

## Pathological fractures secondary to unicameral bone cysts

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Accepted: 6 July 1993

**Summary.** *We carried out a retrospective review of 75 children with unicameral bone cysts, who had sustained 52 pathological fractures, to determine which cysts were likely to be at risk and whether healing was accelerated after a fracture. Most lesions were in the metaphysis of a tubular bone, the commonest sites being the the upper part of the humerus and femur. The percentage of bone occupied by the cyst in the transverse plane was more than 85% in both anteroposterior and lateral radiographs in every case of pathological fracture. In most cases, the cyst recurred and sometimes became large without any acceleration of healing.*

**Résumé.** *Nous avons conduit une étude rétrospective de 75 malades porteurs d'un kyste solitaire des os afin de déterminer quels sont les types de kystes comportant un risque de fracture et si cette fracture peut accélérer la guérison du kyste. Soixante-quinze patients avec 52 fractures pathologiques ont été revus. Les lésions siégeaient en majorité au niveau de la métaphyse des os longs. Elles étaient localisées essentiellement à l'extrémité proximale de l'humérus et dans la partie supérieure du fémur. La surface occupée par le kyste dans le plan horizontal dépassait 85% sur les radiographies de face et de profil chez tous les patients présentant une fracture pathologique. Dans la plupart des cas l'évolution se fit vers la récurrence et même vers l'extension du kyste originel, sans accélération du processus de guérison.*

### Introduction

Pathological fractures in children occur most frequently in the long bones [1, 2, 4, 8], and may be caused by several types of lesion, including unicameral bone cysts. The fractures may be spontaneous or as a result of a minor injury, and there is still controversy about which cysts are most at risk of a fracture.

Age, site, size, degree of loculation and cortical erosion, the stage of the cyst and whether it is active or not are all factors to be considered.

This study is an attempt to discover which unicameral bone cysts are most at risk of fracture.

### Patients and methods

We reviewed the medical records and radiographs of patients seen from 1950 to 1982 at the Alfred I. DuPont Institute in Wilmington, Delaware, and the Nemours Children's Clinic in Jacksonville, Florida, US. Patients were selected who could be followed until complete healing of the fractures had occurred. Fifty two were followed until skeletal maturity, but some cysts healed before the patient was skeletally mature.

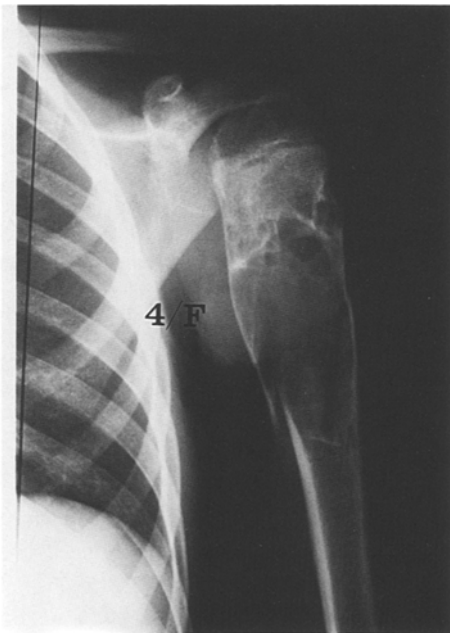
Seventy-five children with unicameral bone cysts with a total of 52 pathological fractures were included. The cysts were assessed radiologically according to their site, loculation, whether single or multiple, size, the presence and location of a fracture and the time of healing.

All the fractures were treated by immobilisation in a plaster cast or by bed rest for a period of 4 to 6 weeks. After healing of the fracture, as assessed clinically and by radiographs, treatment was either by serial observation, intracystic injection of methylprednisolone, or by curettage and bone grafting.

The cysts were classified as active or latent [8]. Active cysts were situated in the immediate vicinity of the growth plate and were prone to recurrence; latent cysts were separated from the growth plate by an interval of normal bone and had less tendency to recur.

