J Cancer Res Clin Oncol (1992) 119:61–65

Journal of Cancer Research and Clinical Oncology

Calcitonin therapy of aneurysmal bone cysts

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Received 4 May 1992/Accepted 16 June 1992

Summary. Seven aneurysmal bone cysts (ABC) were treated with the hormone calcitonin. Six of the cysts, which were hypovascular responded well to the calcitonin administered directly into the cyst. Ossification and rebuilding of the ABC occurred after some months in every case. One hypervascularized ABC, however, failed to respond either to embolotherapy or to the calcitonin hormone treatment. The authors recommend calcitonin administration as a useful non-invasive method for the treatment of hypovascular ABC.

Key words: Calcitonin hormone – Aneurysmal bone cyst

Introduction

Aneurysmal bone cysts (ABC) are rare tumor-like lesions, growing aggressively and destroying and often expanding the affected bone (Lichtenstein 1957). Malignant transformation of an ABC occurs rarely, mostly following irradiation. About 30% of the ABC are secondary, associated with other bone tumors (Levy et al. 1975; Martinez and Sissons 1988). ABC develop in the metaphysis of the long tubular bones, e.g. in the humerus, femur and tibia. Another frequent location is the pelvis (Schajowicz 1981).

The treatment of ABC is usually surgical: curettage and bone grafting or en bloc resection, if possible. The incidence of recurrence is, especially after incomplete removal, relatively high: 20%–30% (Schajowicz 1981; Szendrői et al. unpublished results).

Recently different non-surgical treatments of the ABC have been described. Papavasiliou and Sferopoulos (1990) proposed percutaneous drilling of the ABC with wires, Maeda et al. (1988) suggested high-energy low-dose irradiation of the lesion. Dubousset (personal communication) noticed intensive ossification of the ABC after filling up the cavity with biopolymer (Ethibloc, Ethicon) and calcitonin administration. Other authors (Chuang et al. 1981; Murphy et al. 1982; Radanovic et al. 1989) reported good results with superselective embolisation of the ABC. A similar experience was reported recently by us (Kónya and Szendrői 1992) in five cases of pelvic ABC.

This paper reports the results with calcitonin treatment of ABC.

Materials and methods

Seven patients with ABC were treated with calcitonin at the Orthopaedic Department of the Semmelweis Medical School in Budapest between 1989 and 1991. The mean age of the six male and one female patients was 16 years (Table 1). The ABC was located in the proximal humeral metaphysis in four cases and in the proximal femur, in the ischial, and in the pubic bone in one case each. The diagnosis was made by open biopsy in four cases and by aspiration cytology, confirmed by typical clinical and radiological findings, in three cases. In two patients, pathological fracture of the humerus was the first symptom of the disease. Angiography was performed in four patients; all but one ABC proved to be hypovascular. The only hypervascular ABC was first treated by superselective embolisation of the supplying arteries with a mixture of 1:1 enbucrylate (Histoacryl) and iodized oil (Lipiodol). After embolotherapy had proved ineffective, we performed calcitonin treatment as in the other cases. Calcitonin (Myacalcic, Sandoz, 100 IU) was given three times weekly (15 times altogether) by direct puncture of the ABC under local anaesthesia. Radiography and a computed tomography (CT) scan were performed 1 month before and 3 months, 6 and 12 months after the onset of the therapy. The mean follow-up time was 12 months.

The Neer classification, modified by Campanacci et al. (1986), was used for the assessment of the results of treatment on the basis of the radiographs and CT scans. The categories complete healing, incomplete healing, recurrence and no response were used.

