Chondroblastoma of the femoral head: management and outcome

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Abstract Chondroblastoma of the femoral head presents particular problems in treatment because the tumour is surrounded by articular cartilage on one side and epiphyseal plate on the other. Ten patients underwent treatment for a chondroblastoma involving the proximal femoral capital epiphysis. The patients were aged between eight and 19 years and in four the epiphysis was not yet fused. Five had curettage via a drill hole created up the femoral neck, of whom two developed local recurrence. Five had a direct approach to the chondroblastoma through the femoral neck, and there were no local recurrences in this group. Both patients with local recurrence were under 14 years of age—one was cured by a direct approach through the neck of the femur and the other by lifting a trap door of articular cartilage. Apart from one patient with a temporary leg length discrepancy, there were no other complications. We conclude that a direct approach is likely to lead to the best outcome for this rare condition.

Introduction

Chondroblastomas of bone are rare benign bone tumours, arising at the cartilaginous growth plate, representing approximately 1–2% of all primary bone tumours and around 9% of all benign bone tumours. The most common sites are the proximal humerus and the proximal tibia, but

the third most common site is the proximal femur [1–5]. The majority occur in the second decade of life, the median age of presentation being 15 years [6]. The tumour is very rare in patients younger than ten or older than 30 years, although they have been described in three to 73-year-olds [1, 2]. The male to female ratio is approximately 2:1.

Histologically, the tumour consists predominantly of well-defined polygonal chondroblast-type cells similar to epiphyseal chondrocytes, with large nucleoli and benign-looking nuclei that have a tendency to be multilobulate and have a continuous dense band of substance along the inner nuclear membrane, intra-cytoplasmic inclusions of glycogen and lipids, numerous mitochondria and superficial secretion vesicles arising from a well developed rough endoplasmic reticulum. There are multi-nucleated giant cells, foci of chondroid matrix, with focal calcification that may acquire a “chicken wire” appearance [4, 5, 7]. Aneurysmal bone cysts are associated with chondroblastoma in 14% of cases [6].

In the proximal femur, some will involve the greater trochanteric apophysis, and thus are relatively easily accessible to the surgeon attempting resection by curettage. Those involving the femoral head epiphysis present a dilemma in terms of the best means of access as the proximal femoral epiphysis is completely intracapsular and there is no access to the lesion without transgressing either the growth plate or the articular cartilage. The choices are therefore whether to use: (1) a minimally invasive approach via a drill along the femoral neck with potential damage to the epiphyseal growth plate, (2) an open approach with capsulotomy and raising a ‘trapdoor’ of the femoral neck, or (3) by a direct approach through the articular surface of the femoral head, avoiding the growth plate but potentially damaging the articular cartilage (Fig. 1).

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Fig. 1 A representation of the three possible methods of access to a chondroblastoma of the femoral neck. Route 1 involves curettage via the femoral neck (CVFN), routes 2a and 2b involve a direct approach through the joint and the femoral neck, while route 3 involves lifting a lid of articular cartilage to access the lesion

We have attempted to determine the best mode of treatment by retrospective analysis of those cases of femoral head chondroblastoma presenting to our unit.

Management strategy

All patients were referred to us for diagnosis and treatment. Patients were staged with anteroposterior and lateral radiographs of the involved hip and either CT or MRI scanning to define the extent of the lesion. In all cases this led to a presumptive diagnosis of chondroblastoma, and biopsy and treatment were combined at the time of curettage.

Throughout the time period of this study we treated benign bone tumours with curettage alone supplemented by the use of a high speed burr to debride the walls of the lesion when appropriate [8]. We only used bone graft when there were concerns about structural support. In all other cases the lesion was left empty in the expectation that it would simply consolidate with time. Patients were advised to remain non weight-bearing for between six and 12 weeks depending on the site and size of the curetted lesion, and all patients were followed-up with regular radiographs and clinical assessment until skeletal maturity or for two years, whichever took longer.

The decision about the best way to access the lesion was based upon the age of the patient and the site of the lesion.

A direct approach was used whenever possible but in the skeletally immature this presented problems with potential damage to the growth plate, and so for central lesions in the femoral head a curettage via the femoral neck (CVFN) was used under image intensifier control. This has the significant disadvantage of not being able to visualise the whole lesion but does (hopefully) minimise the risk of damage to the growth plate.

In cases of local recurrence we used a direct approach to the lesion, if necessary through the articular cartilage of the femoral head.

