Cannulation of simple bone cysts

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We describe a consecutive series of 26 patients with simple bone cysts who were treated by curettage, multiple drilling and continuous decompression by the insertion of either a cannulated screw or a pin. In the first 15 patients we used titanium cannulated screws (group 1) and in the next 11 a cannulated hydroxyapatite pin (group 2). Satisfactory healing was achieved in 12 patients in group 1 (80%) and in all in group 2. This technique seems to be a promising option for the treatment of simple bone cysts. The cannulated hydroxyapatite pin is recommended because of its higher success rate and the fact that it does not need to be removed.

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The appropriate treatment for simple bone cysts remains uncertain. Curettage with autogenous bone grafting has been widely used despite the complications of harvesting of the bone graft and high rates of recurrence. The use of injections of methylprednisolone acetate has been advocated. Although less invasive, this has not proved to be very effective and may require multiple injections, anaesthesia and a long period of healing. Venous obstruction has been suggested as being the most probable cause of simple bone cysts. Treatment by decompression has also been suggested, and although some promising results were obtained after multiple drilling there was a high rate of recurrence.

Patients and Methods

Between 1989 and 2000 we treated a consecutive series of 26 simple bone cysts in 26 patients by this method. In the first 15 patients (group 1) ACE cannulated titanium cancellous screws (Japan Medical Dynamic Marketing Inc, Tokyo, Japan) were inserted, the outer and inner diameters of which were 6.5 and 3.43 mm, respectively (Fig. 1). The subsequent 11 patients (group 2) were treated using a specially designed ceramic pin (Chugai Pharmaceutical Co, Ltd, Tokyo, Japan) made of hydroxyapatite and tricalcium phosphate (Fig. 1). This has high biological affinity and does not need to be removed. The ceramic material has a porosity of 30% to 50% and is sintered at 900º to 1300ºC. The head and inner diameters were 8 and 3 mm, respectively. In group 1 the cysts were located in the calcaneus in six patients, the femur in four, the humerus in three, the tibia in one and the ilium in one (Table I). Those in group
2 were located in the humerus in five patients, the calcaneus in four and the ilium in two (Table I).

**Operative technique.** Through a skin incision of about 1 to 2 cm in length, a hole approximately 6.5 or 8.0 mm in diameter was made in the wall of the cyst. After intralesional curettage, multiple drill holes were made in the wall of the cyst using a Kirschner wire in order to connect the cyst with healthy neighbouring bone. In the case of a ceramic pin, it was cut to the appropriate length. The screw or pin was then inserted.

Clinical and radiological follow-up was carried out at intervals of one to two months until healing had occurred. A cyst was classified as healed when there was complete obliteration of the cavity.

**Results**

The mean age of the patients in group 1 was 15.7 ± 5.9 years and that of group 2 14.4 ± 3.8 years (Table I). The mean operating time in group 1 was 69.7 ± 22.5 minutes.
Patients in group 1 were followed for a mean of 116.5 ± 24.8 months and in group 2 for a mean of 34.2 ± 16.5 months.

Healing was achieved without additional intervention in all patients in group 2 after a mean of 7.5 ± 3.6 months, and in ten patients (66.7%) in group 1 after a mean of 9.5 ± 6.3 months. In group I six further operations were needed to achieve healing in four patients. Three recurrences after healing were also seen in two patients (cases 5 and 9) and pathological fractures occurred in two others (cases 3 and 13) (Table II). No complications were encountered in patients in group 2. At the end of the follow-up period healing had been obtained in 12 (80%) patients in group 1 and in all in group 2. Three patients in group 1 had persistent small residual cysts. All titanium screws were

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Fig. 2a

Fig. 2b

Case 15. Radiographs showing a) a simple bone cyst located in the femoral neck of an 8-year-old girl and b) the cannulated titanium screw inserted in the cavity of the cyst after curettage and drilling. Seven months after surgery the cyst had healed.

Fig. 3a

Fig. 3b

Case 17. Radiographs showing a) a simple bone cyst located in the proximal humerus of an 11-year-old boy with two hydroxyapatite pins inserted in the cavity and b) complete obliteration of the cyst seven months after surgery.
removed after healing of the cysts, or at the time of further surgery. The hydroxyapatite pins were not removed. Two illustrative cases are shown in Figures 2 and 3.

Discussion

Simple bone cysts differ from benign bone tumours in their natural history and high rate of recurrence after treatment. Before 1970, most were treated by curettage and bone grafting, using autograft or allograft. These lesions are commonly seen in children, in whom it is difficult to obtain an adequate volume of autograft, and a rate of recurrence of 30% to 50% has been reported. Other complications include injury to the growth plate, pathological fractures, donor-site morbidity and infection. This technique may also require long periods of immobilisation and hospitalisation. Scaglietti et al and Capanna et al popularised the use of an injection of methylprednisolone acetate as treatment for simple bone cysts. Healing was reported in only 60% and 51% of their patients, respectively. Although topical steroid is still an accepted non-operative treatment, it has a number of disadvantages in that multiple injections were required in 50% to 76% of patients, rates of recurrence of between 15% and 88% were seen after a mean of three injections and about 10% of cysts did not respond to this treatment, particularly those in the os calcis and in adults. A limb-length discrepancy has also been reported in 5% to 15% of patients treated by injection of steroid.

Venous obstruction has been suggested as a primary cause of simple bone cysts. High bone-resorbing activity in the fluid within the cyst due to the presence of prostaglandins, interleukin 1, proteolytic enzymes, other cytokines and oxygen-free radicals has been demonstrated. Bone destruction by this fluid is an important pathogenic factor requiring surgical or pharmacological correction, or both. Good initial results have been reported after treatment by multiple percutaneous drilling as a result of release of the fluid. Making multiple holes through the cyst wall causes haemorrhage into it which stimulates osteogenesis; the release of transforming growth factor ß from platelets may also be important. Frequent recurrence after drilling has been reported. The sealing of the drilled holes may leave cyst fluid, leading to partial recurrence. The effect of multiple drilling may be similar to that of a pathological fracture. When some of the fluid is released the periosteum is stimulated to form bone, but only about 15% of simple bone cysts heal after a pathological fracture, possibly because of the presence of some persistent fluid. Ekkernkamp, Muhr and Lies reported good results in six simple bone cysts treated by continuous decompression using cannulated screws. Titanium has superior osteointegrating properties compared with other biomaterials. In our experience, the results of continuous decompression using cannulated titanium screws have been good, but, because another operation was needed for their removal, we changed to specially designed cannulated hydroxyapatite pins which provide decompression and have osteoconductive properties that may stimulate healing. They do not need to be removed. Although the technique used for insertion of both types of screw was the same, the results with the hydroxyapatite pins were better in terms of the rate of healing and the absence of local recurrence.

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References