Results

Calcitonin could be administered under local anaesthesia because of the thinned and softened bony wall of the cysts. The wall of the ABC became thicker and harder at the end of the treatment course. Appreciable ossification first appeared on the radiographs 1 month after finishing the therapy. With the

Abbreviations: ABC, aneurysmal bone cyst

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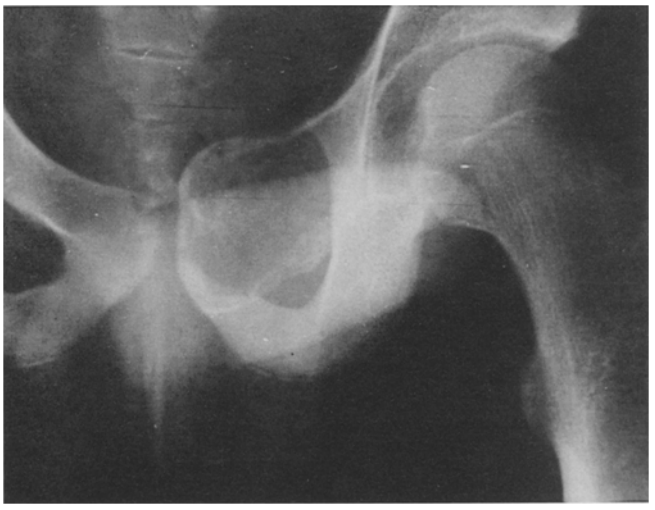

Fig. 1. Case 1: aneurysmal bone cyst (ABC) developing in the left pubic bone (a–p view)

exception of one case, side-effects of the hormone treatment (vomiting, convulsions) were not observed.

The growth of the ABC stopped in six out of the seven cases and a progressive ossification of the cyst occurred. Three ABC healed completely, another three incompletely; e.g. besides new bone formation, residual small cysts were seen within the boundaries of the ABC (Table 1). In one case the hormone therapy had to be interrupted because of allergy and this led to the recurrence of the process.

We describe three of our cases in detail to demonstrate our results.

Case 1. A 16-year-old male patient was referred to us with moderate pain in the left groin. The radiographs (Fig. 1) and CT pictures (Fig. 2a and b) revealed a lytic lesion expanding the left pubic bone. The histological diagnosis was

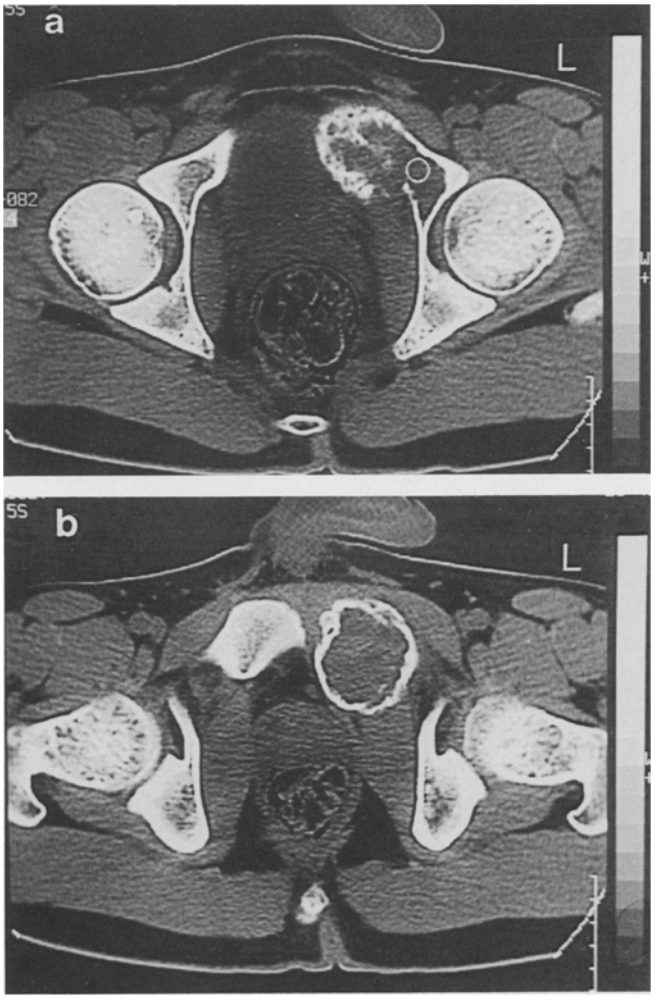

Fig. 2. Case 1: computed tomography (CT) picture at the level of the femoral head (**a**), and greater trochanter (**b**). The pubic bone is expanded; however, there is a small, thin rim of cortical bone around the lesion

