

## Research Article

## Primary Malignant Bone Tumors in Cameroon: Epidemiological and Histopathological Data

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**Abstract:** **Objective:** To determine the epidemiological and histological aspects of primary malignant bone tumors in Cameroon. **Materials and Methods:** A descriptive retrospective study of patients with confirmed malignant primary bone tumors biopsy presented between January 2004 and December 2017 in all anatomic-pathological laboratories in Yaounde and Douala, which are the two biggest towns in Cameroon. Patients with multiple myeloma and lymphoma were excluded. **Results:** A total of 234 bone tumors were found. 56.41% (132 cases) of these tumors were benign tumor, 38.41% (90 cases) were malignant tumors and only 12 (5.11%) were metastases. The average age of the patients with malignant tumors was  $27.95 \pm 17.93$  years, with extremes of 5 and 80 years. Female was the most represented with 51.11% (46 cases), with a male-to-female sex ratio of 0.96. The site most affected by malignant bone tumors was the femur 33.3% (30 cases), the tibia 22.2% (20 cases). Osteosarcoma was the most common histological diagnosis (52 cases, 57.8%); followed by Ewing's sarcoma (15 cases, 16.6%) and chondrosarcoma (11 cases, 12.2%), fibrosarcoma (5 cases, 5.6%), angiosarcoma (4 cases, 4.4%) and liposarcoma (3 cases, 3.3%). **Conclusion:** Primary malignant bone tumors occurred between first and second decade of life with male preponderance. Osteosarcoma was the most common malignant bone tumors, respectively. The femur and tibia was the preferred affected site.

**Keywords** Malignant tumor, Bone, Cameroon.

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## INTRODUCTION

Primary malignant bone tumors refer to the tumors originating in the various bone constituting elements, and are distinguished by their clinical presentation, their epidemiological, radiological and histological characteristics. The three most common genuine primary bone malignancies (osteosarcoma, chondrosarcoma, and Ewing's sarcoma) account for only 0.2% of all malignancies in the UK and USA; however, in children (< 15 years) malignant bone tumors account for approximately 5% of all malignancies (Unni, K. K. *et al.*, 2005). Data from USA, United Kingdom, China, Nigeria and Sud Africa suggest that chondrosarcoma is the most common primary malignant bone tumor (excluding haematopoietic tumors) with respectively 39.5%, 34%, 59.5%, 58.9%, 72.8% ([www.cancer.org](http://www.cancer.org); Arora, R. S. *et al.*, 2012; Niu, X. *et al.*, 2015; Obalum, D. C. *et al.*, 2009; & Pillay, Y. *et al.*, 2016). The incidence of

osteosarcoma has a bimodal distribution with peaks during adolescence and late adulthood (elderly) (Mirabello, L. *et al.*, 2009). Ewing sarcoma has a peak incidence during the second decade of life and occurs rarely before the age of 5 years or after 30 years (Choi, E.Y. *et al.*, 2014) Chondrosarcoma occurs predominantly during adulthood with an incidence increasing gradually with age (Unni, K. K. *et al.*, 2005). In South Africa, here was a slight male predominance with a male-to-female ratio of 1.2:1 and an average 23.8 years (range 5 to 69) (Pillay, Y. *et al.*, 2016). In developed countries like the United Kingdom and United States, the primary malignant bone tumors are the third leading tumors in cancer-related mortality in this age group, just behind leukemia and central nervous system tumors (Geraci, M. *et al.*, 2007). In Cameroon, in a study of bone tumors, coordinated in the city of Douala and Yaounde over a period of 10 years, 268 tumors were studied, 45% were primary cancers of the bone and only 6% were metastases. With

39% of all primary malignancies, osteosarcoma was the most common (Bahebeck, J. *et al.*, 2003). The scarcity of studies on bone tumors and especially the absence of analysis of the socio-demographic and histopathological aspects of the different forms of bone tumors in our country, led us to undertake this work.

## MATERIAL AND METHODS

This is a retrospective and descriptive study. It covers cases of bone malignant tumors diagnosed over a period of 14 years (2004 to 2017) in the approved anatomy-pathology laboratories of two bigger cities of Cameroon (Yaoundé, Douala). Patients were consulted in the traumatology or oncology departments of different health facilities spread throughout the national territory, patients had benefited from a biopsy sample or from an enlarged surgical resection of the tumor. For each case recorded, the results of the anatomopathological examinations which had been carried out after fixation of the biopsy parts and of the operative parts with 10% formalin were investigated. Only patients whose diagnosis of bone cancer was confirmed by histological examinations were included in this series. Considering the information presented in

the different registers and the type of study chosen (retrospective), the data consisted of independent variables such as frequency, sex, patient age, location of tumor, histologic type of tumor, and Gleason score. The dependent variable was prostate cancer confirmed by histology. The analysis of the variables was carried out using the Statistical Package for Social Sciences (SPSS) software, version 16.0. The elements of the descriptive statistics made it possible to calculate frequencies and proportions. The data have been shown in tables and figures.

