avascular necrosis	6, 10.0%	11, 8.8%	17,9.2%
Giant cell tumour	5, 8.3%	11, 8.8%	16, 8.6%
Osteosarcoma	2, 3.3%	12, 9.6%	14, 7.5%
Tuberculous osteomyelitis	4,5.0%	6, 4.8%	9, 4.9%
Aneurysmal bone cyst	4, 6.7%	5, 4.0%	9, 4.9%
Osteoid osteoma	0	6, 4.8%	6, 3.2%
Fibrous dysplasia	3, 5.0%	3, 2.4%	6, 3.2%
Chondroma	3, 5.0%	3, 2.4%	6, 3.2%
Synovial chondromatosis	2, 3.3%	2, 1.6%	4, 2.2%
Small round cell tumour	1, 1.7%	2, 1.6%	3, 1.6%
Metastatic deposits	3, 5.0%	0	3, 1.6%
Chondrosarcoma	3, 5.0%	0	3, 1.6%
Osteoblastoma	2, 3.3%	0	2, 1.1%
Chondromyxoid fibroma	0	2, 1.6%	2, 1.1%
Simple bone cyst	1, 1.7%	0	1, 0.5%
Osteofibrous dysplasia	0	1, 1.6%	1, 0.5%
Non ossifying fibroma	1, 1.7%	0	1, 0.5%
Gct with low grade sarcomatous differentiaton	0	1, 1.6%	1, 0.5%
Fungal osteomyelitis	1, 1.7%	0	1, 0.5%
Chondroblastoma	0	1, 1.6%	1, 0.5%
Cemento ossifying fibroma	0	1, 1.6%	1, 0.5%
Total	60	125	185

Table 4: Frequency of type of bone lesion with affected bone

Nature of lesion	**Bone affected**												
	Femur	Tibia	Fibula	Humerus	Radius	Small bone	Spine	Knee joint	Multiple long bones	Mandible	Flat bone	Rib	Other long bones
	n	n	n	n	n	n	n	n	n	n	n	n	n
Non neoplastic lesions	23	16	11	0	6	6	6	0	0	1	1	0	0
Benign	30	15	3	10	1	2	0	0	3	1	1	1	2
Intermediate grade	6	1	3	2	5	0	0	4	0	1	0	0	0
Malignant	8	9	3	1	0	1	0	0	0	0	1	1	0
Total	67	41	20	13	12	9	6	4	3	3	3	2	2

Table 5: Frequency of most common bone tumours with affected bone

Bone affected			**Histological diagnosis**	
	Aneurysmal bone cyst n,%	**Giant cell tumour N,%**	**Osteochondroma n %**	**Osteosarcoma N,%**
Femur	5,55.6%	5, 31.3%	11, 31.4%	5, 35.7%
Tibia	1, 11.1%	1, 6.3%	10, 28.6%	7, 53.8%
Fibula	1, 11.1%	3, 18.8%	2, 5.7%	2, 15.4%
Humerus	2,22.2%	2, 12.5%	5,14.3%	0
radius	0	5, 31.3%	1, 2.9%	0
small bone	0	0	1, 2.9%	0
Multiple long bones	0	0	3, 8.6%	0
ulna	0	0	1, 2.9%	0
clavicle	0	0	1, 2.9%	0

Femur was the most common bone affected by aneurysmal bone cyst and osteochondroma. Giant cell tumour showed equal predilection for femur and radius whereas osteosarcoma was reported most frequently in tibia. (**Table 5**).

Metaphysis is the most often affected bony part (50.9%), followed by epiphysis (18.4%) and diaphysis (6.5%). Lesions involving Epi-metaphysis and Meta–diaphysis were 4.9% and 4.3% respectively.

Radiological details were available for 86 cases. Out of which Osteochondroma was the most common radiological diagnosis (22.1%) followed by osteomyelitis (18.6%), avascular necrosis (11.6%) and giant cell tumour (10.5%) respectively.

Chronic osteomyelitis (61.4%) was the most common non-neoplastic lesion observed followed by avascular necrosis (24.3%), tuberculous osteomyelitis (12.9%). Fungal osteomyelitis was the least common non neoplastic lesion observed (1.4%) (**Table 6**).

Table 6: Distribution of spectrum of non - neoplastic lesions in the study subjects

Histological diagnosis	Frequency (N =70)	Percentage
Chronic osteomyelitis	43	61.4%
Avascular necrosis	17	24.3%
Tuberculous osteomyelitis	9	12.9%
Fungal osteomyelitis	1	1.4%

Out of 185 lesions studied, 115 cases were neoplastic lesions (62.2%).

