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Chondroblastoma: An evaluation of the recurrences and functional outcomes following treatment

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ABSTRACT

Objective: Chondroblastoma is a benign aggressive tumor which needs surgical treatment and has a recurrence rate up to 35%. Extended (aggressive) curettage is the mainstay of treatment and local adjuvants have been reported to decrease the recurrence rate.
Methods: The recurrence rates and the functional results of 14 patients who were treated in our institution and 2 other patients who were treated elsewhere between the years 2004–2016 were evaluated. Seventeen cases (13 male, 3 female; mean age: 17.1 [range: 13 to 32] years) who had been diagnosed, treated and followed up in our hospital between 2004 and 2016 were evaluated in terms of recurrence rates and functional outcomes. The average follow-up period was 41.6 (range: 12 to 132) months.
Results: Five cases of recurrence were observed. Two cases had undergone their primary treatment in another institution. Seven cases were performed curettage alone whereas nine others were administered adjuvant treatments. One of the five recurrence patients was advised to undergo disarticulation. Another was treated with curettage and grafting and the remaining three patients with curettage and cementing. No recurrence was observed in their follow-up period. Their mean MSTS score was 27.3 (range: 4 to 30) over a maximum of 30 points and their functional results were good.
Conclusion: Chondroblastoma is a tumor with high recurrence rates in the post-treatment period. However, good functional outcomes can be achieved with early diagnosis and appropriate treatment even after recurrence.
Level of evidence: Level IV, therapeutic study.

Introduction

Chondroblastoma is a rare benign aggressive bone tumor mostly located in the epiphyses and apophyses of long bones. The tumor comprises 1.45% of all benign bone tumors of the Mayo clinic series.[1] The most common sites of localization are the proximal tibia or femur, distal femur and the proximal humerus.[2] The tumor may also be seen in the bones of the hand, the foot, the skull or in the facial bones.[3] Most of the patients present with local pain and upon physical examination, tenderness and limited range of motion are observed.[4] An osteolytic, spheroid or oval-shaped tumor with well-defined contours and a maximum diameter of 5–6 cm are the characteristic radiological findings of chondroblastoma. The tumor shows central or eccentric localization in the epiphysis or apophysis. T2-weighted MRI scans demonstrate a surrounding hyperintense inflammatory response involving the bone marrow and the neighboring soft tissue. Liquid levels can be observed in cases with secondary aneurysmal bone cyst.[5] Histologically, chondroblastomas are benign tumors with giant cells, but the presence of chondroid matrix distinguish chondroblastomas from other giant cell tumors. These lesions may seldom show pulmonary metastasis.[6] Malignant transformation of the tumor is quite rare.[4] Surgery is the primary treatment, and aggressive curettage and bone grafting is mostly preferred.[7] Recurrence is not uncommon and adjuvant treatments have been reported to decrease the recurrences.[8,9]

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Table 1
Affected sites in the extremities listed by the number of lesions.

	Location	n
1	Proximal humerus	4
2	Proximal tibia	3
3	Proximal femur	3
4	Distal femur	2
5	Distal humerus	1
6	Distal tibia	1
7	Calcaneus	1
8	Metacarpals	1
Total		**16**

In our study, we aimed to evaluate the recurrences and functional outcomes following the treatment.

Patients and methods

The files and clinical records of 19 patients, who had been treated by experienced orthopaedic oncologists in our hospital between the years 2004 and 2016 for chondroblastoma, were thoroughly and retrospectively evaluated. Three patients were excluded from the study due to inadequate data and follow-up. Sixteen cases (13 males, 3 females; mean age: 17.1 years [range: 13 to 32]) whose examinations, imagings and MSTS scorings (over a max. Score of 30 – Ref) could be performed were included in the study (Table 1). Primary treatment of 14 cases had been performed in our hospital and two cases had been treated in another institution. The average follow-up period was 39.3 months (range: 12 to 132).

Following the consultation and physical examination, the patients were evaluated with local X-rays and MR scans. Fourteen patients were diagnosed with biopsies (closed-Jamshidi biopsy in 10 cases and open biopsy in four cases) and two with diagnosed was on the basis of typical and characteristic radiological findings, and their treatment was planned accordingly. The postoperative pathological diagnoses of two cases were confirmed as chondroblastoma.