## RESULTS

In our study (January 2004 - December 2017), Patients were included if they had a biopsy-confirmed diagnosis of primary malignant bone tumor. Patients with multiple myeloma and lymphoma were excluded.

### General frequency

During our study period, we identified 234 cases. According to Figure 1, 56.4% (132 cases) of bone tumors were benign and metastases accounted for 5.1% (12 cases).

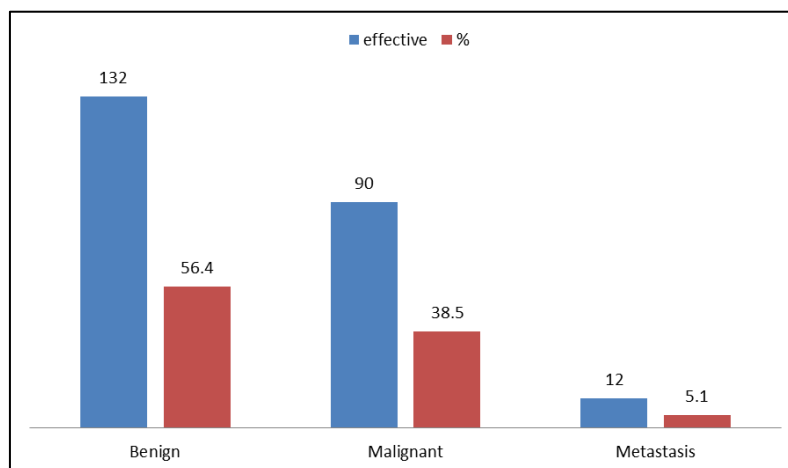


Figure 1: Distribution of Bone Tumors

### Distribution of bone tumors by sex

Females are relatively more affected than males (46 cases, 51.11%), female-to-male ratio was 1.04:1. (Table 1)

### Distribution of bone tumors by mean age

Concerning primary bone malignant tumors, we found, an average of  $27.95 \pm 17.93$  years with age ranged from 5 to 80 years (27.72 years in men, 28.17 years in women) (Table 1). As shown in Fig. 2, patients from 0 to 9 years are more affected, with a percentage of 39.47% (45 cases).

Table 1. Distribution of Bone Tumors by Mean Age

	Mean Age		Standard deviation		Extremes			
	M	F	M	F	M (min ; max)		F (min ; max)	
Benign	25.10	27.85	16.48	17.59	5	84	7	70
Malignant	27.72	28.17	17.63	18.22	9	73	5	80
Metastasis	48.00	49.75	14.07	18.57	27	57	16	74
Total	26.74	29.61	17.19	18.66	5	84	5	85

M = Male; F = Female; min = minimum; max = maximum

As shown in Fig. 2, patients from 10 to 19 years are more affected, with a percentage of 41.11%

(37 cases). People were more affected before 40 years (71 cases, 78.89%).

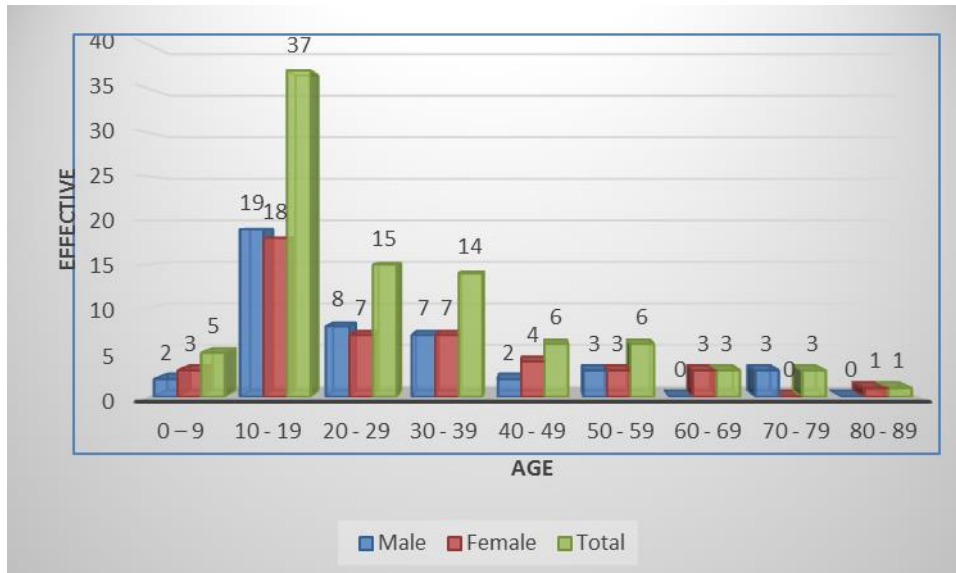


Figure 2. Distribution of primary malignant bone tumors according to age group and sex

