Section: Pathology

Original Research Article

HISTOPATHOLOGICAL PROFILE OF BONE LESIONS: A TWO-YEAR EXPERIENCE AT A TERTIARY CARE CENTER

Divya Prabakar[1], Kanmani Durairaj[1], Arvind Raj R[2]

[1]*Assistant Professor, Department of Pathology, Kalaignar Centenary Super Speciality hospital, Guindy, Tamil Nadu, India*
[2]*Assistant Professor, Department of Surgical Oncology, Kalaignar Centenary Super Speciality hospital, Guindy, Tamil Nadu, India*

Received *: 09/07/2026*
Received in revised form *: 08/08/2026*
Accepted *: 23/08/2026*

Corresponding Author:
Dr. Divya Prabakar,
Assistant Professor, Department of Pathology, Kalaignar Centenary Super Speciality hospital, Guindy, Tamil Nadu, India.
Email: divi.prabakar4@gmail.com

DOI: 10.70034/ijmedph.2026.3.885

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 5741-5745

ABSTRACT

Background: Primary bone tumors are rare and tend to affect people in two age groups. Getting the exact histopathological diagnosis is crucial for guiding treatment and understanding prognosis. The aim and objective are to describe the demographics, where the lesions occurred and the histopathologic categories seen in bone lesions diagnosed at a tertiary -care hospital over two years.

Materials and Methods: This study retrospectively reviewed 57 cases from May 2024 to April 2026 in the Department of Pathology. Lesions were grouped using the WHO bone tumor spectrum into six categories. Demographic data on age, sex and anatomical site were documented.

Results: Benign lesions made up 17.5% (n=10) with Giant cell tumor being the most common, typically in the distal femur and proximal tibia. Malignant tumors accounted for 26.4% (n=15), led by high grade conventional osteosarcoma and chondroblastic variants, with age patterns varying by subtype. Metastatic (10.5%) (n=6) lesions tended to appear in older patients, and spine involvement was common. Non-neoplastic/infectious etiologies represented about 45.6% (n=26) of cases, including granulomatous process and tuberculous osteomyelitis. Overall, there was a slight male predominance and benign cases tended to occur in younger individuals while malignant tumors spanned a broader age range.

Conclusion: In this study, non-neoplastic and infectious lesions accounted for majority of biopsies, highlighting the essential role of histopathology in guiding proper management. Benign lesions favoured younger patients and long bones. Atypical presentations emphasize the need for integrated clinical, radiologic and histopathologic evaluation.

Keywords: Bone tumours, Giant cell tumour, Osteosarcoma, Plasmacytic lesions.

INTRODUCTION

Primary bone tumors are rare, accounting for only 0.2% of all malignancies. There is a bimodal age distribution, with one peak in adolescence and a smaller one in patients older than 60 years. Bone tumours are diverse in size, gross and histologic features and range in their biologic potential from the innocuous to the rapidly fatal.[1] This diversity makes it critical to diagnose tumours correctly, stage them accurately and treat them appropriately, so that the patients can not only survive, but also maintain optimal function of the attached body parts.[2]

Though bone tumours are infrequently encountered compared to the occurrence of other neoplastic lesions, they are of great significance because majority of them affect adolescents and young adults with a tendency of aggressive course.[3]

A definite clinical diagnosis of a bone lesion is often challenging. Correct identification of the lesion is essential before choosing a management strategy - whether curettage or wide local excision or amputation or radiotherapy. To establish an accurate diagnosis, formulate a clear treatment plan and estimate patient prognosis, the histopathological evaluation of biopsy material remains indispensable.[4]

The predilection of specific types of tumors to affect certain age groups and particular anatomic sites provides a diagnostic clue.[5] For example, osteosarcoma incidence peaks during adolescence and most frequently involves the distal femur and proximal tibia. By contrast, chondrosarcoma affects older adults and arises in the pelvic bones and proximal extremities.[6]

Aim and Objectives: To analyse the demographics and anatomical site distribution across various histopathologic spectrum of bone lesions in a tertiary care hospital, categorize them and describe their prevalence.

