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Audit

Management of the giant-cell tumours of the distal radius

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***Background*: Giant-cell tumour of the distal radius is a rare neoplasm that affects the peri-articular metaphysial region of the bone. Curettage alone or with bone grafting has been reported to be associated with high incidence of local recurrence in these tumours. In the present series, we report the results of curettage only as the treatment for primary giant-cell tumour of the distal radius carried out at a single centre.**

***Patients and Results*: A total of 287 patients with giant-cell tumour have been referred to us for treatment over the last 28 years; 24 of these were found to have lesion in the distal radius. One patient underwent endoprosthetic replacement of the distal radius. The remaining 23 patients underwent curettage of the primary neoplasm. Four out of the 23 (17%) patients developed local recurrence of disease, The mean time to local recurrence was 17 months (range, 9–27 months). Complications such as collapse of the articular cartilage are more common in patients with an extensive soft tissue component of the tumour.**

***Conclusions*: Curettage alone is adequate treatment for the majority of patients with giant-cell tumours of the distal radius but some form of stabilisation may be required in the presence of extensive bone destruction.**

Key words: Giant-cell tumours – Distal radius – Curettage

Giant-cell tumour of bone is a rare neoplasm that affects the peri-articular metaphysial region of the bone. These are classified as locally aggressive tumours that can metastasise to the chest. They usually affect bones around the knee joint. The distal radius is the third most commonly affected site after the distal femur and the proximal tibia. Approximately 10% of all giant-cell tumours involve the distal part of the radius.[1]

The patient may complain of pain in the wrist or present with a swelling. Radiological investigations including magnetic resonance imaging aids in diagnosis and histological examination of the biopsy specimen will confirm the true nature of the lesion. The aim of treatment is removal of the tumour completely and to preserve the maximum function of the extremity. Treatment options are: (i) curettage alone or with bone grafting; (ii) curettage of the tumour and packing of the cavity with methylmethacrylate; or (iii) resection of the lesion followed by reconstruction. Local radiotherapy is also used in some institutions.[2]

Curettage alone or with bone grafting has been associated with high incidence of local recurrence in giant-cell tumours.[3–5] High rates of recurrence (23–80%) have been reported in some studies after curettage of the tumour.[6] While packing the cavity created after removal of tumour provides structural support, it has been criticised for obscuring the possible local recurrence of the neoplasm.[7–9] A lower rate of local recurrence has been noted after resection of the diseased bone; but a complex

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reconstruction procedure (arthroplasty) or arthodesis of the wrist is required.[10–12] Other procedures that may be employed to reconstruct the defect include vascularised or non-vascularised bone graft from tibia or proximal fibula,[13–15] osteo-articular allograft,[16] and transposition of the carpus.[6] All these procedure have certain morbidity and complications associated with them; nevertheless, resection and reconstruction may be the only option in cases of aggressive tumours, which have eroded the cortex. Indications for curettage of giant-cell tumours have not been clearly defined. Numerous reports in the past have included tumours of variable grade under similar treatment groups; therefore, the analysis is basically flawed and results are skewed. This has led to undue criticism of curettage in the treatment of giant-cell tumours. Enneking[10] attributed the high incidence of local recurrence to the indiscriminate use of the curettage for all grades of the tumour.

In the present series, we report the results of curettage only as the treatment for giant-cell tumour of the distal radius carried out at a single centre.

Patients and Methods

A total of 287 patients with giant-cell tumour have been referred to us for treatment over the last 28 years (1972–2000). Of these, 24 were found to have lesion in the distal radius. One patient underwent endoprosthetic replacement of the distal radius for an aggressive tumour unsuitable for curettage. The remaining 23 patients underwent curettage of the primary neoplasm and they were closely followed up at regular intervals for any evidence of local recurrence or systemic metastasis. All these patients underwent imaging studies for tumour screening including plain radiographs of the wrist and chest and total body bone scan. Magnetic resonance imaging was performed after it became available. Angiography was not needed in any of the cases. The diagnosis was confirmed by histological examination of the biopsy specimen in all cases.

