Chondroblastoma of bone
LONG-TERM RESULTS AND FUNCTIONAL OUTCOME AFTER INTRALESIONAL CURETTAGE

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We undertook this retrospective study to determine the rate of recurrence and functional outcome after intralesional curettage for chondroblastoma of bone. The factors associated with aggressive behaviour of the tumour were also analysed. We reviewed 53 patients with histologically-proven chondroblastoma who were treated by intralesional curettage in our unit between 1974 and 2000. They were followed up for at least two years to a maximum of 27 years.

Seven (13.2%) had a histologically-proven local recurrence. Three underwent a second intralesional curettage and had no further recurrence. Two had endoprosthetic replacement of the proximal humerus and two underwent below-knee amputation after aggressive local recurrence. One patient had the rare malignant metastatic chondroblastoma and eventually died. The mean Musculoskeletal Tumour Society functional score of the survivors was 94.2%.

We conclude that meticulous intralesional curettage alone can achieve low rates of local recurrence and excellent long-term function.

The term ‘benign chondroblastoma’ was coined by Jaffe and Lichtenstein to describe a rare neoplasm with a predilection for the epiphyses of long bones, thus distinguishing it from the giant-cell tumour of bone. Some features of chondroblastoma had been recognised earlier by Kolodny, who described it as a “giant cell variant”, and Codman who used the term “epiphyseal chondromatous giant cell tumour”. Chondroblastoma accounts for about 1% of all primary bone tumours and appears to arise from secondary centres of ossification. Although the most common sites are the hip, shoulder and knee, there is no part of the axial or appendicular skeleton which can be excluded.

Most lesions are seen in adolescence during the period of active epiphyseal growth. Patients present with gradually increasing pain and local tenderness, followed by swelling and limitation of movement of the neighbouring joint.

The histopathological description of chondroblastoma according to the World Health Organisation is “a relatively benign tumour, characterised by highly cellular and relatively undifferentiated tissue, made up of rounded or polygonal chondroblast-like giant cells of osteoclast type arranged singly or in groups. The presence of a cartilaginous intercellular matrix with areas of focal calcification is typical.” About 10% to 15% of lesions are associated with large, fluid-filled spaces indicative of a secondary aneurysmal bone cyst component.

The recommended surgical treatment for chondroblastoma varies. Curettage, either alone or in conjunction with bone grafting or packing the cavity with polymethylmethacrylate, or coupled with cryosurgery, are among the techniques which have been described.

The rate of recurrence after these procedures has been reported to be between 10% to 35%.

Our aim in this retrospective study was to evaluate the rate of recurrence after intralesional curettage, to define any factors associated with aggressive tumour behaviour and to evaluate the functional outcome of the patients.

Patients and Methods
We performed a retrospective study of 70 patients with chondroblastoma who had been referred to an orthopaedic oncology unit between 1974 and 2000. The diagnosis was based on recognised radiological and histological criteria. The age at presentation, gender, presenting symptoms, anatomical site and previous treatment were noted along with the clinical signs, operation records and intra- and post-operative complications.
Of the initial 70 patients, seven had already been treated elsewhere and a further ten had been seen within the last two years and were not felt to have sufficient follow-up. Thus, 53 patients (40 men; 13 women) were included in the study. The mean age of the men at presentation was 17.8 years (8 to 48) and of the women was 18.2 years (12 to 39) (Fig. 1).

The radiographs at presentation were reviewed for the site of the lesion, the degree of cortical destruction and subjective assessment of the activity (latent/active/aggressive). Latent lesions were defined as being confined to bone, with a well-defined, intact reactive sclerotic rim surrounding the radiolucent chondroblastoma. Active lesions were confined to bone but had an incomplete rim or were contained within a margin of reactive periosteal bone. Aggressive lesions had a poorly-defined edge, with minimal or no intra-osseous reaction and an extra-osseous component which was not surrounded by periosteal bone.

The status of the adjacent physis (open/closing/closed) was also determined. A physis was classified as open if a wide, clearly-defined radiolucency was apparent, as closing, if a thin and irregular epiphyseal plate was visible and as closed if an epiphyseal scar was present. The histopathology was studied with special emphasis as to whether there was evidence of an associated aneurysmal bone cyst.

All patients were treated initially by curettage alone. The walls of the cavity were burred and the defect washed with saline. In later years, pulsed lavage was used. Whenever possible, this was done under direct vision.

All the patients were followed up by plain radiography at three-monthly intervals for two years and then six-monthly until five years. Since 1992, any recurrence of symptoms or abnormality identified on plain radiography has been followed by repeat MRI. Local recurrence was confirmed if histological evidence of chondroblastoma was discovered at any subsequent operation.