Table 1. Patient characteristics

Case	Age (years)	Sex	Site of ABC[a]	Pathol. fracture	Treatment (calciton in)	Radiographic result	Progression or recurrence	Follow-up time (months)
1	16	M	Pubis	–	15 times	Completely healed	No	14
2	18	M	Humerus	–	15 times	Healed with residual	No	11
3	16	F	Humerus	+	15 times	Healed with residual	No	11
4	20	M	Ischium acetabulum	–	1. Embolisation 2. Calcitonin (12×) 3. Embolisation	Progression, allergy, incomplete healing	Yes	14
5	15	M	Humerus	–	15 times	Completely healed	No	12
6	15	M	Femur	–	10 times	Completely healed	No	12
7	20	M	Humerus	+	15 times	Healed with residual	No	11

[a] Aneurysmal bone cyst

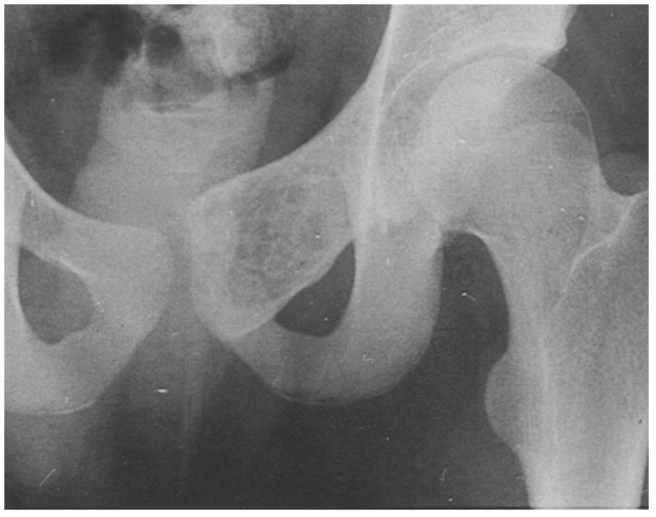

Fig. 3. Case 1: intensive ossification and rebuilding of the ABC 2 months after the onset of the calcitonin hormone treatment (a–p view)

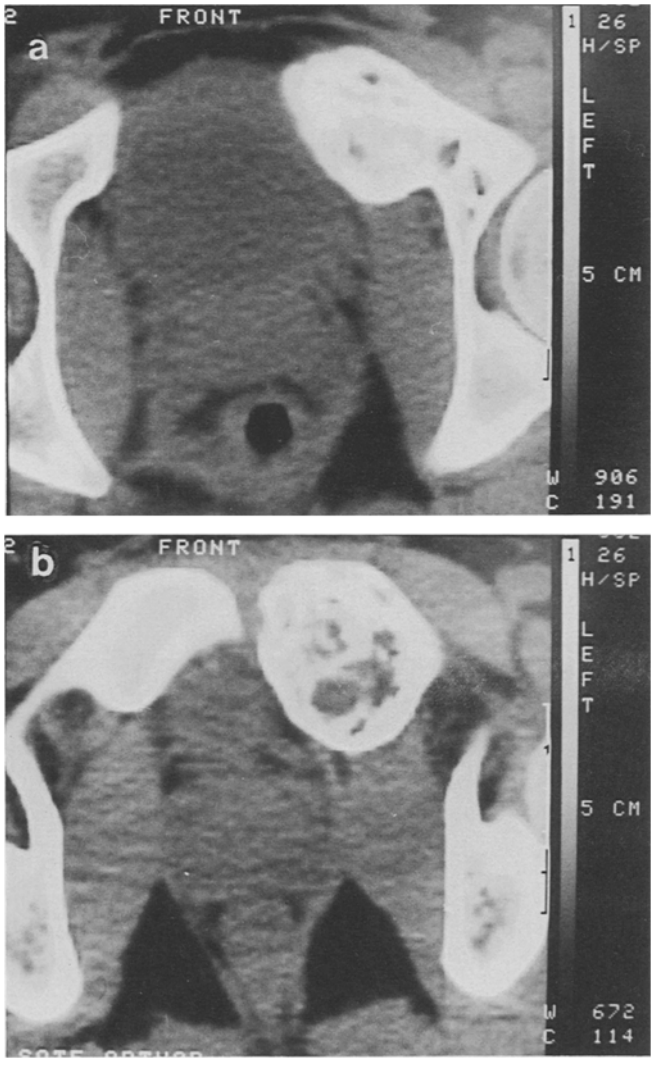

Fig. 4. Case 1: CT pictures, comparable to Fig. 2, demonstrate the ossification inside the ABC at (**a**) femoral head level and (**b**) greater trochanter level

