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Cartilaginous bone tumors in children: A twenty-year epidemiological report from our hospital

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SUMMARY. *Introduction.* Cartilaginous bone tumors are the most common tumors in children. Their clinical presentation and manifestations vary depending on the type and stage of the tumor, based on Enneking’s classification. *Material and Methods.* A descriptive cross-sectional study was conducted in 236 patients diagnosed and surgically treated for cartilaginous bone tumors in our hospital during the period between 1982 and 2002. *Results.* Male patients prevailed over female patients, with 60.5% of cases. The highest incidence occurred in the 11-15 years age group, which included 147 patients and accounted for 62.2% of the series. The most frequent type of tumor was osteochondroma, with 177 patients, accounting for 75%. Symptoms included pain and swelling, found in 79.6% and 68.6% of patients, respectively. The metaphyseal areas around the knee had the highest involvement rate, with over 40% of patients. Active benign tumors under the Enneking classification prevailed. Resection was the most widely used surgical treatment. *Discussion.* Our results match those reported in the literature.

Key words: bone tumor, children, epidemiological study.

RESUMEN. *Introducción.* Los tumores óseos cartilaginosa constituyen la variedad más encontrada en la infancia. Su forma de presentación y manifestaciones clínicas varían de acuerdo a cada tipo de tumor y estadio en que se encuentren según la clasificación de Enneking. *Material y métodos.* Se realizó un estudio descriptivo y transversal en 236 pacientes diagnosticados y tratados quirúrgicamente por tumores óseos cartilaginosa en nuestro hospital, en el período comprendido de 1982 a 2002. *Resultados.* Predominó el sexo masculino en 60.5% de los pacientes. El grupo de edad con mayor incidencia fue el de 11 a 15 años con 147 para 62.2%. El tipo de tumor más encontrado fue el osteochondroma con 177 pacientes representando 75%. La sintomatología compuesta por dolor y aumento de volumen se representó en 79.6% y 68.6% respectivamente. Las zonas metafisiarias alrededor de la rodilla fueron las más afectadas con más de 40%. Predominó el tumor benigno activo según la clasificación de Enneking. El tratamiento quirúrgico más utilizado fue la resección. *Discusión.* Nuestros resultados coinciden con lo reportado.

Palabras clave: tumor óseo, niños, estudio epidemiológico.

Introduction

Bone tumors are considered among the most unusual neoplasias. For example, it is estimated that only 1,500 new cases of osteosarcoma are seen in the USA every year, compared to 93,000 new cases of lung carcinoma and 88,000 new cases of

breast carcinoma. Based on a simple numerical order, bone tumors are relatively unimportant. However, a large number of these tumors affect children and young adults. Radical surgery is therefore necessary and in case of malignancy, extensive and very painful chemotherapy becomes necessary as well.¹⁻³

Due to their significantly low incidence, physicians are not very familiar with cartilaginous bone tumors and have very little experience in their management. This calls for good communication among the medical staff members, particularly the orthopedic surgeon, radiologist, pathologist, and oncologist. Together, they constitute an essential team for a fast and accurate diagnosis, as well as for a more effective management.^{4,5}

Cartilaginous bone tumors are one of the most common bone tumors, accounting for 20% of them, as proposed by

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Unni⁶ at the Mayo Clinic. Because of this large numeric magnitude, great variations are found in the clinical manifestations, histology and, most of all, in the therapeutic approach to cartilaginous bone tumors.⁷

Cartilaginous bone tumors comprise the following: osteochondroma, enchondroma, chondromyxoid fibroma, chondroblastoma, and chondrosarcoma.^{8,9}

Because of their high incidence and the problems in managing this kind of tumors in children, especially benign tumors, we decided to conduct this research to assess their epidemiology and behavior in our hospital as well the therapeutic methods used and their complications.