There was no evidence of metastatic disease in any of the patients at the time of diagnosis. All neoplasms were classified according to the system described by Campanacci *et a1*.[14] in three grades. Grade I tumours had a well-defined border of a thin rim of mature bone and bony cortex was intact. Grade II lesions had relatively well-defined margins but there was no radio-opaque cortical rim. Grade III was designated to the lesions with fuzzy borders, suggesting a rapid, and possibly a permeative, growth of the tumour.

This grading system differs from that of Enneking,[10] which is based on clinical and radiographic features, isotope scan, angiography, computerised tomography as well as macroscopic and microscopic appearance of the tumour.

The tumour size was also measured in three dimensions on antero-posterior and lateral radiographs.

The method of treatment was chosen as curettage in all cases. The lesion was approached through a dorsal incision, the extensor tendons were identified and protected throughout the procedure. The tumour was accessed via a cortical window between the extensor compartment. An effort was made to remove all the neoplastic tissue with the help of the curved curettes and a dental mirror to look under the overhanging bone margins. Saline was used to irrigate the tumour cavity with the help of a pulsed lavage system. Chemical detergents were not used to sterilise the cavity. The stability and congruity of the wrist was assessed at the end of the procedure and, if in doubt, a below-elbow plaster of Paris cast was applied for 3–4 weeks.

The patients were followed-up in the orthopaedic oncology clinic for a minimum of 5 years. Repeat X-rays of the wrist and chest were performed on each visit along with the clinical assessment. Findings of the clinical and radiological examination were documented in the oncology database. Wrist X-rays were assessed for evidence of local recurrence of the tumour and distal radio-ulnar impingement; any change in the ulnar variance after the curettage that may be attributed to radial collapse was noted.

Results

There were 10 males and 13 females in this series. Mean age of the patients was 41 years (range, 16–73 years) and mean duration of symptoms was 37 weeks (range, 4–78 weeks). Nine of these patients had had at least one previous procedure performed by the referring clinician including four open biopsies and five attempts at curettage (Table 1).

Mean follow-up time was 42 months (range, 7–216 months). Sixteen patients had the lesion on the right side and seven had left distal radius involvement. The dominant wrist was involved in 13 patients. Fourteen patients had grade I tumour, four grade II and five grade III lesion. Mean tumour volume was calculated to be 23.8 ml (range, 2.6–48 ml). Two patients were diagnosed to have fracture through the cyst wall at the time of treatment; both were immobilised in plaster and both went on to union in 6 weeks.

Some cortical expansion of the distal part of radius was observed in all patients. The plain radiographs and bone scans were able to outline accurately the intraosseous extension of the tumour. Cortical perforations were seen in grade III tumours only, and their extent was variable. Some soft tissue component was always associated with the grade III lesions.

Four out of the 23 patients developed local recurrence of disease – one had a grade 1 tumour, none had grade II lesions, but three had grade III tumour. Two patients with

