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Primary Bone and Cartilaginous Tumors of the Maxillo-mandibular Region at the Joseph Ravoahangy Andrianavalona University Hospital, Antananarivo: A 10-Year Study

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ABSTRACT

Introduction: *Primary bone tumors of the maxillo-mandibular region are rare and heterogeneous lesions. The aim of this study was to analyze their epidemiological and histopathological characteristics in the Malagasy context and to compare the findings with data from the literature.*

Materials and Methods: *This was a retrospective, descriptive, and analytical study of primary maxillo-mandibular bone tumors diagnosed at the Department of Pathology of the Joseph Ravoahangy Andrianavalona University Hospital, Antananarivo, Madagascar, over a 10-year period from January 2016 to December 2025.*

Results: *During the study period, twenty-seven cases were identified. Patients' ages ranged from 10 to 62 years, with a mean age of 31.9 ± 15.9 years. A female predominance was observed, with a sex ratio of 0.58. The mandible was the most frequent tumor site, accounting for 59.3% of cases. Histologically, osteosarcoma was the most common subtype (51.9%). Osteoid osteoma occurred predominantly in patients younger than 20 years, whereas malignant tumors were mainly observed in patients older than 40 years. No statistically significant association was found between histological type and the different studied parameters.*

Conclusion: *Primary maxillo-mandibular bone tumors differ from those arising in long bones by their more frequent occurrence in adults and by a histological profile dominated by malignant tumors, particularly osteosarcoma.*

Keywords

Chondroma, Chondrosarcoma, Histology, Mandible, Maxilla, Osteoid osteoma, Osteosarcoma.

Introduction

Primary bone tumors of the maxillo-mandibular region are rare lesions that include benign and malignant tumors of osteogenic or chondrogenic origin. Their diagnosis and management remain challenging because of their low frequency, marked histological diversity, and occasionally atypical clinical presentation. Despite recent advances in imaging and molecular pathology, epidemiological and histopathological data regarding these tumors remain limited, particularly in low-resource countries such as Madagascar, where published series are scarce. A case of mandibular osteosarcoma was reported by Nomenjanahary L in 2017 [1]. The study of these lesions in different geographical settings is essential for a better understanding of their distribution and morphological characteristics, thereby highlighting the relevance of the present study. The aim of this work was to analyze the epidemiological and histopathological characteristics of

primary maxillo-mandibular bone tumors diagnosed at the study site and to compare the findings with data from the literature.

Materials and Methods

This was a retrospective, descriptive, and analytical study of primary maxillo-mandibular bone tumors diagnosed at the department of Pathology of Joseph Ravoahangy Andrianavalona University Hospital over a 10-year period from January 2016 to December 2025. Data were collected anonymously and confidentially from the department registers and histopathological reports. Statistical analysis was performed using Epi Info 7 software. A p-value < 0.05 was considered statistically significant.

Results

During the study period, twenty-seven cases of primary maxillomandibular bone tumors were identified.

Age

Patients' ages ranged from 10 to 62 years, with a mean age of 31.9 ± 15.9 years. The most represented age group was 20–40 years (Figure 1).

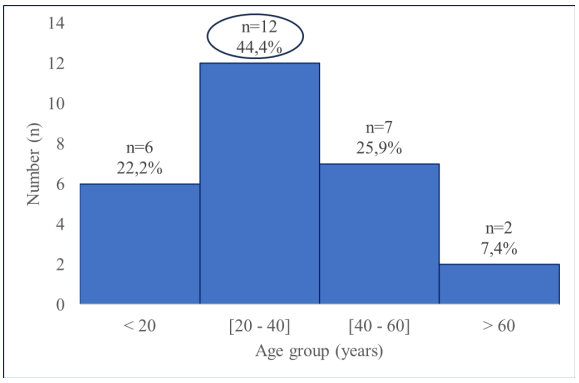

Figure 1: Distribution of patients according to age groups.

Gender

A female predominance was observed, with a sex ratio of 0.58 (Figure 2).