Materials and methods

A descriptive, cross-sectional study was conducted with pediatric patients up to 15 years of age, both alive and dead, diagnosed and surgically treated in our hospital for cartilaginous bone tumors, during the 20-year period comprised between 1982 and 2002.

Our data source was the biopsy logbook of the Pathological Anatomy Department, from which a list was made that included: the case history and biopsy numbers, and the patients' first and last name. Based on the list we located the case histories and collected the data in a survey especially designed for this purpose. We set out to analyze the following variables: age, gender, type of tumor, reason for visiting the doctor, tumor location, tumor behavior according to Enneking's classification, type of treatment, and complications.

In spite of all cartilaginous bone tumors belonging to the same family, their surgical treatment varies a great deal. We therefore found it necessary to define each type of procedure as follows:

- Resection: it involves the surgical removal of the tumor by using an osteotome.
- Resection and curettage: it is generally used in cavity tumors and involves removing the tumor with a gouge.
- En-bloc resection: the tumor is removed through its reactive area.
- Resection, curettage, and bone graft: the above procedures are combined and a bone graft is added.

Data were statistically analyzed with the Chi square (χ^2) method. Any p value <0.05 was considered as significant.

A Microsoft Word software was used in a Pentium II computer to process the wording, tables and charts.

Results

A total of 336 bone tumors were treated in our hospital during the study period. Of these, 70.2% were cartilaginous bone tumors, equivalent to a universe of 236 patients. Males prevailed with 60.5% of all patients and the age group with the highest incidence was the 11-15 years group, accounting for 62.2% of cases (*Table 1*).

Cartilaginous bone tumors accounted for 97.1% of all benign tumors. According to Enneking's classification, the active benign tumor prevailed with 86.4% (204) of all patients. Two patients had one malignant tumor each, of low and high histological grade, accounting for 0.4% each (*Table 2*). Osteochondroma was the most frequent tumor, found in 75% (177) of patients, and chondrosarcoma was the least common one, with 0.8% (2 patients). No chondroblastomas were found (*Chart 1*).

Pain was the most common reason for visiting the doctor's office and was reported by 188 patients (79.6%); a pathological fracture was the most unusual reason, mentioned by 10 patients (4.2%) (*Chart 2*).

The most common location, found in 65 patients (27.5%), was the distal femur metaphysis, and the most unusual location, found in 11 patients (4.6%), was the costal arches (*Figure 1*).

The most usual treatment was resection, which was used in 148 patients (62.7%), and the least common was resection and curettage, applied in 12 patients (5%). One patient with chondrosarcoma was disjointed (0.4%) (*Table 3*).

The main complication, relapse of osteochondroma, occurred in 11 patients (4.6%), followed by hematoma, reported in 4 patients (1.6%), and infection, in 3 patients (1.2 percent).

Discussion

The male to female ratio in our study was 1.5:1, consistent with Unni,⁶ who reported that males accounted for 63% of patients affected by this pathology. The age group with the highest incidence was the 11 to 15 years group, also matching Unni's statistics⁶ reporting over 60% of patients less than 20 years of age, and a large proportion of patients in their twenties.¹⁰

Table 1. Cartilaginous bone tumors distribution by age and gender.

Age Group (years)	Males		Sex		Females		Total	
	Number	%	Number	%	Number	%	Number	%
0 - 5	10	4.2	5	2.1	15	6.3		
6-10	50	21.1	24	10.1	74	31.3		
11-15	89	37.7	58	24.5	147	62.2		
Total	143	60.5	93	39.4	236	100		

Source: Survey

Table 2. Behavior according to Enneking's classification.

