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Osteosarcoma: Age, Sex, Site Distribution and Histopathological Pattern, an 18 Year Study at the Jos University Teaching Hospital

Akpa PO[1,2] Emmanuel I[1,2,] Kwaghe BV[2] Silas OA[1,2] Dauda AM[1,2]

[1] *Department of Pathology, University of Jos, Jos, Plateau State Nigeria.*
[2] *Department of Anatomic Pathology and Forensic Medicine, Jos University Teaching Hospital, Jos, Plateau State Nigeria.*

***Correspondence**: Philip Ojile AKPA, Department of Pathology, University of Jos, Jos, Plateau State, Nigeria.*

E-mail: akpaphilip@yahoo.com

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ABSTRACT

The aim of the study was to determine the age, sex, anatomical sites affected and morphological distribution of osteosarcoma at the Jos university Teaching Hospital. It is a retrospective observational study that utilized archival slides, paraffin wax tissue blocks, surgical pathology register, cancer registry entries and case files of all cases of osteosarcoma diagnosed during the period of review. The age, sex, site affected by tumor and histopathology were documented for each case. Other relevant data such as total number of cancers, total number of primary bone tumors and total number of primary malignant bone tumors during the period was extracted in other to relate them to osteosarcoma figures. Data obtained was analyzed utilizing Epi info 7 (version 3.5.4) and presented in tables. Forty four cases of osteosarcoma met the criteria for inclusion in the study. Osteosarcoma accounted for 0.83% of all cancers, 21% of all primary bone tumors and 50.6% of all primary malignant bone tumors. There was a male predominance with a male to female ratio (M:F) of 1.4:1. The peak age range for osteosarcoma diagnosis was the second decade with a mean age of 20.22±13.08 years. The commonest site of osteosarcoma diagnosis was the femur. A majority of osteosarcomas were of the central (medullary) type (93.2%) while 6.8% were of surface (peripheral) type. The conventional subtype of central osteosarcoma constituted the overwhelming majority at 88.6% of all osteosarcomas. In conclusion, osteosarcoma is the commonest primary malignant bone tumor at the Jos University Teaching Hospital. The age and sex distribution, the bones affected and histopathological types are in keeping with established published literature.

Keywords: Osteosarcoma, Jos, Histopathological pattern, Conventional, Osteoblastic

INTRODUCTION

Osteosarcoma is a malignant mesenchymal tumour that produces bone matrix.It is the commonest primary malignant bone tumor world wide[1-3]but is however a relatively rare tumour in the human population.[4,5] World health organization (WHO) data shows that it has an annual incidence rate of about 4.4 per million, 1.7 per million and 4.2 per million of people aged 0-24 years, 25-59 years and ≥60 years respectively world wide.[1]

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There are a variety of associations with osteosarcoma but the exact cause is unknown.[6,7]Risk factors include the period of rapid skeletal growth in adolescents, therapeutic exposure to radiation, preexisting bone pathologies and some genetic syndromes such as Li-Fraumeni and hereditary Retinoblastoma.[1,6-8] Other factors such as tall stature, high birth weight and being of African ancestry have also been associated with a higher incidence of the disease.[9,10]

Osteosarcomas have a bimodal age distribution, it is most frequently seen in adolescents with a second peak in adults greater than 60 years[2-4]It has a male predominance worldwide with only a few authors documenting a female predominance[1,11,12] The commonest sites of osteosarcoma diagnosis are the femur and tibia(the sites with the most active growth plates), with over 50% of cases occurring around the knee.[1,8]

The classification of osteosarcoma into the different subtypes is based on the anatomic location on the bone, the predominant histologic pattern and the histologic grade. Osteosarcoma may arise from the medullary (central) or the peripheral (surface) location of the affected bone. The Conventional, low-grade well differentiated, telangiectatic and small cell subtypes occur under the umbrella of central osteosarcomas while the surface type has the parosteal, periosteal and high-grade surface subtypes.[1,13,14] Among the various subtypes, the conventional variant is the commonest of all subtypes of osteosarcoma accounting for as high as 80% of cases in individuals affected within the first two decades of life.[14]The histological subtypes of conventional osteosarcoma recognized by the World Health Organization (WHO) histological classification include the osteoblastic, chondroblastic, fibroblastic and giant cell rich subtypes among others. This histologic classification is dependent on the cell type and the kind of matrix produced.[1,13,14] The Osteoblastic variant of conventional osteosarcoma produces principally neoplastic bone which could be lace-like or compact. The chondroblastic variant most times produces extensive high-grade hyaline chondroid matrix in addition to neoplastic bone although the cartilaginous matrix could be myxoid. The fibroblastic variant is often times composed of spindle cells with significant atypia which produce extensive collagen frequently disposed in storiform pattern in addition to neoplastic bone necessary for an osteosarcoma diagnosis.[1,13] The 3 variants of conventional osteosarcoma mentioned above are the most common with representation of about 76-80%, 10-13% and 10% for the Osteoblastic, chondroblastic and fibroblastic histological subtypes respectively.[1] There is no significant difference in prognosis or modality of treatment in these three histologic types. Other less frequently encountered histologic subtypes of conventional osteosarcoma are the giant-cell rich, epithelioid, clear cell, osteoblastoma-like and chondroblastoma-like subtypes.[1,13,14] Surface osteosarcomas are more often low-grade tumors in comparison to the medullary types and are about 20 times less common.[13]They are classified based on their location on the affected bone, their histologic grade and type of matrix produced. These surface tumors have a tendency for local recurrence but a limited capacity for distant spread.[13]