**Location of Primary bone tumors**

**Distribution of bone tumors by location and sex**

In our series, the most frequent localization was femur (30 cas, 33.33%) with 14cases (15.56%). % in men and 16cas (17.78%) in women, followed by tibia

(20 cas, 22.22%) 8 cas (8.89%) in men and 20 cas (13.33%) in women (Table 2)

**Table 2.** Distribution of Primary Bone Tumors by Location and Sex

Localization		SEX				total		
		Male		Female		n	%	
		n	%	n	%			
Head and Neck	Skull	2	2,22	-	0,00	2	2,22	
	Mandible	1	1,11	-	0,00	1	1,11	
	Humerus	2	2,22	2	2,22	4	4,44	
	Radius	2	2,22	2	2,22	4	4,44	
	Hand	1	1,11	-	-	1	1,11	
Upper limb	phalanx	-	-	1	1,11	1	1,11	
	Iliac wing	1	1,11	3	3,33	4	4,44	
	Hip	1	1,11	-	-	1	1,11	
	Knee	5	5,56	3	3,33	8	8,89	
	Femur	14	15,56	16	17,78	30	33,33	
Lower limb	Fibula	2	2,22	1	1,11	3	3,33	
	Tibia	8	8,89	12	13,33	20	22,22	
	Ribs	1	1,11	2	2,22	3	3,33	
	Thorax	Scapula	-	-	2	2,22	2	2,22
	Spine	Spine	4	4,44	2	2,22	6	6,67
Total		44	48,89	46	51,11	90	100,00	

EAC: External Auditory Canal; M = Male; F = Female; n = effective; % = percentage

**Distribution of Primary Bone Tumors by Location and Age**

According to the Table 4, the majority of tumors encountered in the age group 10-19 years, are

located mainly on the lower limb, same observation for the two following age groups

**Table 4.** Distribution of Bone Tumors by Location and Age

	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Head and Neck	-	1	-	-	-	1	-	1	-
Thorax	-	2	1	2	-	-	-	-	-
Upper limb	2	2	3	-	-	2	-	1	-
Lower limb	3	30	11	11	5	2	3	1	1
Spine	-	2	1	1	1	1	-	-	-
Total	5	37	15	14	6	6	3	3	1

**HISTOLOGICAL TYPES OF PRIMARY BONE MALIGNANT TUMORS**

**Distribution of Malignant Tumors by Histological Type and Age**

Osteosarcoma was more common in the 10 to 19 age group with 23 cases followed by Ewing's sarcoma 10 cases in the 10 to 19 age group (Table 5).

**Table 5.** Distribution of malignant tumors by histological type and age

	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	Total
Osteosarcoma	2	23	10	9	3	2	2	-	1	52
Chondrosarcoma	-	2	2	3	1	1	-	2	-	11
Ewing Sarcoma	3	10	1	-	-	-	-	1	-	15
Angiosarcoma	-	-	-	1	1	1	1	-	-	4
Fibrosarcoma	-	2	2	-	-	1	-	-	-	5
Liposarcoma	-	-	-	1	1	1	-	-	-	3
Total	5	37	15	14	6	6	3	3	1	90

**Distribution of Malignant Tumors By Histological Type And Sex**

Females predominated in osteosarcoma with 29 cases (32.2%). There is a male predominance in Ewing's sarcoma (Table 6).

**Table 6.** Distribution of malignant tumors by histological type and sex

Histological type	Sex		Sex		Total	
	Male	Female	Male	Female	Male	Female
Osteosarcoma	23	29	25,5	32,2	52	57,8
Chondrosarcoma	4	7	4,4	7,8	11	12,2
Ewing Sarcoma	9	6	10	6,6	15	16,6
Angiosarcoma	3	1	3,3	1,1	4	4,4
Fibrosarcoma	3	2	3,3	2,2	5	5,6
Liposarcoma	2	1	2,2	1,1	3	3,3
Total	44	46	48,9	51,1	90	100

**Distribution of malignant tumors by histological type and seat**

As shown in Table 7, the lower limb was the predominant seat in most histological types.