MATERIALS AND METHODS

Present study was conducted Retrospectively at the department of pathology, Kalaignar centenary hospital, Guindy for a period of 2 years from May 2024 to April 2026. A total of 57 cases were included in the study. Tumors were classified as recommended by WHO Classification of bone tumors. The lesions were categorized in to six distinct histopathologic groups: Non-specific, Benign, Primary malignant, metastatic, Osteomyelitis (including tuberculosis/ potts) and Osteoradionecrosis. The specimen were formalin fixed, decalcified (whenever needed) and paraffin embedded and the sections taken. Routine Haematoxylin and Eosin staining was done. Ethical committee approval was obtained from the institution.

Inclusion Criteria

All bone resected specimen.

Exclusion Criteria

Small biopsies of Bone lesions and Revision surgery specimen.

Type of Study: Retrospective study – Descriptive study (No statistical analysis can be done).

RESULTS

Gender Distribution: A total of 57 cases were identified from May 2024 to April 2026. Among the 25 neoplastic cases, benign lesions were more common in males (70%) than females (30%), whereas malignant lesions showed a relatively balanced gender distribution, with 53.3% males and 46.7% females. [Table 1]

Age distribution: Benign lesions were seen predominantly in younger individuals, with 60% occurring in the 0–19-year age group, while no cases were observed between 40 and 59 years. In contrast, malignant lesions were more common in older patients, with the highest proportion (40%) occurring in the 40–59-year age group, indicating a tendency for malignant tumours to present later in life. [Table 1]

Anatomical site distribution: The femur was the most frequently affected site in both benign (40%) and malignant (26.7%) lesions, highlighting its predilection for neoplastic involvement. Benign lesions were mainly limited to the long bones of the lower limb, particularly the femur, tibia, and fibula. In contrast, malignant lesions showed a broader anatomical distribution, involving the spine, humerus, mandible, sternum, foot, and skull in addition to the long bones. [Table 1]

Table 1: Demographic details of Neoplastic bone lesions (n=25)

Gender wise distribution of neoplastic cases: (n=25 cases)					
Benign	**Number of cases**	**Percentage**	**Malignant**	**Number of cases**	**Percentage**
Male	7	70%	Male	8	53.3%
Female	3	30%	Female	7	46.7%
Total	10	100%	Total	15	100%
Age distribution of neoplastic lesions: (n=25 cases)					
Benign	**Number of cases**	**Percentage**	**Malignant**	**Number of cases**	**Percentage**
0-19 yrs	6	60%	0-19 yrs	4	26.7%
20-39yrs	3	30%	20-39yrs	3	20%
40-59yrs	0	0%	40-59yrs	6	40%
>=60yrs	1	10%	>=60yrs	2	13.3%
Total	10	100%	Total	15	100%
Anatomical site distribution of neoplastic lesions: (n=25 cases)					
Benign	**Number of cases**	**Percentage**	**Malignant**	**Number of cases**	**Percentage**
Femur (head, neck, proximal, distal)	4	40%	Spine/ vertebra(l5, d8, transpedicular)	4	26.7%
Tibia (proximal, distal)	2	20%	Femur (head, neck, proximal, distal)	4	26.7%
Fibula	2	20%	Humerus	2	13.3%
Lumbosacral vertebrae	1	10%	Tibia(proximal/distal)	1	6.7%
Clavicle	1	10%	Mandible	1	6.7%
Total	10	100%	Sternum (chest wall)	1	6.7%
			Foot (1st metatarsal)	1	6.7%
			Skull(occipital bone)	1	6.7%
			Total	15	100%

Among the lesions, Benign lesions comprised of 15.8% and most common benign lesion was Giant cell tumors involving the distal femur, proximal tibia, fibula with one case involving the occiput. [Figure 1]

Others included osteoid osteoma, Osteoblastoma and Osteochondroma. Malignant tumors comprised 26.4% predominantly presenting was Osteosarcoma high grade- conventional type and Chondroblastic variants [Figure 2] average age of presentation 19 to 20 years involving the femur and fibula. Plasma cell neoplasms were seen exclusively in the median age group of 55 years mostly localising to the spine L5 and D8 vertebras. Chondrosarcoma presented variably as recurrent tumor of mandible, chest wall (sternum) and metatarsal. [Figure 3] A rare case of malignant Giant cell tumor was identified in a 49 year old female. [Table 2,3]