**Table 1.** Distribution of unicameral bone cyst and pathological fracture

Bone	No. of cysts	No. of pathological fractures	Rate of pathological fractures (%)
Proximal humerus	36	33	92
Proximal femur	21	11	52
Distal femur	5	3	60
Proximal tibia	6	2	33
Distal tibia	4	2	50
Others	2	1	50
Total	75	52	69

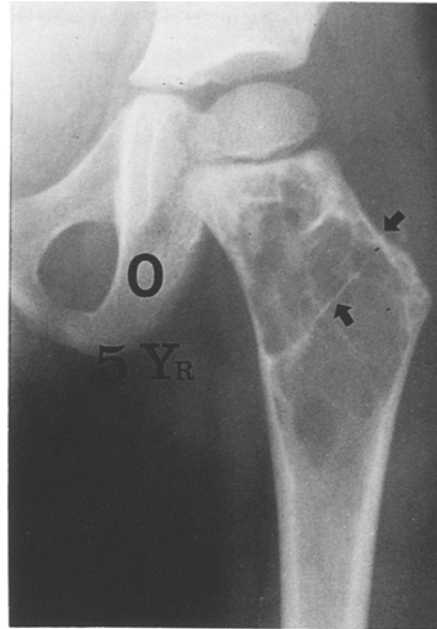
**Fig. 1.** Unicameral bone cyst with a pathological fracture in the proximal humerus

## Results

The average age at presentation was 7 years and 10 months (range from 2 to 17 years). The sites of the cysts and the occurrence of pathological fractures are shown in Table 1.

A single pathological fracture was present in 52 patients (65%). In 12 there was a second pathological fracture after healing of the first; 3 fractures occurred in each of 4 patients, and 5 in each of 2.

Measurement of the radiographs showed an average vertical diameter of 54 mm (range 42 to 107 mm). Pathological fractures occurred when the transverse diameter of the cyst took up 85% of the total transverse diameter of the bone (Figs. 1 and 2); fractures occurred in 80% of patients with unilocular and 72% with multilocular cysts.

**Fig. 2.** Unicameral bone cyst with a fracture (indicated by arrows) in the proximal femur. The cyst involves more than 85% of the diameter of the bone

The fractures treated by immobilisation healed at an average of 5 weeks. One fracture of the proximal femur was treated immediately by bone grafting, and a further fracture occurred after healing; compression plating was then carried out with a satisfactory result. Another fracture developed delayed union due to deep infection.

There appeared to be radiological healing of the cyst after some fractures, but this proved false as the cyst subsequently returned to its original size. Cysts healed without operation or steroid injection in 4 cases of pathological fracture with a follow up at an average of 5.5 months after the fracture. In those treated by operation there was a complication rate of 7%, including premature epiphyseal fusion with coxa vara or shortening of the humerus, and infection.

## Discussion

The commonest site for unicameral bone cysts and pathological fractures was the proximal humerus, as has been reported by other authors [1, 2, 6, 8]. The degree of loculation does not appear to influence the occurrence of a fracture. Our results indicate that cysts which occupy more than 85% of the diameter of a long bone have an increased risk of fracture with only minor trauma.

There are varying views about the healing of the cysts after fracture. In our cases, 8% of the cysts

**Table 2.** Effect of location on the end result and type

	No. of cases	No. of recurrence (%)
Active cysts	38	21 (55)
Latent cysts	14	4 (28.5)
Humerus	33	20 (61)
Femur	11	5 (45)
Active cysts and below 10 years old	26	24 (90)

healed spontaneously at an average of 5.5 years (range 4 to 7 years) after from one to 4 fractures. Those without fracture healed at an average of 5 years (range 2 to 11 years) after diagnosis. Garceau reported that 15% of simple bone cysts healed after fracture [5], but others found no evidence of healing of the cysts [1, 8].

We found that fractures occurred more often when the cyst was in an active phase; cysts were less prone to fracture and had a lower rate of when they were in a latent stage. Children over the age of 10 years had fewer fractures with fewer recurrences (Table 2).

Pathological fractures may present problems if the growth plate is affected by the lesion [6, 8], and when active cysts are within 1 cm of the plate [8]. Physeal growth disturbance occurs less frequently in the femur compared to the humerus; the capital femoral epiphysis contributes approximately 25% of the total length of the femur, whereas the

proximal humeral contributes 80% of the length of the humerus.

Early identification and appropriate treatment of cysts at increased risk of fracture will help to reduce the incidence of fracture and the complications of such an injury, including physeal damage, malunion and angular deformity in the proximal humerus and femur.

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