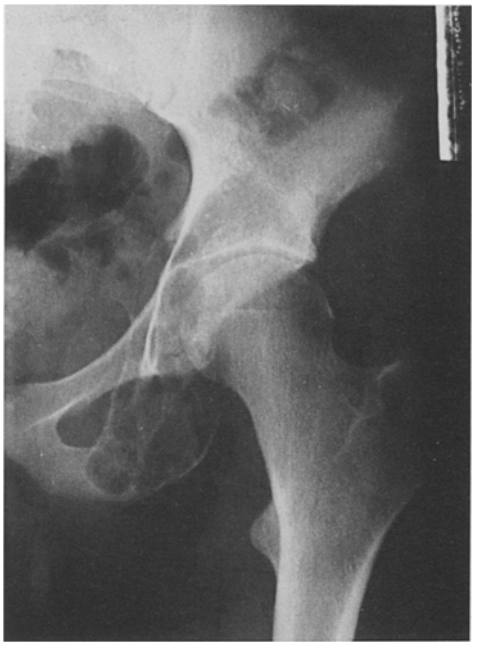

Fig. 5. Case 4: ABC affecting the left ischial bone and acetabulum (a–p view)

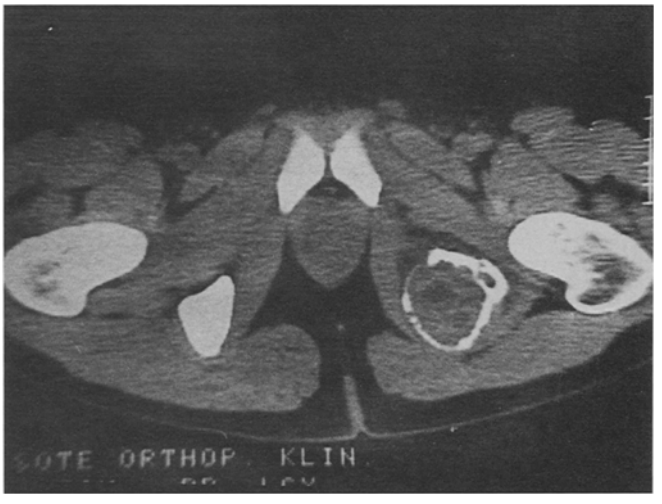

Fig. 6. Case 4: CT picture of the ABC before the treatment

ABC. Embolisation was planned, but the cyst was hypovascular and the supplying arteries too small for catheterization. Calcitonin was injected into the cyst 3 times during 1 week, 15 times altogether. Six months later strong ossification and complete healing could be detected on the radiographs (Fig. 3) and CT scans (Fig. 4 a and b).

Case 4. A 20-year-old male patient was examined because of painful motion of the left hip. On radiographs (Fig. 5) and CT scans (Fig. 6) a lytic lesion of 8×6×4 cm was found to be present in the left ischial bone affecting also the medial wall of the acetabulum. Open biopsy was performed and the histology revealed ABC. The lesion was hypervascular, so embolisation of the supplying obturator artery was performed using a mixture of Histoacryl and Lipiodol. Despite the embolisation, the cyst continued to grow without