The functional outcome was assessed by the Musculoskeletal Tumour Society (MSTS) scoring system devised by Enneking et al. Results

The main presenting symptoms were pain in 52 patients (98.1%), stiffness in 39 (73.6%) and local swelling in 21 (39.6%). There was local tenderness in 48 patients (90%) and a joint effusion in two (3.7%). The duration of symptoms was less than one year in 40 patients (75.5%) and 11 (20.8%) had symptoms varying from one to three years. The two remaining patients had symptoms of six and ten years each. The most common site was the proximal humerus in 14 patients (26.4%), followed by the proximal tibia in ten (18.9%), the distal femur in nine (17%), the proximal femur in eight (15%), two in the greater trochanter, four (7.5%) in the os calcis, three (5.7%) in the talus and two (3.8%) in the distal tibia. There was one case each involving the scapula, the distal humerus, and the third cervical vertebra. The physis was open in 18 patients (33.3%), closing in 11 (20.5%) and closed in 24 (46.2%). The lesions were radiologically latent in one (2.6%), active in 45 (84.6%) and aggressive in seven (12.8%). Six patients (11.3%) had a previous history of injury.

Delays in diagnosis were common. For example, a 22-year-old man had been suffering from pain in the knee for ten years and arthroscopy performed three years before presentation to us had been normal. Radiography showed a lesion in the proximal tibial epiphysis. A 14-year-old boy with pain for 22 months had a lytic lesion in the distal femur. He had sustained a minor injury preceding his symptoms and an arthroscopy 12 months before presentation had been reported to be normal. Two boys, aged 11 and 16 years, had undergone prolonged physiotherapy to the

Table I. Details of patients who developed local recurrence (LR) and their management

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yrs)</th>
<th>Gender</th>
<th>Site</th>
<th>Time to LR (mths)</th>
<th>Treatment of first LR</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>M</td>
<td>Proximal humerus</td>
<td>17</td>
<td>Curettage</td>
<td>Further LR after 12 months, two further curetages followed by resection and endoprosthesis</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>F</td>
<td>Proximal tibia</td>
<td>7</td>
<td>Curettage</td>
<td>No further problems at five years</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>M</td>
<td>Talus</td>
<td>9</td>
<td>Below-knee amputation</td>
<td>No further problems at five years</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>M</td>
<td>Proximal femur</td>
<td>4</td>
<td>Curettage</td>
<td>No further problems at five years</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>M</td>
<td>Proximal humerus</td>
<td>16</td>
<td>Endoprosthetic replacement</td>
<td>No further problems at five years</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>M</td>
<td>Proximal femur</td>
<td>14</td>
<td>Curettage</td>
<td>No further problems at three years</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>M</td>
<td>Os calcis</td>
<td>4</td>
<td>Below-knee amputation</td>
<td>Metastases at six months, died after 4.5 years</td>
</tr>
</tbody>
</table>
shoulder after trivial injuries before lesions in the proximal humerus were discovered.

The most common symptom was pain around a joint accompanied by loss of function. Patients often developed a fixed deformity and loss of movement was common in lesions around the knee.

There was local recurrence in seven patients (13.2%) (Table I). The mean time to recurrence was ten months (4 to 17) (Fig. 2). In patients with recurrent lesions none had an associated aneurysmal bone cyst on histopathological examination. The growth plate was open in six and closing in one. The lesions were radiologically active in three and aggressive in four.

Local recurrence was diagnosed on the basis of three features: 1) the failure of symptoms to resolve or their return; 2) the radiological appearance when a previously curetted lesion had failed to fill in and consolidate; and 3) the MR images showing increased bone destruction and florid peri-lesional marrow oedema with or without an adjacent effusion (Fig. 3).8

Three patients underwent a second intralesional curettage and had no further recurrences. Of these, two had lesions in the femoral head and one in the proximal tibia. An 11-year-old boy with a lesion in the proximal humerus had an aggressive recurrence with erosion of the articular cartilage. He underwent two further curettage procedures followed by endoprosthetic replacement. A 16-year-old male with a similar aggressive lesion underwent endoprosthetic replacement of the proximal humerus after the first recurrence.

A 13-year-old boy with lesions in the talus developed extensive further lesions in the talus and calcaneum six months after the primary procedure. Since this recurrence was too extensive for any reconstruction, he had a below-knee amputation.

In one patient recurrent chondroblastoma of the calcaneum proved to be malignant and extensive metastases developed despite amputation.9

Predictive factors for recurrence. Two of the six chondroblastomas in the capital femoral epiphysis developed local recurrence, both of which were radiologically aggressive. Six of the seven patients with local recurrence were less than 14 years old and six were male. None of the patients with local recurrence had evidence of an aneurysmal bone cyst (Fig. 4). The younger the patient the greater was the risk of local recurrence (p < 0.05).