Method

We retrospectively reviewed the case notes and radiographs of patients diagnosed and treated at our unit with a chondroblastoma of the proximal femur found on the prospectively compiled database of our unit. We investigated treatment and outcome to try and identify whether our management strategy led to a successful outcome both in terms of local control but also in terms of growth disturbance and hip function as well as radiological appearance.

Results

We identified ten patients with a diagnosis of chondroblastoma of the femoral head out of a total of 79 patients with chondroblastoma (13%). Eight were male and two female with an age range at presentation from eight to 19 years (mean 13.9 years).

Of the ten patients with femoral head lesions, five patients underwent curettage via the femoral neck (CVFN) by a lateral approach under image intensifier guidance (mean age 13.4 years, range 8–19 years) (Table 1). One of these patients, the first in the series, had a trochanteric osteotomy to improve access. Five underwent curettage using a direct approach into the lesion through the femoral neck, just below the growth plate. These patients were slightly older (mean age 14.4 years, range 9–18 years).

All patients who had a direct approach to the lesion made a full recovery and had no evidence of local recurrence and returned to full function. Although most were skeletally mature at the time of treatment, there was no documented limb length difference in any of these patients.

There were two local recurrences, both following CVFN. The first, a 13-year-old, had persisting symptoms and radiological evidence of recurrence four months after CVFN and underwent a revision by open curettage via a Ludloff approach with an 8×10 mm window in the femoral

Table 1 Patient characteristics

Patient	Age (y)	Gender	Initial treatment	Result	Second treatment	Result	Leg lengths	Function
1	8	M	CVFN	LR after 16 months	Curettage via direct approach through articular surface	Cured at nine years	Initially 1 cm longer, now equal	Normal, plays rugby
2	11	M	CVFN	Cured at five years			Slight shortening, <1 cm	Slight limp, no sports, no pain
3	11	M	Curettage + bone graft via posterior approach	Cured at five years			Equal	Normal
4	13	M	CVFN	LR after four months	Curettage via medial Ludloff approach through joint	Cured after five years	Equal	Normal
5	14	M	Curettage via anterior approach	Cured at two years			Equal	Normal
6	15	F	Curettage via anterior approach	Cured at two yrs			Equal	Normal
7	16	M	CVFN	Cured at five years			Equal	Normal, plays football
8	14	M	Curettage via anterior approach	Cured at one year			Equal	Normal
9	18	M	Curettage via anterior approach	Cured at five years			Equal	Normal
10	19	M	CVFN with trochanteric osteotomy	Cured at 15 years			Equal	Olympic canoeist, developed hip pain seven years later, cured after arthroscopy showing labral tear

M male, F female, CVFN curettage via the femoral neck

neck. Some damage to the growth plate was documented, but he made a full recovery after one year. There was subsequently no limb length discrepancy and he was enjoying full sporting activities (basketball and surfing) five years following treatment. The second was an eight-year-old who had symptoms and radiological evidence of recurrence 16 months after initial treatment by CVFN and was explored by a posterolateral approach with a trapdoor in the posterior articular surface directly over the lesion. He was the only patient who had a transient limb-length increase, developing 1 cm excess on the affected side, which resolved after one year following his second procedure, although he still had some persisting slight discomfort at that time. He made a full recovery six months later and by the age of 17 (at latest follow-up) he was symptom free and radiographs were normal (Fig. 2). There were no local recurrences in children over age 14 at the time of diagnosis, but two of the four younger patients developed local recurrence.

The only other patient who failed to make a full recovery was an 11-year-old who underwent CVFN. At one year following surgery he had slight limb shortening (<1 cm) and a persisting limp with reduced range of hip rotation and flexion limited to 90 degrees, but there was no radiological evidence of recurrence. After two years, his range of motion had improved to nearly full, but he still had a slight limp at the latest review, which was thought to be due to premature partial fusion of the growth plate in the line of the curettage.

Of the five patients undergoing CVFN, two made a full uncomplicated recovery, one had persisting symptoms, and two had recurrence with subsequent full recovery after revision by an alternative approach. None were bone grafted, and only two developed a slight limb length discrepancy, neither of which required any treatment.

None of the seven patients who underwent a trans-articular approach, either primarily or for local recurrence, developed a further local recurrence or showed any evidence of clinical or radiological osteoarthritis at the latest follow-up.