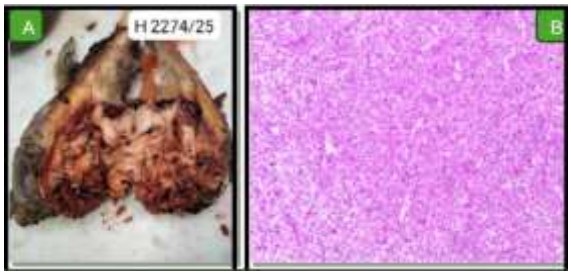

Figure 1: A – Gross appearance of Giant cell tumour - Fleshy expansile tan grey mass with haemorrhagic areas; B – 4x, H & E image showing Sheets of Mononuclear stromal cells with multinucleated osteoclast like Giant cells

About 10.5% (6 cases) of metastatic diseases were observed in the median age group of 55 to 75 years. Involving most commonly the spine, 2 proved to be metastasis from prostate and one from the breast. [Table 2,3]

About 49.1% of cases comprised of non-neoplastic/inflammatory and infective aetiology, predominantly Granulomatous lesions along with caseating tuberculous Osteomyelitis, chronic pyogenic osteomyelitis, aneurysmal bone cysts and non-specific reactive bone/callus/granulation tissue. [Table 3]

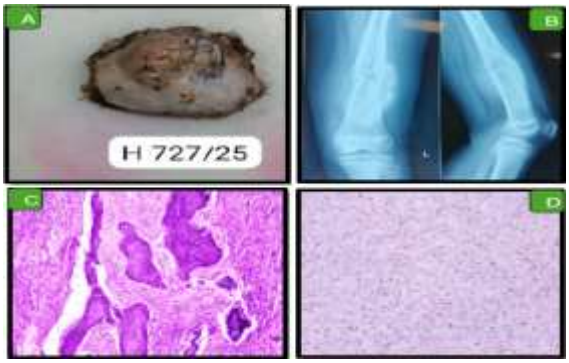

Figure 2: A – Gross appearance of Osteosarcoma case - grey tan gritty mass with focal areas of haemorrhage; B – Radiological image showing lesion in the Left Femur; C – 10x H & E image showing Sheets of atypical pleomorphic osteoblasts surrounded by islands of mineralized osteoid; D – IHC image showing Satb2 positive in the tumor cells

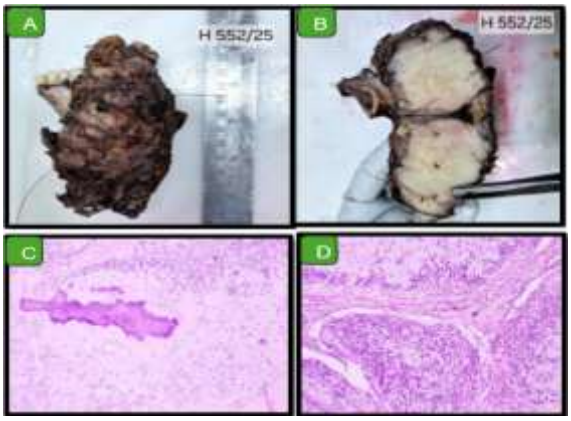

Figure 3: A, B – Gross appearance of Chondrosarcoma case - Well demarcated lobulated mass with glistening grey white areas eroding the mandible; C – 4x, H & E image showing Sheets of atypical pleomorphic cells surrounded by islands of mineralized osteoid; D – 10x, H & E image showing proliferating atypical chondrocytes separated by fibrous

Table 2: Distribution of spectrum of bone lesions (n=57)

Nature of lesion	Number of cases	Percentage
Non Neoplastic	26	45.6
Benign bone lesions	10	17.5
Primary Malignant Bone lesions	15	26.4
Metastatic bone lesions	6	10.5

Table 3: Distribution of individual bone lesions (n=57)

S.No	Non- Neoplastic (n=26)	Benign (n=10)	Malignant (n=15)	Metastatic (n=6)
1.	Osteomyelitis (n=3)	Osteoid Osteoma (n=2)	Osteosarcoma conventional - High Grade (n=5)	Lumbar vertebra (n=6)
2.	Osteoradionecrosis (n=3)	Giant cell tumor (n=5)	Chondrosarcoma-grade II (n=3)	
3.	Granulomatous lesions (n=9)	Enchondroma (n=1)	Chondroblastic variant of osteosarcoma (n=2)	
4.	Necrotic bony spicules (3)	Osteoblastoma (n=1)	Malignant giant cell tumor (n=1)	
5.	Non-specific pathology (8)	Osteochondroma (n=1)	Plasma cell neoplasm (n=4)	