MATERIALS AND METHODS

This study is a retrospective review of all cases of osteosarcoma diagnosed at the Jos university Teaching Hospital (JUTH) department of Anatomic Pathology and Forensic Medicine between 1st January 2005 to 31st December 2022. Materials utilized for this research consisted of Archival slides, paraffin wax tissue blocks, surgical pathology register, cancer registry entries and case files of all cases of osteosarcoma diagnosed during this period. The patient age at diagnosis, gender and site/bone affected by tumor were documented for each case. All cases were reviewed by the authors of this article for a proper histopathological analysis, this was done by reviewing archival slides and making fresh sections from paraffin wax tissue blocks in cases of missing or poor quality slides. Von Kossa histochemical stain which demonstrates osteoid was employed in confirmation of some cases of osteosarcoma. Data such as total number of malignancies, number of primary bone tumors and primary malignant bone tumors

diagnosed during the period of review were also extracted for analysis in relation to osteosarcoma. Data obtained was analyzed utilizing Epi info 7 (version 3.5.4) and presented in tables.

RESULTS

The records of 46 cases of osteosarcoma were reviewed with 44 meeting the inclusion criteria. Two cases were excluded for incomplete data. There were 5324 malignancies diagnosed during the period of review with osteosarcoma accounting for 0.83% of all cancers. A total of 209 primary bone tumors were diagnosed during the 18 years of our review, 122 were benign and 87 malignant. The 44 cases of osteosarcoma recorded accounted for 50.6% of all primary malignant bone tumours and 21% of all primary bone tumours seen in the period of study.There was a male predominance with a male to female ratio (M:F) of 1.4:1(see table 1). The peak age range for osteosarcoma diagnosis was the second decade with a mean age of 20.22±13.08 years (see table 1).The commonest site of osteosarcoma diagnosis was the femur followed by the tibia and a significant number also occurred craniofacial bones (see table 2).

A majority of osteosarcomas were of the central (medullary) type (93.2%) while 6.8% were of surface (peripheral) type (see table 3). The conventional subtype constituted 88.6% of all osteosarcomas with its osteoblastic, chondroblastic and fibroblastic histologic variants constituting74.3%, 15.4 % and 10.3% of the conventional subtype respectively respectively.

Table 1. Table showing age and gender distribution of Osteosarcoma

S/N	Age Range	Male	Female	Frequency (%)
1	0 - 10	2	3	5 (11.4)
2	11 - 20	11	9	20 (45.4)
3	21 - 30	6	3	9 (20.5)
4	31 - 40	4	2	6 (13.6)
5	41 - 50	2	0	2 (4.5)
6	51 - 60	0	0	0(0)
7	>60	1	1	2 (4.5)
TOTAL		26	18	44 (100)

Table 2. Anatomical site distribution of osteosarcoma cases

S/N	SITE OF TUMOUR	Frequency (%)
1	Craniofacial bones	5 (11.4)
2	Femur	20 (45.4)
3	Foot bones	1 (2.3)
4	Humerus	2 (4.5)
5	Ilium	3 (6.8)
6	Tibia	12 (27.3)
7	Ulna	1 (2.3)
	TOTAL	44 (100)

Table3. Histopathological pattern of osteosarcoma using the WHO 2023 clasification

S/N	Type	Subtype	Histological type	Frequency (%)
1	MEDULLARY (CENTRAL)	**Conventional**	Osteoblastic	29 (65.9)
2			Chondroblastic	6 (13.6)
3			Fibroblastic	4 (9.1)
4		**Talangiectatic**		1 (2.3)
5		**Small cell variant**		1 (2.3)
	SURFACE (PERIPHERAL)	**Parosteal**		2 (4.5)
		Periosteal		1 (2.3)
	TOTAL			**44 (100)**