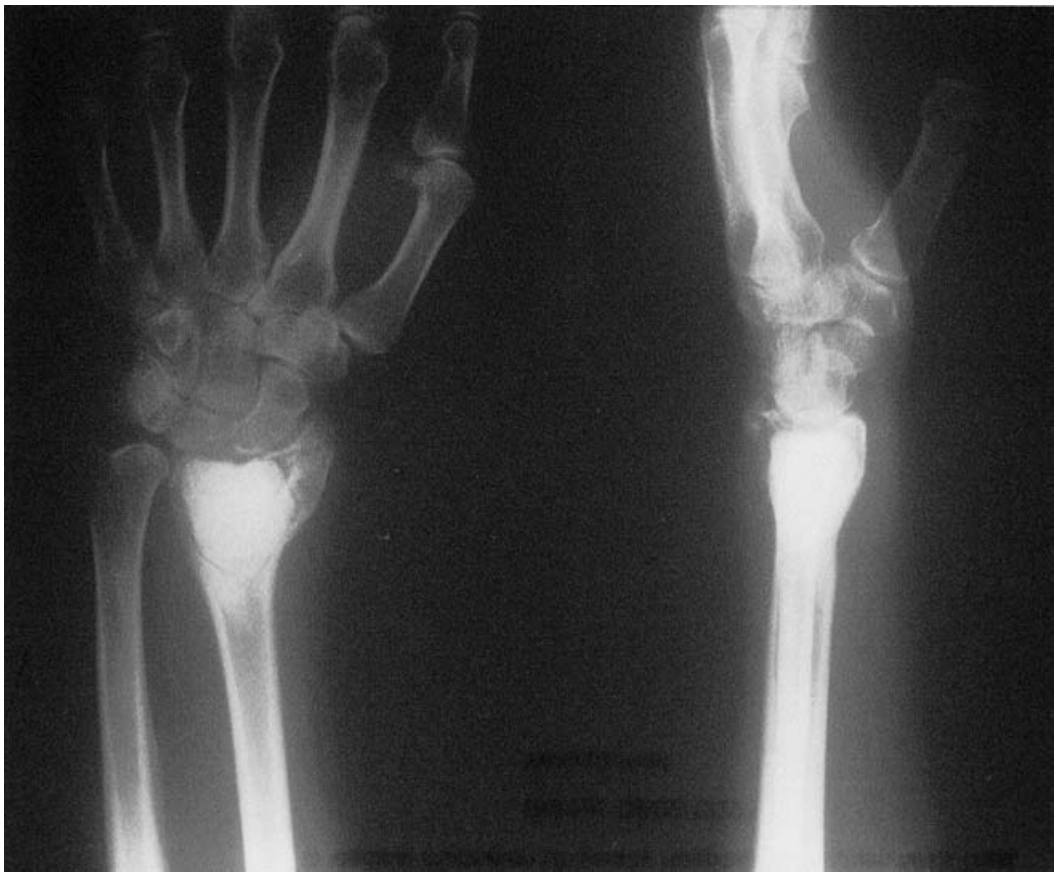

Figure 1 A case of recurrent giant-cell tumour of distal radius managed with further curettage and filling the cavity with bone cement.

Table 1 Patient data

Number	Sex	Age (years)	Side	Grade	Local recurrence (months)	Complication
1	M	32	R	I		
2	F	32	R	I		
3	F	38	L	I		
4	M	27	R	III	66	Ulnar impingement
3	F	26	R	II		
6	M	27	R	I		
7	M	41	R	III		
8	M	24	L	I		
9	F	27	R	I		
10	M	39	R	I		
11	F	73	R	III		CTS
12	M	27	R	I		
13	F	16	R	I		
14	M	34	R	II		
13	F	39	R	I		
16	F	37	R	I	9	
17	F	39	R	III	3	Below-the-elbow amputation
18	F	31	R	III	10	Ulnar impingement
19	F	28	L	II		
20	F	30	L	II		
21	F	48	R	I		
22	F	36	L	I		
23	M	48	L	I		