DISCUSSION

Osteosarcoma is the most common primary malignant bone tumor, exclusive of hematopoietic malignancies. It usually occurs as a painful mass in patients between 10 and 25 years of age and is exceptionally rare in very young children. A second peak age incidence occurs after 40, usually in association with other preexisting disorders.[7] Most osteosarcomas arising de novo arise in the

metaphyseal area of long bones, particularly the distal femur, the proximal tibia, and the proximal humerus. A few cases arise in the diaphyses and an even smaller number in the epiphyses. Less commonly, osteosarcomas are found in flat bones such as craniofacial bones, pelvis, and scapula.

According to Wu G et al,[8] the manifestation of craniofacial skeleton remains to be a documented anomaly, accounting for only 6% to 10% of all cases Published series by Guo Z et al,[9] and Oda D et al,[10] show that most patients present in their 3rd to 4th decades of life, similar to our study, which shows a mean age of 39 years.

Singh R et al,[11] in the Journal of Postgraduate Medicine noted that calvarial (skull vault) osteosarcomas exhibit a distinct clinical profile in comparison with their appendicular counterparts. Osteosarcoma of the extremities shows a peak in 2nd decade while primary skull vault osteosarcomas present between 3rd and 4th decades. Histopathologically, Chondroblastic variant is more frequent, the presentation of an occipital conventional high-grade osteosarcoma in our cohort accentuates the diagnostic vigilance required by surgical pathologists.

Chondrosarcoma, a malignant tumor with chondroid differentiation, the pelvic bones, ribs (usually at the costochondral junction), shoulder girdle, and femur are the most common locations. Chondrosarcomas of the small bones of the hands and feet are exceptional but have been described by several authors.

Tupe R et al,[12] in the journal of Orthopaedic Case reports Chondrosarcoma of the hand and foot is an uncommon clinical entity, representing merely 1.5% to2.97% of all cases of chondrosarcomas. Within the lower extremity, the femur is the most common site, whereas the foot remains an infrequent location for the occurrence of chondrosarcoma. Pathologically differentiating low grade or moderate grade chondrosarcoma from benign cartilaginous tumor like enchondromas remains a major radiologic and histopathologic challenge. A localised Grade 2 conventional Chondrosarcoma arising in a short tubular bone, such as the first metatarsal was observed in our study.

Kundu S et al,[13] noted that Gnathic conventional Chondrosarcomas vary significantly from skeletal long bone tumors by showing onset among younger patients.

Well demarcated lobulated mass with glistening grey white areas eroding the mandible Lobules of atypical chondrocytes entrapping trabecular bone Giant cell tumor is usually seen in skeletally mature patients over 20 years of age.318 It is more common in women than in men and seems to occur more frequently in China than in Western countries. Giant cell tumors involve the epiphysis of a long bone, from which they may spread into the metaphyseal area, extend through the cortex, or even cross a joint space via structures such as the anterior cruciate ligament or ligamentum teres. The sites most commonly affected (in order of frequency) are the distal femur, the proximal tibia, and the distal radius.

Kumar S et al,[14] in the Journal of Indira Gandhi Institute of Medical Sciences Epidemiologic audits confirm that the incidence of GCT in Asian population is higher than that in the Caucasian population, accounting for up to 20% of all primary skeletal neoplasms in the region. Clasically Giant Cell Tumor of the skeletally mature young adult (20-40 years) with a slight female preponderance and over 50% of cases cluster in the epiphyseal-metaphyseal junctions around the knee joint. Arising within the pectoral girdle, specifically the clavicle represents an extreme anatomical deviation comprising fewer than 1% of all documented GCT cases.

CONCLUSION

Primary bone lesions present a diagnostic challenge because their clinical and radiological features often overlap. In this series, non-neoplastic and infectious conditions made up a large portion of the biopsies-with tuberculous osteomyelitis remaining a key finding, particularly in the spine.

When looking at primary bone tumors, clear patterns emerged across age and location. Benign tumors were mostly seen in children and young adults, typically affecting the long bones of the limbs. When looking at primary bone tumors, clear patterns emerged across age and location. Benign tumors were mostly seen in children and young adults, typically affecting the long bones of limbs. Malignant tumors on the other hand split along clear lines: High grade osteosarcomas were concentrated in younger patients, while plasma cell tumors and metastatic disease occurred almost exclusively in older adults, showing a strong preference for the spine.