As per the 5th edition WHO classification of bone tumours, chondrogenic tumours accounted for 44.3% of the bone tumours observed in this study, followed by Osteoclastic giant cell-rich tumours (24.3%) and Osteogenic tumours (19.13%). (**Table 7**).

Table 7: Distribution of study subjects based on WHO classification of bone tumours

Type of Bone tumour		Frequency	Percentage	Percentage of Total
Chondrogenic tumours	Benign	44	86.3%	39.7%
	Intermediate	4	7.8%	3.4%
	Malignant	3	5.9%	2.6%
Total		51		44.3%
Osteoclastic giant cell-rich tumour	Benign	11	39.3%	9.5%
	Intermediate	16	57.1%	13.8%
	Malignant	1	3.6%	0.9%
Total		28		24.3%
Other mesenchymal tumours	Benign	8	72.7%	6.9%
	Malignant	3	27.3%	2.6%
Total		11		9.6%
Osteogenic tumours	Benign	6	28.6%	4.3%
	Intermediate	2	9.5%	1.7%
	Malignant	14	63.63%	12.1%
Total		22		19.13%
Small round cell tumours	Malignant	3	100.0%	2.6%
Total		3		2.6%
Grand Total		115		100.0%

Table 8: Spectrum of benign bone tumours based on WHO classification

Type of Benign Bone Tumour Based On Who Classification	Histological diagnosis	Frequency (N = 69)	Percentage (%) (out of index Category)	Total Percentage (%)
Chondrogenic Tumours	Chondroblastoma	1	2.3%	1.4%
	Chondroma	6	13.7%	8.7%
	Chondromyxoid fibroma	2	4.5%	2.9%
	Osteochondroma	35	79.5%	51.0%
Total		44		64.0%
Osteoclastic – Giant Cell Rich Tumour	Aneurysmal bone cyst	9	81.8%	13.0%
	Cemento ossifying fibroma	1	9.1%	1.4%
	Non ossifying fibroma	1	9.1%	1.4%
Total		11		15.8%
Other Mesenchymal Tumours Of Bone	Fibrous dysplasia	6	75.0%	8.7%
	Osteofibrous dysplasia	1	12.5%	1.4%
	Simple bone cyst	1	12.5%	1.4%
Total		8		11.5%
Osteogenic Tumours	Osteoid osteoma	6	100.0%	8.7%
		6		8.7%
Grand Total		69		100.0%

Out of the total 185 lesions observed, 69 were benign (37.29% of total); Chondrogenic tumours (64.0%) were the most common benign tumours observed in this study followed by Osteoclastic giant cell rich tumours (15.8%). Osteogenic tumours accounted for the least common benign tumours observed in this study (8.7%). Osteochondroma was the most common chondrogenic tumour (79.5%) and the most common benign tumour (51.0%) observed in this study, followed by Aneurysmal bone cyst (13.0%).(**Table 8**)

Of all the bone lesions studied, intermediate-grade bone tumours were 11.9%. Giant cell tumour (72.7%) was the most common intermediate-grade bone tumour observed in the present study, followed by synovial chondromatosis (18.2%). Osteoblastoma was the least common intermediate bone tumour observed (9.1%).

Malignant bone tumours accounted for 13% of the bone lesions studied. Osteosarcoma (58.3%) was the most common malignant bone tumour studied followed by Chondrosarcoma, Ewings sarcoma and Metastatic deposits (12.5% each).Giant cell tumour with low grade sarcomatous transformation was the least common malignant tumours observed (4.2%).