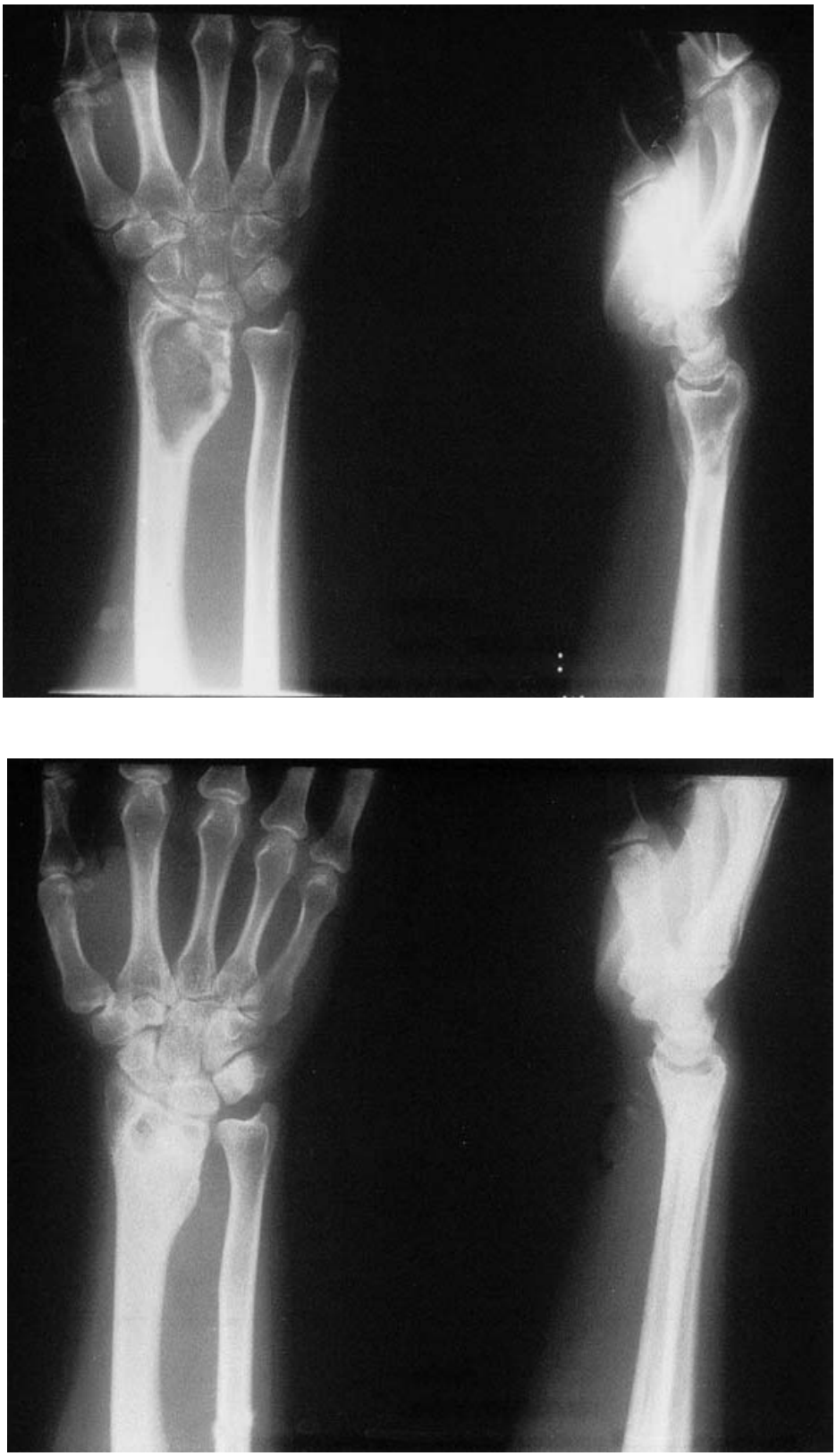

Figure 2 (A) Plain radiographs showing giant-cell tumour of the distal radius (Campanacci grade I) in a 36-year-old female patient. (B) The same patient 5 years following curettage of the tumour. The cavity after curettage is now filled with healthy bone.

grade III lesions had had a previous attempt at curettage performed before being referred to us and both recurred. One of these two patients later went on to have a below-the-elbow amputation for massive soft tissue extension of the neoplasm. The only patient with a recurrent grade I lesion had a recurrence 2 years after her first curettage. She was managed with further curettage and filling of the bony cavity with methylmethacrylate cement; she remains free of any further recurrence (Fig. 1). The remaining two patients with local recurrence were treated with further curettage of the tumour and both had no further local recurrence (Fig. 2). Mean time to local recurrence was 17 months (range, 9–27 months).

Complications

Five patients had a change in their ulnar variance after the curettage. All developed an ulnar plus deformity after curettage, which implies that there was a collapse of the distal radius in these patients. Three of these patients later developed symptoms from distal radio-ulnar impingement and two needed surgical correction. One patient had ulnar shortening and the other had excision of the distal ulna. One patient developed carpal tunnel compression probably because of volar collapse of the proximal carpal row and needed open carpal tunnel decompression (Fig. 3).

One patient had to have a below-the-elbow amputation after initial curettage for extensive soft tissue involvement around the wrist. She had three attempts at curettage, and all were unsuccessful.

Nineteen remaining patients (13 grade I, 4 grade II, and 2 grade III) had no evidences of local recurrence. The mean tumour volume in the no-recurrence group was 24.6 ml compared to 23.8 ml for the whole group.