Function. In 40 patients, the outcome was evaluated using the MSTS functional scoring system. The mean length of follow-up was 84 months (24 to 324). The two patients who had endoprosthetic replacement of the proximal humerus and the other who died because of malignant chondroblastoma were excluded. The mean score was
94.2% (70% to 100%), half of the patients having no functional deficit. The best scores were in patients with lesions in the greater trochanter and calcaneum, while the worst resulted from lesions in more inaccessible places, such as the talus, proximal tibia and the proximal humerus. Among the skeletally-immature patients the only one to develop limb-length discrepancy was an 11-year-old boy with a lesion of the capital femoral epiphysis. He developed arrest of growth after treatment, resulting in asymptomatic shortening of 1 cm. There was no significant difference in the MSTS score between those who were skeletally immature and those who were mature at the time of treatment.

The most recent radiographs were studied for evidence of articular irregularity caused either by the tumour before treatment or by curettage. Excluding the patients who had endoprostheses, no other abnormalities were identified.

**Discussion**

There is no accepted standard treatment for chondroblastoma. Curettage, either alone, combined with packing of the cavity with bone graft or polymethylmethacrylate, or with associated cryosurgery are described.\(^6,10,11\) Marginal resection\(^11\) and radiofrequency heat ablation\(^12\) are other options.

We consider that recurrence is likely to be due to incomplete curettage as surgeons are understandably concerned that aggressive curettage will cause damage to the growth plate. This justifies the need for adjuvant treatment, such as filling the cavity with methylmethacrylate in the hope that the heat of polymerisation will kill tumour cells, or cryosurgery.\(^11\) These techniques may be useful but carry the risk of thermal damage to the articular cartilage or growth plate. We believe that our method of aggressive intraleisional curettage alone is curative in most cases. Our rate of recurrence of 13.2% is similar to that reported in other studies which have included adjuvant methods.\(^9,10,13\) In all our cases the patient's own bone filled or partly filled the defect left by curettage and, although many lesions were subarticular, there was no case of further collapse of the joint line after curettage.

We evaluated the functional outcome in 40 patients using the MSTS system. They underwent treatment at our unit and were followed up for at least two years. To our knowledge this is the only study which has used a standard scoring system for this condition. Good functional results were obtained in spite of our policy of aggressive curettage. We therefore believe that the growth plate is resilient and, with proper care, aggressive curettage is appropriate. Unfortunately, we did not assess function before surgery. However, most patients with a chondroblastoma of the lower limb have considerable functional disability at diagnosis.

We looked for factors associated with aggressive behaviour of the tumour. It has been suggested that the association of a component of an aneurysmal bone cyst produces a higher rate of recurrence, but a recent detailed review by de Silva and Reid\(^14\) failed to confirm this. Our findings agree with them. We did not find that lesions in inaccessible areas had a higher rate of recurrence. Our only statistically significant risk factors were age and gender, with recurrence being more likely in the younger patient (\(p < 0.05\)). This may be because less extensive curettage may be performed in the younger patient due to concerns about the growth plate.

Treatment of proximal femoral lesions can be challenging, particularly in children. The traditional approach is through the base of the femoral neck or the trochanter.\(^15\) This can lead to epiphyseal damage, angular deformities and discrepancies in limb length. Our usual approach is a limited exposure through the neck of the femur under control of an image-intensifier. For more peripheral lesions in the femoral epiphysis a direct approach through the articular cartilage can be used, although this can potentially damage the cartilage.

Metastatic or malignant chondroblastoma is rare and histologically does not differ from other chondroblastomas. Our previous review of the literature identified that all cases arose after local recurrence of the tumour.\(^8\) Thus, any patient with a local recurrence should be screened for metastases. We recommend that a patient with a recurrent chondroblastoma should have a radiograph of the chest at the time of recurrence and one year later. We also recommend review of the original histology to ensure that the correct diagnosis has been made.

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Fig. 4a – Radiograph of the calcaneum showing a cystic lesion with an intact but thinned cortex. Fig. 4b – CT showed numerous fluid levels typical of aneurysmal bone cyst. This was a chondroblastoma with secondary bone cyst changes of an aneurysm.
Chondroblastomas are rare, accounting for 1% of all primary bone tumours. About 87% can be cured by meticulous intralesional curettage alone and this technique can produce good long-term functional outcomes. The main challenges are lesions in the proximal femoral epiphysis in children, the treatment of local recurrence and recognition of the possibility of malignant change.

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References