DISCUSSION

Osteosarcoma is the commonest sarcoma of bone reported world wide but is a relatively rare tumor in humans. It was the commonest bone sarcoma diagnosed in our study even though it represented only 0.83% of all malignancies diagnosed during the 18 years of review. It accounted for 50.6% of all primary malignant bone tumors during this period. Reports by authors from other parts of Nigeria reinforce the predominance of osteosarcoma among primary malignant bone tumors in our environment.[15-19]The percentages documented in other parts of Nigeria ranges from 50% in Lagos (South-Western Nigeria) to as high as 80.1% in Enugu (South-Eastern Nigeria).[15,16] Authors from other parts of Africa and the developed world also report a predominance osteosarcoma, although slightly lower percentages were seen in western countries.[17-19] In studies by Bahebeck et al (Cameroon) and Negash et al (Ethiopia), osteosarcoma

accounted for 45.7% and 70.3% of primary malignant tumors of bone respectively.[17,20]Western studies by Arora et al (England) and Blackwell et al (Australia) also reported osteosarcoma as the commonest primary malignant bone tumor but at lower percentages of 34.2% and 35.7% respectively.[21,22] The higher percentages of Osteosarcoma documented in Nigeria and other African countries may be coincidental, however studies have shown a higher incidence of osteosarcoma in people of African ancestry.[10]Robust research to investigate the genetic bases for this observation is required

This study demonstrated a male predominance with a male to female ratio (M:F) of 1.4:1(see table 1). Reports from other parts of Nigeria such as Ibadan (1.6:1), Enugu (1.1:1) and Lagos (7:0) showed a male predominance while a report from Zaria in Northwestern Nigeria showed a female predominance (M:F 1:1.4).[11,15,16,23]A few other studies such as a report by Ferreira et al in South Africa (M:F 1:1.4)[12]and another by Shah et al from Karachi, Pakistan (M:F 1:1.09)[22]documented a female predominance of osteosarcoma, however the universal picture is of a male predominance.[1,8,24]

Osteosarcoma affects every age group with a bimodal age distribution. Individuals less than 20 years bear approximately 75% of the disease burden.[8]The peak period of osteosarcoma diagnosis in our study was in the second decade (accounting for 45.4% of cases). Seventy seven percent of all diagnosis was made in the first 3 decades with only 2 cases (4.5%) occurring in patients greater than 60 years (see table 1) .The bimodal age distribution of Osteosarcoma is not reflected in our study. The lower life expectancy in our environment and the resultant young population lacks the older population cohort within which the second peak occurs. The rapid skeletal growth that occurs in children and adolescents is thought to be a predisposing factor to this disease and therefore its tendency to affect young individuals.[23] However established etiologic factors such as radiation exposure and genetic predisposition.[1] have not been well studied in Nigeria.

The femur and tibia were the commonest sites of osteosarcoma diagnosis and combined to make up 72.7% of tumour site diagnosis in our study (see table 2). A majority of cases diagnosed in the tibia and femur occurred around the knee (distal femur and proximal tibia), which correlates with the findings of Abdulkareem et al in Lagos Nigeria.[15] The long bones of the extremities are universally the commonest sites of osteosarcoma diagnosis, with the femur and tibia being the first and second most common sites reported world-wide.[1]Five cases (11%) occurred in craniofacial bones (four affecting the mandible and one the maxilla) which is not usually a common site of osteosarcoma diagnosis in Nigeria and elsewhere.[15-18,23] A study by Mohammed et al in Zaria North-western Nigeria however reported 41.8% of osteosarcoma diagnosis in craniofacial bones.[11]Osteosarcomas of the jaw (also called Gnathic osteosarcoma) are relatively rare (4-6% of cases), they occur in slightly older patients in their 30s and are biologically aggressive.[25,26] Gnathic osteosarcoma are most commonly of the chondroblastic variant, however no case of gnathic chondroblastic osteosarcoma was seen in our study.[13]

A Majority of cases of osteosarcoma diagnosed during the period of our review were of the Central (medullary) anatomical type (see table 3). Conventional osteosarcoma (a high-grade medullary subtype)was by far the commonest subtype in our study accounting for 88.6% of all cases of osteosarcoma diagnosed, with its osteoblastic histologic subtype predominating. This finding correlates with that of ferreira et al in south Africa in which 91.5% of cases were of the conventional subtype.[12] The conventional subtype of osteosarcoma is consistently the predominant subtype reported by authors worldwide.[1,13,14,27]It is a rapidly growing tumor with a tendency for early metastasis however its sensitivity to chemotherapy has improved survival rate in recent times.[1]Three cases of surface (peripheral) osteosarcoma comprising two parosteal (4.5% of cases) and one periosteal (2.3% of cases) subtype were recorded, this finding also correlates with the picture worldwide.[1,13,14,27]The anatomical types and histological subtypes of osteosarcoma seen in our study correlates fairly with findings of most authors worldwide.[1,12-14,28]

CONCLUSION

Osteosarcoma was the commonest primary malignant bone tumor diagnosed in our facility. It is a relatively rare with individuals in the second decade most commonly affected. The age and sex distribution, the site affected and histopathological subtypes correlate with reports from other parts of the world.

Recommendation

We recommend more research into osteosarcoma especially with regards to its genetic characteristics in our environment.

Conflicts of interest

Authors declare there no conflicts of interest

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