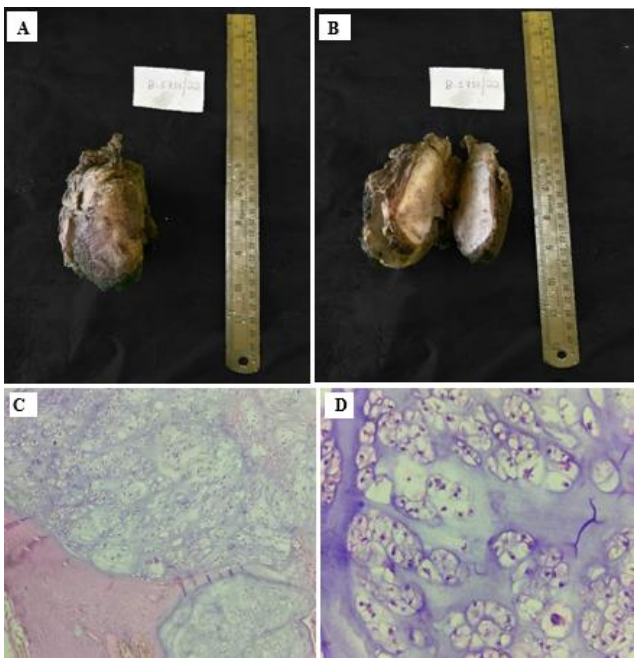

Figure 1: A & B: Gross photograph of a case of chondrosarcoma of scapula; **C:** Microscopy of Chondrosarcoma: Well-defined tumour with chondrocytes seen arranged in lobules (H& E,10x); **D:** Microscopy of Chondrosarcoma: Atypical round to oval cells with hyperchromatic nucleus and scant cytoplasm seen in lacunae. Few binucleated cells also seen (H & E, 40x)

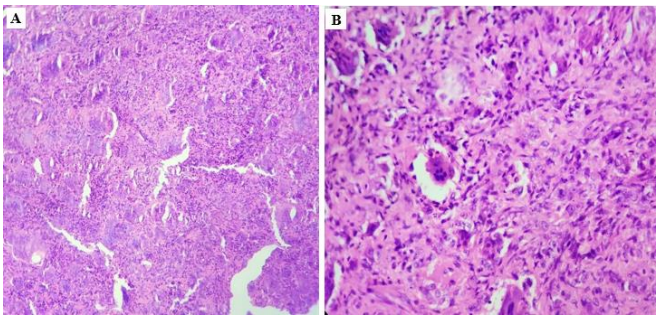

Figure 2: A & B: Microscopy of giant cell tumour showing mononuclear plump spindle cells admixed with osteoclastic type giant cells.(H & E,10x,40x).

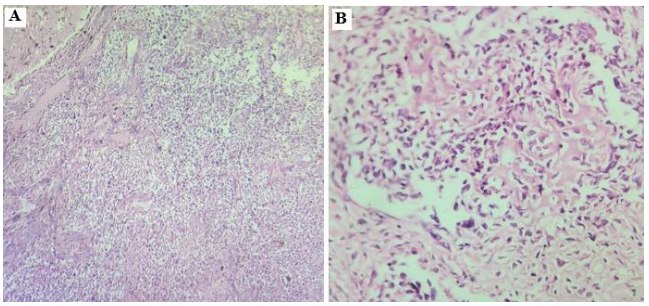

Figure 3: A & **B**: Microscopy of osteosarcoma showing pleomorphic cells with vesicular nuclei arranged in sheets with pericellular thin osteoid.(H & E, 10x,40x)

4. Discussion

This was a three and half years retrospective and one and half year prospective study conducted in Karnataka medical college and research institute to explore the clinical and pathological spectrum and relative frequencies of various bone lesions with respect to incidence, age, anatomical distribution and histo morphological features.

All age groups are susceptible to bone lesions; no age is exempt. The age range in the present study was 2 to 77 years. The youngest patient in this study was a 2-year-old boy with osteochondroma of the right proximal fibula. A 77 years old man suffering from tuberculous osteomyelitis of the spine was the oldest patient. In the current study, the maximum number of cases ranged from age 10 to 19 years. This mimics the same in the studies by Deoghare et al.[2] and Jain et al.[5] With a male-to-female ratio of 2.08:1, there was an overall male preponderance in the present study. This is similar to the findings in studies such as Deoghare et al.,[2] Bamanikar SA et al.,[6] Anita et al.[7] and Karia K M et al.[8]

The most frequent bone affected was the femur (36.2%) followed by the tibia (22.1%) which parallels findings in other studies.[1,6,9,10] However, the current study revealed a greater frequency of malignant bone tumours in the tibia than in some previous studies where the femur was the most common site of malignant bone tumours.[4,11]

In the present study, metaphysis was the most common bony part affected which was similar to the other studies.[2,12] Pain (78.72%) and swelling (74.46%) were the most common

clinical presentation in the present study. This result was in agreement with the same from other studies.[3,13]

In this study, radiological reports were available for 86 cases out of 185. Six of these cases showed discordance between the radiological and histopathological diagnoses. This included a case of giant cell tumour, osteosarcoma, chondrosarcoma, ewings tumour, chondromyxid fibroma and fibrous dysplasia which on radiology were diagnosed as aneurysmal bone cyst, pathological fracture, enchondroma, osteosarcoma, chondroblastoma and aneurysmal bone cyst respectively.