Enneking's Classification		Number	Percentage
Benign	Latent	30	12.7
	Active	204	86.4
	Aggressive	—	—
Malignant	Low Grade I	1	0.4
	Low Grade II	1	0.4
	Low Grade III	—	—
Total		236	100

Source: Survey

Although the incidence of cartilaginous bone tumors is lower than the data reported in this study, it is important to clarify that universal statistics do not report only the cases that occur in the pediatric age groups. In this study osteochondroma is the most common cartilaginous bone tumor, matching the statistics given by several authors such as Dorfman,¹¹ 35%; Adler¹² 58%; Unni⁶ 34%. Although these numbers are lower than ours, a strong prevalence if this tumor is clearly seen. Statistics on the incidence of enchondroma in the world literature are very similar to the data in our study, as shown in the reports by Unni⁶ with 13.4%; Adler¹² with 19%; and Dorfman,¹¹ 24%. The incidence of chondromyxoid fibroma is very similar to the reports by Unni, 1.8%. Given that chondrosarcoma is a malignant tumor most common in elderly patients, the data in the literature do not match the reports in study, which only reports these tumors in children.¹³⁻¹⁵

The most common symptoms in patients with cartilaginous bone tumors were pain and swelling. This is consistent with the data provided by Unni⁶ and Dorfman.¹¹ Osteo-

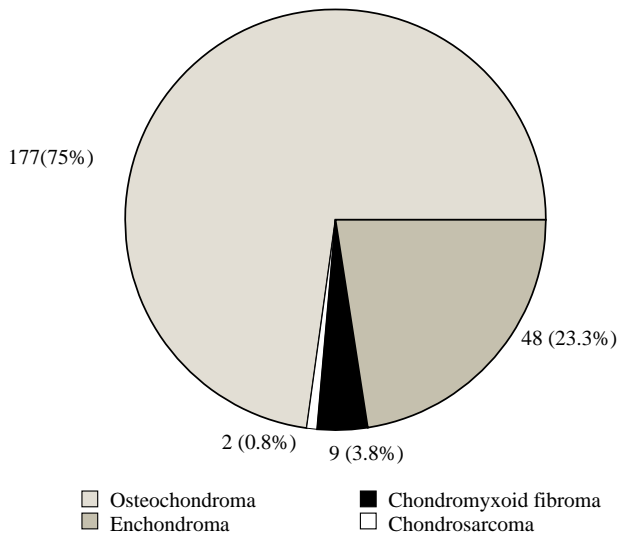


Chart 1. Distribution by type of tumor. Source: Survey

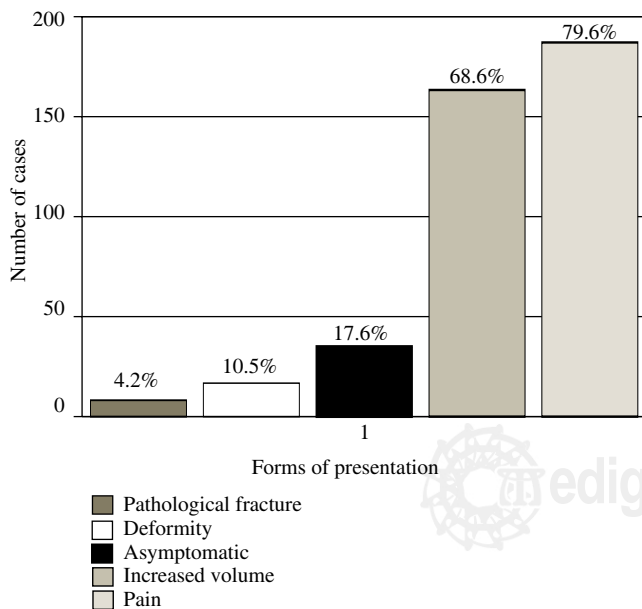
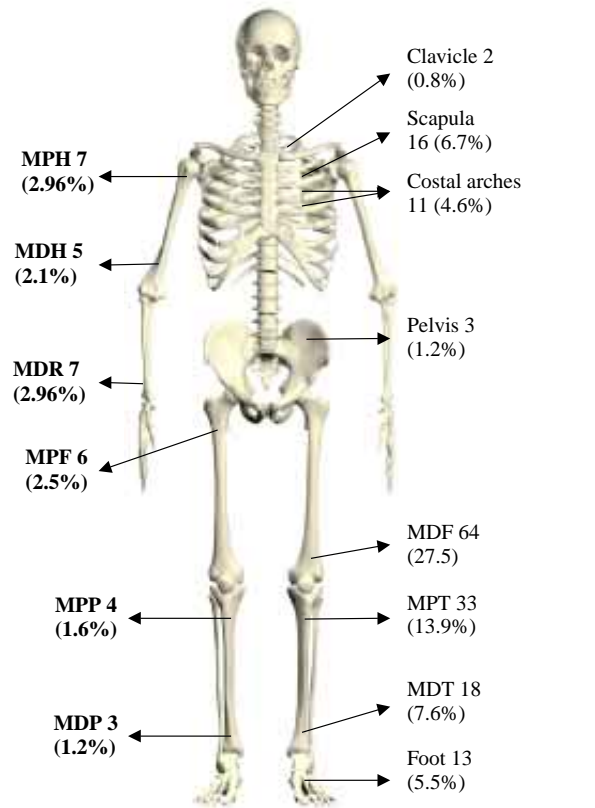