All cases were performed curettage. Spongious bone grafting was performed in 14 cases allografting and cementing was performed in two cases to fill the defect. In addition to curettage, nine cases were given adjuvant treatments with burring, phenol or electrocauterization, based on the surgeon's preference (Fig. 2).

The patients were followed up at three-month intervals throughout the first one or two years, then at six-month intervals till the fourth or fifth year and with annual visits thereafter.

Local recurrences were checked by physical examinations, X-rays and MRIs, and lung metastases were checked with a CT scan of the lung at the initial diagnosis and with X-rays during the follow-up period.

Results

Recurrence was observed in five cases (Table 2); two of which had undergone their primary treatment in another institution and presented to our clinic due to recurrence of their complaints. One patient, who had been treated for his pathological fracture of the proximal femur at another institution, was recommended disarticulation due to several recurrences of the lesion in the femur and neighboring soft tissue. However, the patient refused to undergo surgery. No recurrence was observed in the remaining four patients during the follow-up period.

The mean MSTS score of the patients was 27.1 (range: 4 to 30) over a maximum of 30 points during the last follow up.

Discussion

Chondroblastoma is a benign aggressive tumor and its treatment modality is surgical. Recurrence rates varying between 8% and 35% have been reported.[4,9,10] Concerns regarding severe functional

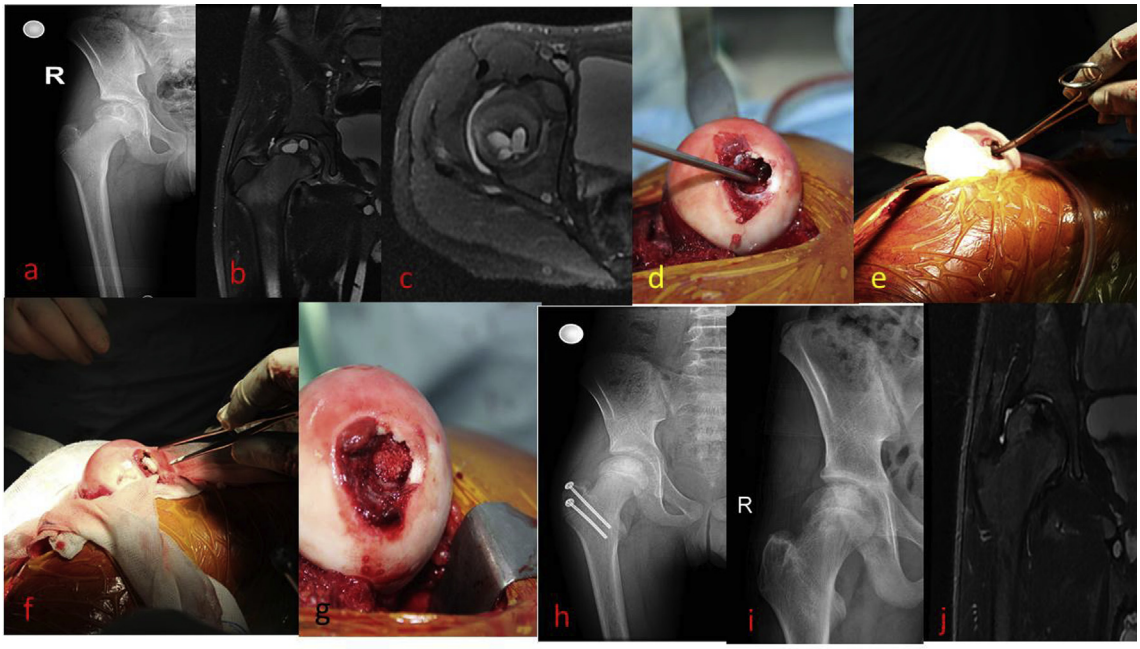

Fig. 1. **(a)** Conventional radiograph of the 12-year-old male patient with chondroblastoma in the proximal femur. **(b)** MR image of the chondroblastoma in the coronal plane. **(c)** MR image of the chondroblastoma in the transverse plane. **(d)** View shows our approach which we use in order to burr the lesion, from the fovea capitis after safe dislocation of the hip. **(e)** View from the intraoperative use of phenol. **(f)** View from intraoperative allografting. **(g)** Intraoperative appearance of the chondroblastoma in the proximal femur following grafting. **(h)** Conventional radiograph of postoperative period. **(i)** Conventional radiograph image of the lesion following screw removal **(j)** Follow-up MR image of the lesion.