Discussion

Treatment is by curettage, with or without packing with bone graft or cement [5, 7, 9]. Adjuvant cryotherapy and phenolisation have both been described, though it is unclear if these provide a significantly improved outcome. No studies have yet shown the benefit of using any of these adjuvants, nor even of the use of bone graft [10]. Use of an endoscope or arthroscope to visually inspect the cavity following curettage via a minimally invasive approach has been described with good results, though only as case

Fig. 2 Case 1, the youngest child in the series. This patient presented at the age of eight years with a typical chondroblastoma of the femoral head, clearly shown on MRI (a). This was treated by curettage via the femoral neck (CVFN) but recurred 18 months later. The radiograph clearly shows the healed track up the femoral neck and the persistent cavity in the femoral head (b). This was treated by a direct approach through the articular cartilage, elevating a trap door to allow direct vision of the tumour and a detailed curettage. The final radiograph taken six years later at skeletal maturity shows the lesion had completely healed and there does not appear to be any damage to the growth plate or the joint itself (c)

reports, so there is no evidence that this significantly reduces recurrence rates [11, 12]. There is no role for chemotherapy in the management of chondroblastoma. Radiotherapy is contraindicated, as there is a significant risk of inducing a malignant transformation. Recurrence rates of 10–40% have been described [1, 5, 9, 13]. There have been rare reports of seeding into soft tissues locally, and of pulmonary metastasis in about 1% of cases [12, 14].

Growth disturbance rates and growth deformities are not widely published in the available literature. Schuppers et al. found 7% (6 of 81) of patients with minor shortening, all in patients 14 years or younger with open growth plates, though they do not specify the site involved. However, of eight cases with functional impairment at follow-up, five involved the hip, with the other three all at different sites [1]. Lin et al. noted that few patients with chondroblastoma had much growth remaining, but that four patients who had treatment before skeletal maturity had a growth plate disturbance [13]. They also reported that all patients with femoral head chondroblastomas were curetted by a cortical window in the femoral neck, but none developed avascular necrosis. Grimer et al. reported on four patients with lesions of the femoral head, all of whom underwent curettage through the base of the femoral neck, whereby one developed a pathological fracture, another needed a later osteotomy, presumably because of epiphyseal damage, and a third developed limb shortening and angular deformity [15].

Chondroblastomas of the femoral capital epiphysis present an unusual challenge, as in the skeletally immature, the lesion is surrounded on one side by articular cartilage and on the other by epiphyseal cartilage. One or the other will necessarily be violated to access the lesion. Deciding which route of access will cause the least harm is a considerable challenge as there is no useful information available on this topic. The capital epiphysis fuses at the age of about 15 years in males and 14 in females, so breaching this in children near skeletal maturity is not likely to cause significant problems in terms of growth arrest or stimulation.

Our results have shown the mixed way in which this benign and inaccessible tumour has been treated at our

centre. In five, the primary approach was up the femoral neck, while accepting that this may damage the growth plate in the one patient who had not yet reached skeletal maturity. There is no clinical or radiological evidence that this happened in this patient. Previous studies have also shown no evidence of major affect on the growth plate when it has been transgressed by surgical intervention, but this must always be a concern with any surgical approach through a growth plate [16]. We did find however that two

of the patients developed local recurrence after curettage through this approach (see Fig. 1), and this may not be surprising given the technical difficulties inherent in curetting a cavity at the end of a long thin passage! Clearly the availability of a large variety of curettes with long stems is essential if this approach is to be considered.

The direct approach through the femoral neck is also unattractive in younger children because of the risk of damage to the growth plate and the risks of both avascular necrosis or osteoarthritis. On the other hand, it will allow a much better view of the tumour allowing a greater chance of obtaining local control. Our results have confirmed this—all six patients with this approach were cured and fortunately there were no complications apparent at latest follow-up with no patient developing either a growth arrest or avascular necrosis. Approaching the lesion through the articular cartilage, particularly in the weight-bearing part of the hip, is potentially fraught with danger, but in our one case the long-term result has proved most satisfactory.

Another potential option for treating these lesions is to use radiofrequency ablation—something which has some appeal given the complexity of open surgical approaches [17].

In conclusion we would recommend that a chondroblastoma of the capital femoral epiphysis should be carefully assessed radiologically and its accessibility via different approaches should be considered. A peripheral lesion, particularly one in the inferior aspect of the capital epiphysis, may be best approached directly whilst a lesion below the weight bearing surface superiorly is far more of a challenge. An approach up the femoral neck may well be preferred in the skeletally mature in whom there is no risk of damage to the growth plate, but there is an increased risk of local recurrence. An approach through the articular cartilage is never an attractive option at any stage but may be preferred because of the lower risk of local recurrence and for those in whom access through the femoral neck is difficult.

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