At the same time, this study shows that bone tumors do not always follow classic textbook patterns. Cases such as a high grade osteosarcoma in the occipital bone, Grade 2 chondrosarcoma in the mandible and metatarsal, and a giant cell tumor in the clavicle serve as practical reminders that these lesions can show up in excepted sites and age groups. Ultimately, thorough histopathological evaluation, interpreted alongside clinical and imaging findings, remains essential for accurately diagnosing these atypical cases and planning appropriate treatment.

REFERENCES

1. Saran S, Phulware RH. World health organization classification of bone tumors (fifth edition): What a radiologist needs to know? Indian Journal of Musculoskeletal Radiology. 2022 Dec 21;4:73–86. doi: 10.25259/IJMSR_38_2022
2. Rani R, Gupta I, Suri J. Histopathological Study of Bone Tumours- 4 Years Study in A Tertiary Care Centre. JK Science Journal of Medical Education & Research 2022 Oct. 10; 24(4):243-8. Available from: https://journal.jkscience.org/index.php/JK-Science/article/view/156
3. Spectrum of tumour and tumour-like lesions of bone in a Tertiary Care Hospital in North Karnataka, India. Indian

Journal of Pathology and Oncology. 2020 Dec 15;5(1):75–80. doi.org/10.18231/2394-6792.2018.0014
4. Hathila R, Mehta J, Jha B, Saini P, Dudhat R, Shah M. Analysis of bone lesions in tertiary care center - A review of 79 cases. International Journal of Medical Science and Public Health. 2013;2(4):1037. doi.org/10.5455/IJMSPH.2013.300720131
5. Mehta K, McBee MP, Mihal DC, England EB. Radiographic Analysis of Bone Tumors: A Systematic Approach. Seminars in Roentgenology. 2017 Oct;52(4):194–208. doi.org/10.1053/j.ro.2017.04.002
6. Stitzlein RN, Wojcik J, Sebro RA, Balamuth NJ, Weber KL. Team Approach: Osteosarcoma of the Distal Part of the Femur in Adolescents. JBJS Reviews. 2017 Dec;5(12):e5–5. doi: 10.2106/JBJS.RVW.17.00030
7. Xu Q, Gao T, Zhang B, Zeng J, Dai M. Primary osteosarcoma in elderly patients: A report of three cases. Oncology Letters. 2019 June 7;. doi: 10.3892/ol.2019.10446
8. Wu G, Liang Q, Liu Y. Primary osteosarcoma of frontal bone. Medicine. 2017 Dec;96(51):e9392 doi: 10.1097/MD.0000000000009392
9. Guo Z, Hu K, Zhao B, Bian E, Ni S, Wan J. Osteosarcoma of the skull base: An analysis of 19 cases and literature review. J Clin Neurosci. 2017 Oct;44:133-142. Epub 2017 Jun 27. PMID: 28666652. doi: 10.1016/j.jocn.2017.06.014.
10. Oda D, Bavisotto LM, Schmidt RA, et al. Head and neck osteosarcoma at the University of Washington. Head Neck. 1997;19(6):513-523. doi:10.1002/(sici)1097-0347(199709)19:6<513::aid-hed9>3.0.co;2-1
11. Singh R, Jha K, Pant I, Satti D. Primary osteogenic sarcoma of the skull. Journal of Postgraduate Medicine. 2018;64(4):232–6. doi: 10.4103/jpgm.JPGM_706_17
12. Tupe R, Panchwagh Y, Bartakke G, Puranik R, Waghchoure C. A Rare Cause of Ankle Pain – Chondrosarcoma of the Talus: A Case Report and Literature Review. Journal of Orthopaedic Case Reports. 2022;12(8):70–4. doi: 10.13107/jocr.2022.v12.i08.2970
13. Kundu S, Pal M, Paul R. Clinicopathologic correlation of chondrosarcoma of mandible with a case report. Contemporary Clinical Dentistry. 2011;2(4):390. doi: 10.4103/0976-237X.91811
14. Kumar S, Haque SS, Muzaffar MA,Kumar I, Kumar A, Tanweeruddin Md, et al. Giant Cell Tumor of Clavicle in an 8Year Old Girl: A Rare Case Report. ClinCase Rep Int. 2020; 4: 1141.