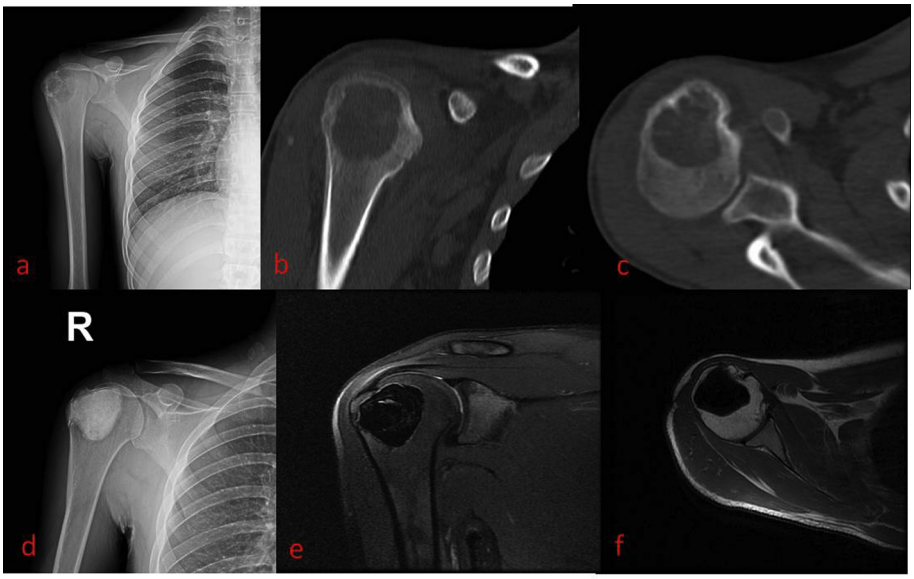

Fig. 2. (**a**) Conventional radiograph of the recurring chondroblastoma in the proximal humerus in our 18-year-old male patient. (**b and c**) CT images of the recurrence in the proximal humerus. (**d**) Conventional radiograph showing postoperative curettage + cementing (**e and f**) Postoperative MR images.

damages in the joints is common as the lesion is often located in the epiphyses of the long bones. The recommended treatment is extended curettage and filling of the defect with grafting.[11]

A rigorous and aggressive curettage is one of the most important factors for a successful treatment.[4,12] Incomplete or inadequate curettages have been shown to be the leading causes for recurrence. The fear of damaging the physis or the intent of preserving the joint cartilage as much as possible may lead to an incomplete or inadequate curettage, thus justifying the use of local adjuvants.[4]

Burring, 13 liquid nitrogen,8 phenol, 14 electrocauterization9 and cementing (by utilizing the heat effect)15 have been used as local adjuvants and have been reported to decrease the rates of recurrence. We believe in the benefit of local adjuvants. However, to the best of our knowledge there is no comparative study searching the best local adjuvant. High speed burring may stay in the forefront rather than local adjuvant application following an extensive local curettage.[13,21] However, phenol which has a demonstrated efficacy may be preferably applied in cases with lesions close to but not violating the joint(lieratur 14) Multiple adjuvants can be applied together.

The effect of the cement on the physes in patients with an immature skeleton is controversial.[15] Wallace and Henshaw[16] argued that cementing had no negative effect, whereas Gasden et al has reported its undesirable outcomes.[17] The use of high-speed burring may be limited in patients with an immature skeleton as it may increase the damage to the physis or destruct the cartilage in the areas with subchondral bone loss. No additional morbidities have been reported with the proper use of phenol and liquid nitrogen.[8,14]

There are studies reporting good results achieved with radiofrequency ablation (RF) in the treatment of chondroblastoma. However, RF is recommended to performed in smaller lesions rather than wider lesions as it may cause damage to joint cartilage and growth plates.[19,20]

In our series, grafting was performed in 14 out of the 16 cases, while the defects were filled with cement in the other two. One of the cementing patients was 27 years old and had completed the skeletal maturity. Eight patients were performed curettage only, whereas nine cases were given one or more adjuvants. The most employed adjuvant treatments were high-speed burring and passing small phenol-impregnated dressings inside the defect twice. Adjuvants were not administered in four of the five cases with recurrence (of which two had been treated in another institution) and the remaining patient underwent electrocauterization. No recurrence was observed in the two cases treated with cementing. We concluded that in addition to curettage, grafting with the proper use of a high-speed burr and phenol application would be a good treatment option. Cement was used to fill the defects in three of the four recurrence cases. These cases were 18 years of age or more at the time of the treatment of recurrence. The patient with the extensive recurrence of the lesion in the proximal femur and the neighboring soft tissue was advised disarticulation.