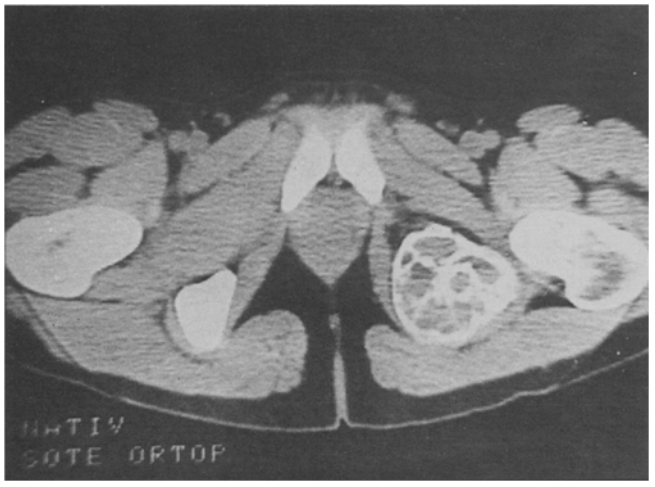

Fig. 7. Case 4: CT presents incomplete ossification of the ABC after calcitonin hormone treatment

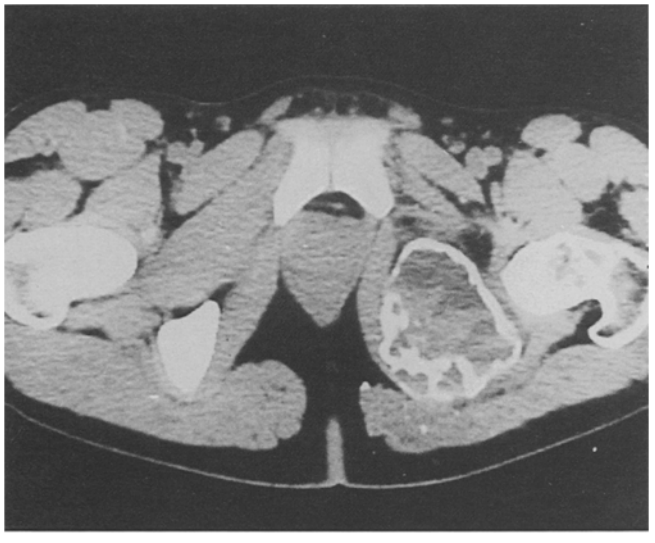

Fig. 8. Case 4: following the suspension of the calcitonin treatment the ABC continued to grow, the newly formed bony trabecules diminished inside the cyst

detectable ossification on the radiographs, its size reaching 13×10×8 cm. As revascularization of the ABC was suspected, a new angiography was performed; neither the supplying artery nor the cysts were delineated; the ABC had been excluded from the arterial circulation. Calcitonin treatment was started. At the beginning of the treatment we observed relatively high intracystical pressure, which decreased continuously during the course of the treatment. Side-effects of the hormone (vomiting, moderate convulsions) were observed a few seconds after the instillation into the cyst. The symptoms were suspended by i.v. calcium administration. Three months later some ossification and incomplete healing of the ABC were seen on the CT scans (Fig. 7). Unfortunately, the patient had became hypersensitive to the calcitonin, and the treatment had to be stopped. Some weeks later another control CT (Fig. 8) revealed progression of the lesion. The newly formed bony trabecula had