Chronic osteomyelitis (23.2%) was the most common histological diagnosis similar to the findings observed in the study by Kethireddy S et al.[10] followed by Osteochondroma (18.9%), Avascular necrosis (9.2%) Giant cell tumour (8.6%) and Osteosarcoma (7.0%) respectively. However, the study by Bhuva et al,[14] identified giant cell tumours (17%) as the most common bone lesion in their study followed by avascular necrosis(15%), chronic osteomyelitis(13%), and tuberculous osteomyelitis (12%) respectively.

Bone lesions can be essentially classified as either neoplastic or non-neoplastic based on their nature. Neoplastic lesions (62.2%) accounted for most of the specimens in the current study compared to non-neoplastic lesions (37.8%). This was in concordance with the other studies.[3,4,13] On the other hand, the studies such as Kumari et al,[15] Manjani S et al,[16] and George Mathew et al.[17] found non-neoplastic lesions to be more common than neoplastic lesions.

Neoplastic lesions were further subdivided into benign, intermediate, and malignant bone tumours based on the 5th edition WHO classification of bone tumours.

In the present study, chondrogenic tumours accounted for 44.3% of the bone tumours observed, followed by Osteoclastic giant cell-rich tumours (24.3%) and Osteogenic tumours (19.3%). This mimics the findings in some studies[18] but is different from what is observed in others.[13,19]

The majority of the benign neoplastic lesions observed in this study are chondrogenic tumours accounting for 63.2% of the benign bone tumours. This parallels the findings observed by Sugiyama H et al.[20] and Blackwell J B et al.[21] Similar to the results of the study by Bahebeck et al,[22] and Hasan FF,[23] osteochondroma (51.0%) was the most prevalent benign bone tumour in our study, followed by aneurysmal bone cyst (13.2%).

In the present study, of all the bone tumours studied, intermediate-grade bone tumours were 19.3%. Giant cell tumour (13.79% of all bone tumours and 72.7% of intermediate lesions) was the most common intermediate bone tumour observed which parallels the results obtained by Sugiyama H et al.[20] followed by synovial chondromatosis and osteoblastoma.

In the present study, 20.86% of bone tumours were malignant. The most frequent malignant tumours observed were osteogenic tumours, with osteosarcoma accounting for 58.3% of all tumours. These findings are consistent with those of earlier research, including

Sharma S et al.,[24] Shah S H et al.[25] and Ahmad M et al.[26] followed by chondrosarcoma, Ewings sarcoma and metastatic deposits; all of which constituted 12.5% each of malignant tumours. The younger age group (10-19 years) was more commonly affected. This parallels the findings observed by Rhutso Y and Deoghare SB.[1,2]

There were 3 cases of metastatic deposits which accounted for 12.5% of cases of malignant tumours studied. This is concordant with results in the study by Gayathri, T. et al.[27] and Nayar M.[28] However, Chitale AR.[29] noted a higher incidence of malignant deposits (25.1%). All three patients were females; two of the patients were in their 5th decade of life and 3rd patient was in the sixth decade of life.

In the present study, the location of the metastatic deposit was the femur in two cases and the rib in the third case. The cases in the femur presented with pathological fractures and were diagnosed as adenocarcinoma deposits and follicular carcinoma deposits respectively. The third patient had metastatic deposits of papillary renal cell carcinoma in the ribs.

5. Conclusion

The data on 185 bone lesions that were received by the pathology department from a single healthcare facility over the course of five years is summarized in this study with regard to lesion subtype, frequency, site of occurrence, and patient demographics. Over the course of a year, the histopathological section of the pathology department has reported on a spectrum of 23 distinct forms of histopathological bone lesions, indicating the occurrence of various bone lesions in KMCRI Hubballi and in North Karnataka in general. The reviewed data supports our findings by showing that the specific tumour has an affinity for some specific age, sex, and site. Ultimately, a precise diagnosis of bone tumours can be challenging at times.

6. Limitations

The present study lacks molecular and genetic analysis.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Bhanu M, Chavan SS, Jayaram K, Bhaskaran A, Vernekar S. Clinico pathological spectrum of bone lesions in a five year study in a tertiary care centre. *Indian J Pathol Oncol*. 2025;12(2):142–148.