



## Simple bone cysts of the proximal humerus complicated with growth arrest

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A simple bone cyst of the proximal humeral metaphysis was found to cause growth disturbance with shortening and deformity in four patients. All had one pathological fracture. Three of them were treated with cortisone injections ; the fourth patient, who presented an erosion of the physis, was treated with saline solution irrigation. Four hypotheses about the aetiology of growth arrest in the evolution of this benign lesion, are discussed : iatrogenic lesion of the physis, growth plate involvement by fracture, cortisone injection, and increased cyst pressure leading to erosion and even perforation of the growth plate.

### CASE REPORTS

**Case 1 :** A six-year-old girl was first seen in September 1985 after a fall from a bicycle. Radiographs demonstrated a pathological fracture of the right proximal humerus and a unilocular active cyst close to the physis (fig 1). The patient was treated with a sling, and the fracture healed in three weeks. Three months later, a roentgenogram showed that the cyst had increased in size. A biopsy was performed. Eighty milligrams of methylprednisolone acetate were injected into the cyst. The injection was repeated after six and twelve weeks. At age nine, radiographs showed

### INTRODUCTION

Simple bone cysts, which may be considered as a benign condition in children, are usually located in the proximal humeral metaphysis (2, 3). Their evolution is marked by a high frequency of pathological fractures and recurrences. Growth arrest has been reported in 6 to 20% of the cases (2, 7). The cause of this partial or complete fusion of the physis is controversial. It is unclear whether such a condition is due to the surgical treatment (7), the fracture (7, 6, 8), the steroid injection (5), or the activity of the cyst across the growth plate (4, 9).

We report the clinical history of four patients who presented a physal growth arrest of the proximal humerus due to a simple bone cyst, and discuss the possible aetiology.

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*Fig. 1.* — A six-year-old girl with a pathological fracture of the proximal right humerus through a simple bone cyst (case 1).



*Fig. 2.* — Recurrence of the cyst and varus deformity in a nine-year-old patient (case 2).

that the cyst had begun to heal, but there was a one centimetre shortening of the humerus. At age 14 the patient was asymptomatic but the discrepancy measured seven centimetres, and the cyst was still present, without varus or valgus deformity.

**Case 2 :** The second case was a four-year-old boy who was seen after a fall. A pathological fracture of the right proximal humerus was diagnosed. Initial treatment consisted of immobilisation in a sling for four weeks. Two months after the accident a biopsy confirmed the diagnosis of benign cyst, and a corticosteroid injection was performed (80 mg prednisolone). The patient was examined five years later at age nine, because of limited abduction and shortening of the arm (4 cm). Radiographs revealed a varus deformity, and recur-

rence of the cyst (fig 2). MRI confirmed closure of the medial half of the epiphyseal plate. Two months later, a valgus osteotomy was performed, combined with epiphysiodesis of the remainder of the growth plate and bone grafting of the cyst. Again, bopsy confirmed the diagnosis. At age sixteen the total abduction was 120°. The cyst had healed radiographically, but the humerus was 13 cm shorter. The patient did not accept a limb-lengthening procedure.

**Case 3 :** An eight-year-old boy without any pathological history was examined for mechanical pain at his right shoulder. Radiographs revealed a cyst of the proximal humerus without fracture. A biopsy was performed and 80 mg of methylprednisolone acetate were injected into the cyst. Six



*Fig. 3.* — Cyst healed with 10 cm. of shortening of the humerus in a 16-year-old patient (case 3)

weeks later a multicameral cyst appeared and injection became impossible. Two years later, at age ten, the patient experienced pain after a minor trauma, and radiographs showed an impacted fracture through the cyst. Healing of the fracture was obtained in five weeks with conservative treatment. At that time, physical examination revealed that the affected limb was 3 cm shorter than the contralateral limb. However, radiographs revealed no physical changes. At age sixteen the cyst had healed with 10 cm. shortening of the humerus (fig 3).

**Case 4 :** A nine-year-old girl was seen in the emergency room with a history of left arm pain.

Roentgenograms made at that time revealed a fracture through an active unicameral bone cyst eroding the physis (fig 4). The fracture was treated with an arm sling, and healed in six weeks. Biopsy, aspiration and irrigation with saline solution were performed. However, the parents did not accept any further treatment. The patient was reviewed ten years later, at age 19. The left arm was six cm shorter than the right. She had a full range of motion. Both roentgenograms and MRI showed a varus deformity of the proximal humerus, incomplete healing of the cyst and closure of the growth plate.



Fig. 4. — Erosion of the physis in a 9-year-old patient (case 4)

## DISCUSSION

Limb shortening after simple bone cyst is not rare : it occurs in 6 to 20% of the cases (2, 7). The pathogenesis of this complication is not clear and several hypotheses have been proposed.

Firstly, Neer *et al* (7) suggested lesions of the growth plate during curettage and bone grafting. They reported 71 simple cysts of the proximal end of the humerus treated by curettage, cauterisation with phenol (in about 40%) and bone grafting. They noted 4 (6%) premature epiphyseal closures, resulting in shortening of one to three cm. This technique, which exposes the physis to iatrogenic damage, is no longer used and none of our cases were treated in this way.

Secondly, several authors (7, 6, 8) attributed the growth plate involvement and subsequent growth arrest to repeated pathological fractures through the cyst. Neer *et al* (7) reported 41 cases of simple bone

cysts of the proximal end of the humerus, initially treated by fracture immobilisation and observation alone. They noted 4 cases (10%) of growth disturbance and deformity of the proximal humerus. Moed and Lamont and Foster (6) reported 3 cases of growth inhibition and suggested the role of the combination of multiple fractures in the presence of an active cyst. Nelson (8) reported closure of the proximal humeral physis in a 15-year-old girl, which may have been related to an injury three years before. However, in this series the fracture was always located below the growth plate and was minimally displaced ; a Salter-Harris fracture was not seen.

Thirdly, cortisone injection has been suggested as a cause of growth arrest (5). In 1979 Scaglietti *et al* (10) proposed the technique of methylprednisolone acetate injection for the treatment of bone cysts. They reported 72 cases of unicameral bone cysts treated with this method, and did not note any

growth disturbance. However, Campanacci *et al* (2) reported 141 cysts, mostly localised at the proximal humerus, treated with one or more cortisone injections, and noted that 28 patients (about 20%) had a limb-length discrepancy. Stanton and Abdel'Mota'al (11) reported three cases of growth arrest in unicameral bone cysts localized in the proximal humerus and treated by steroid injection. Herring and Peterson (5) reported two cases of premature epiphyseal closure after steroid injection of a cyst located at the proximal end of the humerus. We report three new cases of growth disturbance after steroid injection for a simple cyst of the upper metaphyseal humerus. However, this is not enough to accept a causal relation.

The fourth hypothesis concerning growth arrest was proposed by Gupta and Crawford (4), and more recently by Ovidia *et al* (9). Increased cyst pressure might cause local erosion and subsequently perforation of the growth plate. Once the epiphysis is reached, the vascular supply of the growth plate is further compromised, as most of this supply comes from the epiphyseal side. Bensahel *et al* (1) have observed nine cases of length discrepancy due to simple bone cysts in the proximal humerus. Three of these nine cases were explained by connections of the cyst with the physis. Our fourth case shows erosion of the physis, which seems to support this hypothesis.

It is possible that several mechanisms exist. MRI will probably further elucidate this problem. Parents and patients should be aware of a possible growth disturbance.

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