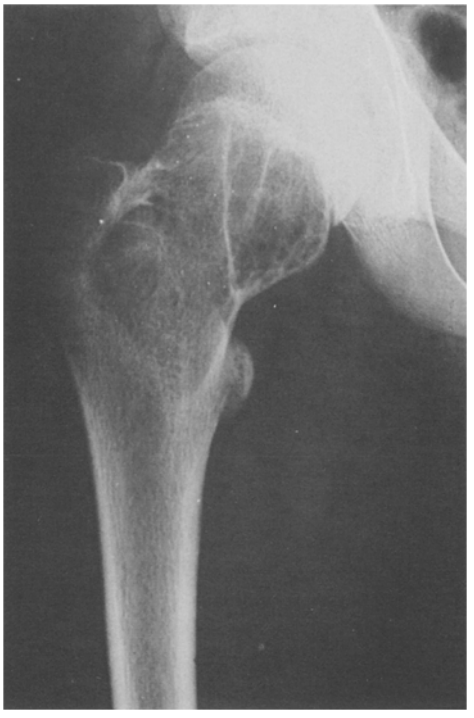

Fig. 9. Case 6: ABC located in the proximal femoral metaphysis

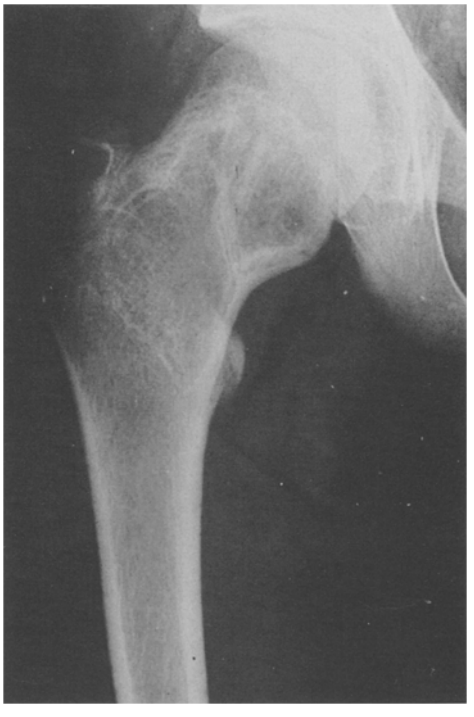

Fig. 10. Case 6: strong ossification and rebuilding of the ABC 3 months after the onset of the treatment

diminished inside the ABC. Since the location of the ABC was problematic for surgical intervention, another angiography was carried out. This revealed revascularization of the cyst. Because of this, embolisation was performed again. Three months later partial and moderate ossification of the cyst are detectable on the radiographs.

Case 6. A male patient, 16 years old, was referred to us with moderate pain in the right hip following a minor trauma. A large lytic lesion in the right femoral neck was observed on the radiographs (Fig. 9). At direct puncture of the lesion, a cyst was reached, which was filled with blood. Histology revealed ABC. The ABC proved to be hypovascular at angiography, and calcitonin hormone treatment was decided upon. Three months after the start of the treatment the cyst stopped growing and a strong ossification was seen on the radiographs (Fig. 10).

Discussion

The etiology of ABC is unclear. Earlier it was considered to be a benign bone tumor. Hadders and Oterdoom (1956) classified it as one of the haemangiomas of the bone; Thompson (1954) supposed that a subperiosteal haematoma may have a role in its etiology. At the present time most authors agree that ABC develops from a basis of haemodynamic disturbances of the bone (Campanacci et al. 1986; Lichtenstein 1972), which are often associated with increased intraosseous venous blood pressure or the development of an arteriovenous shunt. This is supported by the observation that the pressure in an ABC is generally as high as in the arterioles (Biesecker et al. 1970).

There are some observations that ABC may heal spontaneously (McQueen et al. 1985) but in the majority of cases they grow rapidly and destroy the affected bone and joint. Thus an ABC needs treatment, which is usually surgical, but recently some alternative therapies, like embolisation, have also been recommended (Murphy et al. 1982; Cory et al. 1989). It is obvious that embolisation of the arteries supplying the ABC alters the haemodynamics and, consequently, that the intracystical pressure will decrease (Misasi et al. 1982). As a result of this, progressive ossification and bony rebuilding of the ABC may develop (DeRosa et al. 1990; Kónya and Szendrői 1992).

Most ABC are, however, hypovascular (Schajowicz 1981) and therefore unsuitable for superselective embolisation. In these cases, according to our results, calcitonin hormone therapy administered directly into the cyst results in progressive ossification and healing of the ABC.

The effects of calcitonin on bone remodelling in osteoporosis, Paget's disease, and its analgesic activity in bone metastases are well known (Avioli and Dambacher 1984; Azria 1989); however, its role in the treatment of ABC is still hypothetical; it may block the activity of the osteoclasts and/or promote the formation of new bony trabecula in the fibrous septa of the ABC.

In one of our cases we only achieved incomplete and temporary ossification of the ABC (case 4). The reason for this could be threefold: the ABC was only partially excluded from the circulation after the first embolisation, or the ABC revascularized or the patient had become allergic to calcitonin.

According to our experience, calcitonin therapy should be combined with embolisation in cases of hypervascular ABC. Hormone treatment alone seems to be effective if the ABC is hypovascular and the calcitonin is administered directly into the cyst.

Our results lead us to believe that surgery can be replaced in the future by embolisation and hormone therapy. However, we need further experience of such treatment in this rare, aggressive tumor-like lesion of the bone.

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