Discussion

Giant-cell tumour of the distal radius is a rare neoplasm. It constitutes approximately 10% of all cases of giant-cell tumour of the bone.[1,6,17] When it grows larger, the endosteal surface of the cortex is destroyed and a thin shell of reactive bone is formed. This neocortex appears thin and expanded on X-rays; in some cases, it may be difficult to see on plain X-rays.[1]

As the lesion progresses, the reactive shell is perforated and the neoplasm extends to, and through, the overlying periosteum. Pronator quadratus muscle is said to provide an effective barrier to further spread of the tumour on the volar surface of the distal radius.[6] On the dorsal surface, local spread of the tumour is usually between the periosteum and the extensor compartment. Involvement of the extensor tendons is rare. Perforation of the articular cartilage of the distal radius is even rarer.

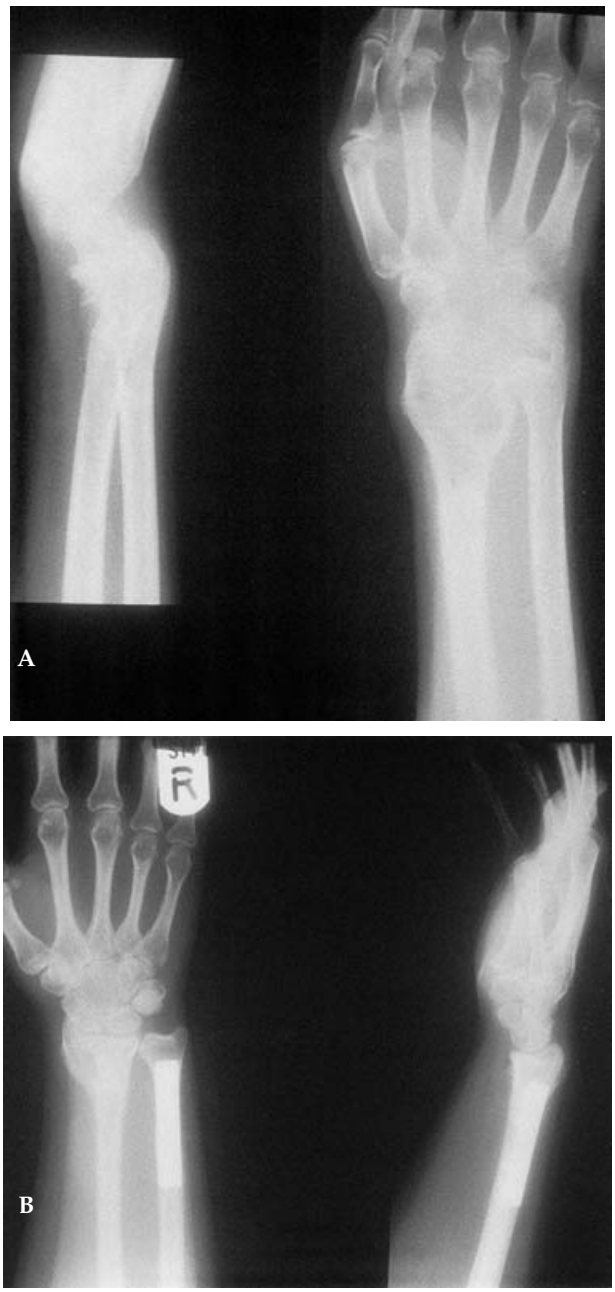

Figure 3 (A) Radio-ulnar impingement in a patient due to radial collapse following curettage for giant-cell tumour of distal radius. (B) The same patient after ulnar shortening and internal fixation with compression plate.

The goal of treatment for any tumour would be the complete eradication of the diseased tissue while preserving normal bony architecture and joint function. The surgical approach to giant-cell tumours in the 19th century was routine amputation. This was later changed by Joseph Bloodwood who suggested that simple

curettage was usually sufficient;[2] this has since been extensively used in clinical practice.