The patients had good functional outcomes in the post-treatment period. Their mean MSTS score was 27.3 over a maximum of 30 points. The patient with the lowest score of 4, was the patient advised to undergo disarticulation (Fig. 3). Another patient with the lesion in the proximal humerus had mild findings

Table 2
Evaluation of the recurrence cases.

Age	Sex	Location	Time of recurrence	Primary treatment	Treatment after recurrence	Follow-up period	MSTS score
16	M	Proximal tibia	14 months	Curettage + electrocauterization + grafting	Curettage + grafting	36 months	30
18	M	Proximal humerus	9 months	Curettage + grafting	Curettage + cementing	40 months	30
18	M	Metacarpals	24 months	Curettage + grafting	Curettage + cementing	20 months	27
32	M	Proximal femur	24 months	Curettage + grafting	Disarticulation recommended	36 months	4
17	M	Distal femur	12 months	Curettage + grafting	Curettage + burring + cementing	132 months	30

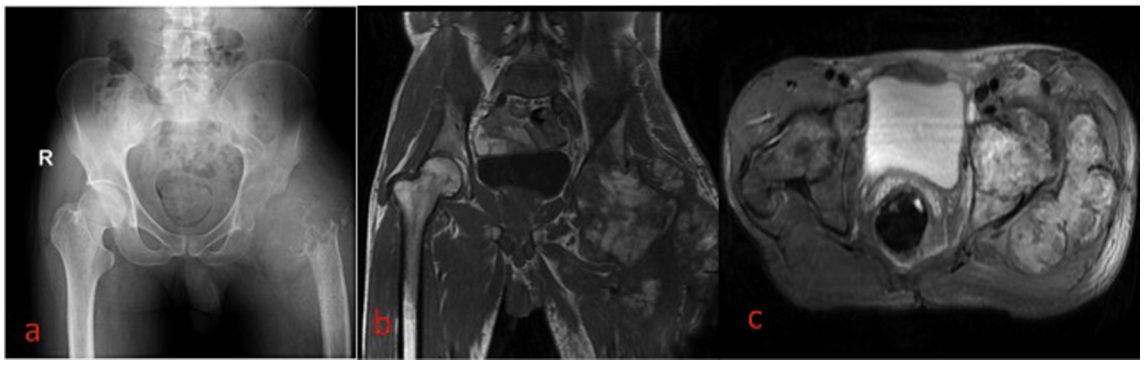

Fig. 3. (**a**) Conventional radiograph of the 32-year-old male patient with chondroblastoma in the proximal femur (Disarticulation recommended) **(b and c)** MRI images in the proximal femur.

of arthrosis, yet could score 25 points. Most of the patients got full points.

In terms of possible joint problems and arthrosis, the most challenging location of the lesion is the proximal femur.[4,7] The inaccessibility of the lesion at this site, and the probability of cartilage damage during the treatment, especially in those close to the periphery, are the reason behind this challenge. Following the safe dislocating of the joint,[18] curettage was initiated at the femoral head via the fovea capitis and the procedure was completed with no damage to the cartilage in our 13 and 14-year-old cases with proximal lesions (Fig. 1). The cases were followed up with visits at the 19th and 80th month, respectively, and no findings of recurrence, AVN or arthrosis were found. Both had full MSTS scores.

No malignant transformation was observed in our cases. Lung metastasis is rarely reported in cases with local recurrence.[20] Lung metastasis may demonstrate different type of behaviours. They can stay stabile without growing as well they may heal totally after being resected.[22] We have not encounter lung metastasis in any of our cases.

In conclusion, chondroblastoma is a tumor with not so low rates of recurrence, but satisfactory functional results can be achieved even in case of a recurrence, with early diagnosis, aggressive curettage and local adjuvants, with grafting being the first choice. Rare metastasis of the lesion in the lung and very exceptional cases of malignant transformation should also be kept in mind.

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