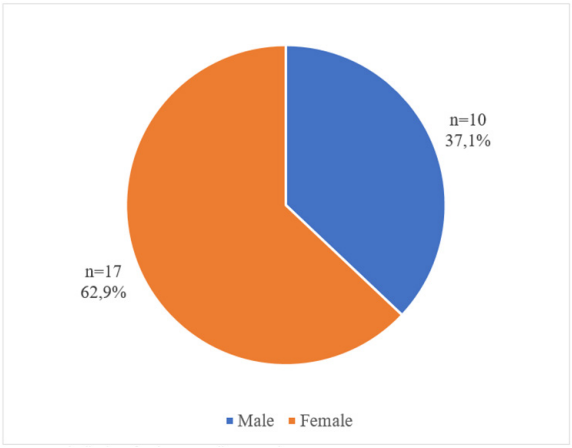

Figure 2: Distribution of patients according to gender.

Tumor Location

A slight predominance of mandibular involvement was observed, accounting for 59.3% of cases (Table 1).

Table 1: Distribution of cases according to tumor location.

Location	Number of cases (n)	Percentage (%)
Maxilla	11	40.7
Mandible	16	59.3

Histological Findings

A marked predominance of malignant tumors was observed (62.9%), among which osteosarcoma accounted for 82.4% of cases (Table 2).

Table 2: Distribution of patients according to histological types.

Histological types	Number of cases (n)	Percentage according to (%)		
		all cases	tumor nature	histological subtypes
Benign tumors	**10**	**37,1**	-	-
- Osteoid osteoma	6	22,2	60	-
- Chondroma	4	14,8	40	-
Malignant tumors	**17**	**62,9**	-	-
- Osteosarcoma	14	51,85	82,4	-
• Conventional	10	37,1	-	71,4
• Chondroblastic	4	14,8	-	29,6
- Chondrosarcoma	3	11,1	17,6	-

Relationship Between Histological Types and Different Parameters

Age Group and Histological Types

Analysis according to histological type showed that benign tumors (osteoid osteoma and chondroma) occurred mainly in subjects younger than 20 years, whereas osteosarcoma was predominantly observed in patients older than 40 years. However, no statistically significant association was found between age group and histological type (p = 0.08) (Table 3).

Table 3: Relationship between age and histological types.

Age group (year) / Histological types	> 20	[20–40]	[40–60]	< 60	p-value
Benign tumors					
- Osteoid osteoma	**4**	**1**	1	0	
- Chondroma	**1**	**2**	1	0	
Malignant tumors					
- Osteosarcoma	3	**4**	**6**	**1**	p=0,08
• Conventional	3	2	5	1	
• Chondroblastic	0	2	1	0	
- Chondrosarcoma	1	2	0	0	

Gender and Histological Types

A female predominance was observed in both benign and malignant tumors. However, no statistically significant association was found between gender and histological type (p = 0.41) (Table 4).

Table 4: Relationship between gender and histological types.

Age group (years) / Types histologiques	Female	Male	p-value
Benign tumors			p=0,41
- osteoid osteoma	4	2	
- Chondroma	3	1	
Malignant tumors			
- Osteosarcoma	10	4	
• Conventional	7	3	
• Chondroblastic	3	1	
- Chondrosarcoma	2	1	

Discussion

Primary bone tumors of the maxillo-mandibular region constitute a rare group of lesions, representing a small proportion of all bone tumors and maxillofacial pathologies. According to the 2020 WHO classification, these tumors include benign and malignant lesions of osteogenic or chondrogenic origin with distinct morphological, biological, and clinical characteristics. Their low incidence explains why most available data derive from retrospective studies including limited numbers of cases, often from specialized oral and maxillofacial pathology centers [2,3].

In the present study, 27 cases of primary maxillo-mandibular bone tumors were collected over a 10-year period. The literature demonstrates considerable variability in case numbers according to geographical region, recruitment period, and type of institution involved. In Africa, smaller series than the present study have been reported, including 28 cases over 21 years and 15 cases over 10 years by Arotiba GT et al. in 1998 [4] and Ogunlewe MO et al. in 2006 [5], respectively, in Nigeria. Similar findings have been reported in Europe, where Ruhin B et al. in France in 2011 identified 14 cases of maxillary osteosarcoma over 26 years [6], while Rodriguez-Molinero J et al. in Spain in 2024 reported 8 cases over 22 years [7]. In the United Kingdom, Costello L et al. in 2021 reported 4 cases over 11 years [8]. In Asia, larger series have been described, notably by Wu Y et al. in China with 88 cases over 15 years [9]. In several centers in the Cairo Governorate, Elsonbaty NA et al. in 2022 reported a higher frequency, with 186 maxillo-facial bone and cartilaginous tumors over a 10-year period [10]. In the United States, analysis of the SEER registry by Klein MJ et al. in 2015 included 541 cases, representing one of the largest available cohorts over 38 years [11]. This heterogeneity in case numbers, ranging from a few cases to several hundred, reflects both the rarity of these tumors and methodological differences between single-center, multicenter, and population-based registry studies, as well as disparities in access to specialized healthcare facilities and diagnostic resources.