Simple curettage of giant-cell tumours has previously been criticised for its high rate of local recurrence.[3,15,18,19] However, the techniques of curettage[3,4,10] and grading of the tumour have not been included in previous analyses; therefore, it is difficult to comment on the causes of recurrence. It has also been said that curettage alone (that led to recurrence) may not have completely removed the tumour, and a local recurrence may well be the residual tumour. Enneking felt that the bad reputation of curettage in the management of giant-cell tumours is undeserved. He thought that the high rate of local recurrence was due to the indiscriminate use of curettage for all lesions including the highly aggressive tumours.[10,13]

Curettage followed by packing the cavity with the autogenous bone or allograft[1,3,13,20–23] is the other option. Autogenous bone grafting is associated with donor site morbidity, risk of disease transmission, as well as the risk of resorption of the grafted bone. The cavities that have been filled with bone graft often show areas of radiolucency. This may be due to incomplete packing, inflammatory changes, bone graft resorption or even a low-grade infection. These changes may be difficult to distinguish from a tumour recurrence. Bone grafting has not been proved to affect the rate of recurrence or the functional outcome.

Acrylic bone cement (methylmethacrylate) has been suggested as the alternative filler[4,7–9,18,19,24,26,27] for the bone cavities. It has been thought that the use of cement would extend the area of curettage, due to the toxic effect of the monomer and the exothermic reaction of the polymer. At the same time, there has been concern that the use of cement may lead to premature onset of degenerative changes[8,25] of the adjacent wrist joint due to heat damage. The bone cement inserted under pressure may also force the residual tumour into the local soft tissues. The acrylic cement also leads to the development of radiolucent lines in the cyst cavity, which makes a diagnosis of recurrence difficult.[7]

Resection of the tumour followed by arthroplasty or arthodesis is the alternative option in aggressive tumours. Arthroplasty has an associated risk of deep infection and subluxation of the carpus. Wrist arthodesis on the other hand has a risk of delayed or non-union at the arthodesis site as well as morbidity from the operation.[12,15,16]

In the present series, extended curettage on its own was able to eliminate the tumour in 19 (78.2%) patients with one curettage and 21 (91.4%) patients were cured with further curettage. Recurrence was seen mainly in the aggressive grade III tumours with one exception. Complications requiring further surgical intervention were seen only in patients with grade III tumours. Of the 21 patients without any previous treatment, curettage was successful in 17 (80%).

Age of the patient or size of the tumour did not seem to influence the risk of recurrence in any grade of tumour. There was not much difference in the volumetric size of the two groups. Two of the recurrent tumours were further treated with curettage and bone-cement filling and both responded favourably.

There have been attempts in the past to grade giant-cell tumours by Jaffe and Enneking.[10,18,26] Enneking's system is a complex combination of clinical, radiological, surgical and histological assessment, and is unlikely to be able to advise on the management of giant-cell tumours. Others have tried to relate the histological features with the course of the tumour and predict the outcome on that basis, but this has proved unreliable. We used the radiological grading system devised by Campanacci *et al*.[1] and assessed the clinical relevance of surgical treatment to the final outcome of the tumour. We believe that this simple grading system can predictably guide the surgeon on the management of the giant-cell tumour of the distal radius.

Curettage alone or combined with adjuvant phenolisation of the cavity followed by bone grafting or filling the resultant cavity with bone cement has never been gauged against the type of tumour. We agree that curettage alone may not be the best treatment option for grade III giant-cell tumours, but it works very well in most of the grade I and II and some grade III patients. We believe there is no proof that phenolisation of the cavity is required after thorough curettage. O'Donnell *et al*.[26] have shown that, over a 9-year period, the highest incidence of recurrence was observed in Campanacci grade III tumours of the distal radius. The chances of recurrence were increased if curettage was performed without the use of high speed burr.

While single extended curettage performed carefully by an experienced orthopaedic oncologist offers a good chance of eliminating the disease, the results are not so predictable in aggressive grade III tumours. The complications are few and can be easily managed with simple procedures.

We recommend that treatment with curettage for grade I and II giant-cell tumours offers a very good (90%) chance of cure. A high rate of local recurrence and complications is to be expected with curettage alone in grade III tumours. The patient should be counselled about other options including curettage and cementation or resection and reconstruction.

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