Osteosarcoma was the most common 22 cases found in the femur and 14 cases in the tibia.

**Table 7.** Distribution of malignant tumors by histological type and seat

		OS	CS	ES	AS	FS	LS	Total
Head and Neck	Skull			1		1		2
	Mandible			1				1
	Humerus		1	2		1		4
	Radius	2		1			1	4
	Hand			1				1
Upper limb	phalanx	1						1
	Iliac wing	2		2				4
	Hip				1			1
	Knee	6	2					8
Lower limb	Femur	22	2	2	1	2	1	30
	Fibula		1	2				3
	Tibia	14	3	2	1			20
	Ribs	1	1			1		3
	Scapula	1	1					2
Thorax								
Spine	Spine	3		1	1		1	6
	Total	52	11	15	4	5	3	90

OS: Osteosarcoma; CS: Chondrosarcoma; ES: Ewing Sarcoma; AS: Angiosarcoma; FS: Fibrosarcoma; LP: Liposarcoma

## DISCUSSION

Of the 234 cases identified in our study, the average frequency was 17 tumors per year, 56.4% of these tumors were benign, 38.5% were malignant and 5.1% were metastases. Similar results were found in Obalum *et al.*, in Nigeria in 2009 where, in 242 patients, the average frequency was 10 tumors per year, of which 53.7% were benign tumors and 46.3% were malignant tumors (Obalum, D. C. *et al.*, 2009). In contrast, Bahebeck *et al.*, in 2003 in Cameroon had 268 cases with an average frequency of 27 tumors per year. Of which 48% were benign tumors, 45% malignant tumors and 6% metastases (Bahebeck, J. *et al.*, 2003). This difference could be explained by our recruitment, which excluded bone-related hematopoietic tumors.

In our study, we found that the average age was  $27.95 \pm 17.93$  years [5-80 years] in primary malignant tumors and 78.89% of patients (71 cases) was affected before their 40 years. Dorman in 1995 and Unni in 2005 revealed that, the incidence of malignant bone tumors shows a striking age-specific distribution: in the age group 0–40 years, there is an incidence peak between 10 and 20 years (primarily osteosarcoma and Ewing's sarcoma) and for the age group above 40 years there is a steady increase in incidence up to 80 years (primarily chondrosarcoma and to a lesser degree Paget's related osteosarcoma) (Unni, K. K. *et al.*, 2005; & Dorfman, H.D., & Czerniak, B. 1995).

The most represented age group in our series was 10 to 19 years old. This approached that of Mendimi Nkodo *et al.*, in 2013 in Cameroon and that of Ottaviani G and Jaffe N in 2009 in the United States with an age range of 10 to 20 years (Nkodo, J. M. M. *et al.*, 2013; & Ottaviani, G., & Jaffe, N. 2009).

Of 90 patients with malignant tumors, 48.9% (44 cases) were men and 51.1% (46 cases) were women

and a median age of 20 years. These results do not corroborate those of Omololu *et al.*, in Nigeria in 2002, there were 114 benign tumors 58.9% (68 cases) in men and 41.1% (46 cases) in women (Omololu, A. B. *et al.*, 2002). In South Africa, there was a slight male predominance with a male-to-female ratio of 1.2:1 and) (Pillay, Y. *et al.*, 2016). This is explained by the fact that the female population is preponderant compared to the male population.

The most common site for malignant bone tumors was the femur 33.3% (30 cases), the tibia 22.2% (20 cases). Unlike Omololu *et al.*, in 2002 in Nigeria where the mandible was predominant with 27, 1% (31 cases), femur 23.9% (27 cases) and tibia 15.8% (18 cases) (Omololu, A. B. *et al.*, 2002). This difference is explained by the exclusion of hematopoietic tumors with bone localization. However, another study in Nigeria with the same exclusion criteria as ours revealed that the top anatomical locations was the distal femur (33%), proximal tibia (24%), humerus (7%) and pelvis (6%) (Pillay, Y. *et al.*, 2016), while in China, two medical formations found that the top three anatomical locations were the distal femur (25% and 42.3%), tibia (9.6% and 19.6%) and pelvis (14% and 11%) (Niu, X. *et al.*, 2015).