From a pathophysiological perspective, craniofacial osteosarcomas classically occur later in life than those affecting long bones, as demonstrated by Dorfman HD [12]. This difference may be related to the particularities of craniofacial bone remodeling involving pathways such as RUNX2, a key transcription factor in osteogenesis that is overexpressed in osteosarcoma [13], and TGF-β, which contributes to tumor progression by modulating the bone microenvironment, promoting invasion, and interacting with osteoclasts and osteoblasts in the setting of pathological bone remodeling [14].

Demographically, the mean age of 31.9 ± 15.9 years observed in the present series is generally consistent with African data, such as the study by Arotiba GT et al. in Nigeria in 1998 reporting a mean age of 30 years [4], but lower than those reported in European and American studies. In France, Ruhin B et al. in 2011 reported a mean age of 43 years [6], while Rodriguez-Molinero J et al. in Spain in 2024 reported a mean age of 41 ± 14.75 years [7]. In the United States, Klein MJ et al. reported a mean age of 41.3 years [11]. In China, Wu Y et al. found a mean age of approximately 37.8 ± 21.6 years [9]. These differences may be explained by variations in diagnostic delay, demographic structure, or biological factors.

Regarding gender distribution, a female predominance was observed in the present series (sex ratio = 0.58), which contrasts with most published data. Ogunlewe MO et al. in Nigeria in 2006 reported a male predominance of approximately 60% [5]. Wu Y et al. in China found a slight male predominance (sex ratio ≈ 1.3) [9]. European studies generally reported a balanced gender distribution [6,7], consistent with the American cohort reported by Klein MJ et al. (49.9% males vs. 50.1% females) [11]. This discrepancy may be related to sampling bias or contextual factors influencing access to healthcare. Interestingly, some data suggest that gender may influence prognosis rather than incidence, particularly in chondroblastic forms [15].

Concerning tumor location, the mandibular predominance (59.3%) observed in this series is consistent with the literature, where mandibular involvement accounts for 55–65% of cases [2,7,10]. This may be explained by the biomechanical constraints and continuous bone remodeling affecting the mandible.

Histologically, one of the most striking findings of this study was the high proportion of malignant tumors (62.9%), dominated by osteosarcoma (14 cases), followed by chondrosarcoma (3 cases). This profile is generally consistent with studies specifically focusing on primary bone tumors, in which osteosarcoma represents the main malignant entity [10]. However, this proportion appears higher than those reported in certain European and Asian studies, where the distribution between benign and malignant lesions is more balanced [7,16]. Several factors may account for this difference, including recruitment bias, underdiagnosis of benign lesions, and delayed diagnosis leading to preferential detection of advanced and aggressive lesions such as osteosarcoma, characterized by rapid growth and marked destructive potential.

Regarding the relationship between histological type and age, no statistically significant association was found. Nevertheless, benign tumors were mainly observed in subjects younger than 20 years. This distribution has been widely described in the literature, where these lesions occur preferentially during the second and

third decades of life [17]. In contrast, malignant tumors were predominantly observed in older patients over 40 years of age.

Conclusion

Primary maxillomandibular bone tumors differ from those arising in long bones by their more frequent occurrence in adults, their predilection for the mandible, and a histological profile dominated by malignant forms. Unlike osteosarcoma of long bones, which is commonly associated with pediatric age peaks and growth-related skeletal development factors, craniofacial forms are linked to specific biological and microenvironmental mechanisms involving bone remodeling pathways and immunoinflammatory interactions. These particularities support the existence of a distinct clinicopathological subtype, thereby justifying a tailored diagnostic and therapeutic approach.

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