Chart 2. Tumor variety. Source: Survey



MDF = distal femoral metaphysis
 MPF = proximal femoral metaphysis
 MPH = proximal humeral metaphysis
 MDH = distal humeral metaphysis
 MPP = proximal fibular metaphysis
 MDP = distal fibular metaphysis
 MPT = proximal tibial metaphysis
 MDT = distal tibial metaphysis
 MDR = distal radial metaphysis

Source: Survey

Figure 1. Distribution of cartilaginous bone tumors according to their location

Table 3. Behavior of cartilaginous bone tumors according to the type of treatment.

Type of treatment	Number	Percentage
Resection	148	62.7
Resection and curettage	12	5
En-bloc resection	33	13.9
Resection, curettage and bone graft	42	17.7
Disjointment	1	0.4
Total	236	100

chondroma is the tumor for which the greatest number of symptoms is reported, including basically pain, which may result from a compression of neurovascular structures, exostosis fracture, and/or formation of the painful bursa.^{4,15}

The most common location of tumor bone activity in this study was the metaphyseal areas around the knee, the distal femoral metaphysis and the proximal tibial metaphysis accounting for 27.5% and 13.9%, respectively. These results are similar to those presented by Unni,⁶ namely distal femoral metaphysis, 16.4%, and tibial distal metaphysis 13%. Other locations had an incidence similar to reports by other authors.^{3,8}

The classification of bone tumors based on their biological behavior, as described by Enneking,¹⁶ is undoubtedly of great help in the diagnosis and prognosis of patients. Bone tumors, both benign and malignant, may vary from one stage to the next. According to Enneking,¹⁶ active benign bone tumors are highly prevalent in pediatric ages. However, aggressive tumors are very uncommon. These findings match those in our study.¹⁷

Because most of the tumors diagnosed were osteochondromas, the prevalent surgical method was resection. Undoubtedly, the latter is the most widely used modality; it consists of defining the base of the osteochondroma, excising the tumor and having a surrounding periosteum about 1 to 1.5 cm long.

One of the major difficulties that orthopedic surgeons face is the type of procedure to perform for a suspected enchondroma at the long bone level. The latter is very similar to the low histological grade chondrosarcoma and hence a broad curettage is desirable. If necessary, the use of methyl methacrylate should be considered. Given that chondrosarcoma is a tumor with poor response to chemo- and radiotherapy, its surgical treatment is a very attractive choice. Furthermore, because of its low progression rate and histological grade, salvage surgery may well be a reasonable alternative.¹⁸⁻²¹

The main complication of cartilaginous bone tumors in our study was relapse. Our relapse rates were slightly lower than those reported by Unni,⁶ with 6.5%, and Dorfman,¹¹ with 5.3 percent.²²

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