Osteosarcoma was the most common type of malignant bone tumor with (57.8%), This is similar to Selma *et al.*, in 2009 in Morocco with osteosarcoma 41.1%, followed by Ewing's sarcoma 36.4% and by chondrosarcoma 11.7% and that of Rao *et al.*, 1996 in India, which found 45.7% of osteosarcoma and 19.4% of Ewing's sarcoma (Selma, E. A. *et al.*, 2014; & Rao, V.S. *et al.*, 1996). Regarding osteosarcoma, 23 cases or 25.5% were represented by men and 29 cases or 32.2% was represented by women. In the study of Ottaviani G *et al.*, in 2009 in the United States revealed that the



incidence of women was higher than that of men (5.1 per million for men and women) (Ottaviani, G., & Jaffe, N. 2009). They corroborated with Buckley *et al.*, (2000) in the United States and Sajid *et al.*, (Pakistan) in 1999 where there were respectively: 75 cases of osteosarcoma in men and 77 cases in women and 22 cases in men versus 24 cases in women (Buckley, J. D. *et al.*, 1998; & Shah, S. H. *et al.*, 1999). Nevertheless, the incidence of osteosarcomas has always been considered to be higher in men than in women.

The average age of patients with osteosarcoma was 26 years (23.1 years for men and 28.7 years for women) is relatively young. This is different from Sajid H *et al.*, in Pakistan in 1999 where the average age was 19 for men and 15.6 for women (Shah, S. H. *et al.*, 1999). This could be explained by the fact that a significant number of these tumors have been observed in children under 15 years of age. In our series, the most frequent location was the femur 42.3% or 22 cases followed by tibia 27% or 14 cases. This result would be similar to that of Ottaviani *et al.*, in 2009 which found 42% in the femur and 19% in the tibia and also would approach that of Sajid H *et al.*, in 1999 Pakistan who found 55.2% to the femur and 20.6% to the tibia (Ottaviani, G., & Jaffe, N. 2009; & Shah, S. H. *et al.*, 1999).

The most common age group was the 10 to 19 age group 41.1%, followed by 20 to 29 years 16.6% and 30 to 39 years 15.5%. This is similar to Omololu and al in 2002 in Nigeria with 42.1% for the age group of 10 to 19 years, 24.5% for the 20 to 29 age group and 15.7% for the 30 to 39 age group (Omololu, A. B. *et al.*, 2002).

In our study, chondrosarcoma represented the second most common tumor. With 12.2%, our incidence is similar to South Africa (11.1%), but lower than other countries where chondrosarcoma was in the same position such as US (29%), UK (27%), China (16%) and Nigeria (21%) ([www.cancer.org](http://www.cancer.org); Arora, R. S. *et al.*, 2012; Niu, X. *et al.*, 2015; Obalum, D. C. *et al.*, 2009; & Pillay, Y. *et al.*, 2016). Like in South Africa, the tibia was the most frequent location, in contrary to International literature reports a high incidence of chondrosarcoma located in the pelvis (Pillay, Y. *et al.*, 2016). In contrast to the data of some authors, these tumors were more common in women with a female-to-male ratio of 1.75:1 and frequent before 60 years.

Concerning Ewing's Sarcoma, we found 15 cases (16.67%), and 14 cases concerning a group age of 0-29 years. It must be recognized that our incidence, although small as compared to that of UK (19%), is nevertheless high if we consider those cited by other authors (USA – 11.9%, South Africa – 9.4%, Nigeria – 7.2%, China – 4.4%) ([www.cancer.org](http://www.cancer.org); Arora, R. S. *et al.*, 2012; Niu, X. *et al.*, 2015; Obalum, D. C. *et al.*,

2009; & Pillay, Y. *et al.*, 2016). In contrast to the two previous tumors, Ewing's Sarcoma is more prevalent in men with a sex ratio of male-to-female of 1.5:1, similar result found in South Africa (1.75:1) (Pillay, Y. *et al.*, 2016). This pathology was specially found in the lower limb. Pillay *et al.*, also noted in their study Ewing's sarcoma's predilection for the long bones of the lower limb (Pillay, Y. *et al.*, 2016).

Several limitations appeared in our study, such as its retrospective design, its relatively small size comparing to similar series from others countries (US, Europe, China, Nigeria, South Africa). The vast majority of our patients were of African descent and this might skew the findings.

## CONCLUSION

Primary bone tumours are frequent in Cameroon. Men are more affected than women with a sex ratio of 1.2: 1 or 53.8% against 46.2%. The most affected age group was between 10 and 19 years old with a total of 85 cases. Osteosarcoma was the most common type in malignant tumors and accounted for 22.2% of all bone tumors. The most affected sites were femur and tibia (27% and 24.9%).

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

Ethical approval was obtained from our Institutional Ethics Committee for Human Health Research.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## Authors' contributions

This work was carried out in collaboration with all authors. Author JPNE designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors AH, AM, BDD, RGA wrote the protocol, managed the analyses of the study and managed the literature searches. Authors ZS and AF read and approved the final manuscript.

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