RADIOLOGICAL AND CLINICAL RECURRENCE OF GIANT-CELL TUMOUR OF BONE AFTER THE USE OF CEMENT

D. REMEDIOS, A. SAIFUDDIN, J. PRINGLE

From the Royal National Orthopaedic Hospital, Stanmore, England

We have reviewed 13 operations on 11 patients using curettage and polymethylmethacrylate cement for giant-cell tumour of bone (GCT) to assess the value of radiology in the early detection of recurrence. There were four recurrences, the most specific radiological sign on plain radiography was lysis of 5 mm or more at the cement-bone interface. This preceded clinical signs by a mean of four months and was identified at a mean of 3.75 months after operation. There was not always a complete sclerotic margin around the cement, but when it was present, there was never evidence of recurrence. MRI was helpful in assessing cases with evidence of recurrence.

Frequent surveillance with plain radiography should continue for one year after operation irrespective of clinical signs of recurrence. When the appearance of the plain radiographs suggests recurrence, MRI should be performed and followed by image-guided needle biopsy.

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Treatment of giant-cell tumours of bone (GCT) by curettage and polymethylmethacrylate cement has been used since 1969.^{1,2} The use of cement gives better early mechanical properties than bone grafting³ and detection of recurrence is easier⁴ as lysis always occurs on the extralesional side of the cement-bone interface. Petersson, Rydholm and

Persson⁵ have described the importance of the width of the lytic zone surrounding the cementoma in evaluating recurrence. We have assessed the features and timing of radiological and clinical recurrence in GCT.

PATIENTS AND METHODS

Between 1983 and 1995, we treated a total of 49 patients with GCT, 14 of whom had previously been operated on elsewhere. Of these, 16 patients were treated by curettage and cementing, two of them twice. We reviewed the radiological records and the notes of clinical follow-up after 13 such procedures in 11 of these patients. The other five patients were excluded since their records were incomplete; two lived overseas and three had been treated more than ten years ago. There were six men and five women with a mean age at operation of 36.8 years (24 to 62). Details of the patients are given in Table I.

The patients had usually been reviewed at two weeks, six weeks, three months, four months after operation and at six months thereafter. Follow-up was for a mean of two years (6 months to 4 years). Radiographs of the cement mass were taken at each attendance. The maximum width of lysis around the 'cementoma' was measured and the presence and completeness of a sclerotic rim assessed. The case notes were reviewed for indications of recurrence such as pain, swelling and limitation of movement. MRI had been performed in some cases of suspected recurrence and all recurrences had been confirmed histologically by needle biopsy⁶ or at operation.

RESULTS

Most of the patients in our series had had previous operations elsewhere and only five of our procedures were on primary tumours. There were four recurrences in three patients, all on the diaphyseal side of the cementoma.

The mean interval between cementing and a clinical diagnosis of recurrence was 7.75 months (7 to 12). In retrospect, recurrence could have been suspected radiologically when the lucent rim around the cementoma was 5 mm or more at any point on either of the two standard projections (Figs 1 and 2). In all such cases later films

D. Remedios, FRCR, Senior Registrar in Radiology
A. Saifuddin, FRCR, Consultant Radiologist
J. Pringle, FRCPath, Senior Lecturer/Honorary Consultant in Pathology
The Royal National Orthopaedic Hospital Trust and London Bone Tumour Service, Brockley Hill, Stanmore, Middlesex HA7 4LP, UK.

Correspondence should be sent to Dr A. Saifuddin.

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Table I. Details of 11 patients with giant-cell tumour

Case	Age (yr)	Sex	Site	Previous surgery	Follow-up (mth)	Clinical recurrence (mth)	Radiological recurrence (mth)	Complete sclerotic rim (mth)
1	60	F	Proximal tibia	None	6	None	None	-
2	34	F	Distal femur	Bone graft x2 Cement x1	12	12	7	-
3	32	F	Distal femur	None	24	5	2	-
			Distal femur	Cement	18	7	4	-
4	32	M	Proximal tibia	Bone graft	24	None	None	-
5	62	F	Distal tibia	Bone graft	14	None	None	-
6	26	M	Proximal tibia	None	19	None	None	7
7	48	M	Distal femur	Bone graft	24	None	None	-
8	28	M	Proximal tibia	None	33	7	2	-
			Proximal tibia	Cement	25	None	None	7
9	33	M	Distal femur	Bone graft	41	None	None	-
10	24	F	Proximal tibia	None	17	None	None	5
11	39	M	Proximal tibia	Bone graft	51	None	None	10
Mean	36.8				23.7	7.75	3.75	7.25

Fig. 1a

Fig. 1b

Fig. 1c

Fig. 1d

Fig. 1e

Case 3. Recurrence of a giant-cell tumour in the lateral femoral condyle after cementing. Plain radiographs immediately after operation (a), two months later (b) and five months later (c) show progressive bony lysis (arrowheads). A lucency of 11 mm is seen at the proximal cement-bone interface in (b). MRI five months after operation shows extensive tumour recurrence at the site of bony lysis. The T1-weighted coronal image (d) shows the signal void of the cement (closed arrow) and the intermediate signal of the tumour (open arrow). The high signal around the metaphyseal cortex and in the tumour mass medially is probably haematoma secondary to pathological fracture (see Fig. 2). The T2-weighted sagittal image through the lateral femoral condyle (e) shows the signal void of the cement (closed arrow) and the high signal tumour proximally (open arrow). The joint effusion (arrowhead) is due to the fracture.

Fig. 2a

Fig. 2b

Fig. 2c

Fig. 2d

Case 3. Recurrence of a giant-cell tumour after recementing. Plain radiographs for four months (a) and seven months (b) after cementing show progressive medullary and cortical lysis (arrowheads). The earlier film shows a lucency 5 mm in width at the proximal cement-bone interface. Callus in the supracondylar cortex is due to a previous pathological fracture. Because of the extraosseous spread of tumour, *en bloc* resection and massive prosthetic replacement were necessary. High-resolution radiography (c) and macroscopic examination of the sectioned resected distal femur (d) clearly show bony lysis by the tumour at the cement-bone interface proximally (arrowheads).

showed progressive widening of the lucency and recurrence of the tumour was confirmed histologically in each case. Using these criteria the mean interval between operation and radiological evidence of recurrence was 3.75 months (2 to 7), four months earlier than was apparent clinically.

MRI of lesions with appearances indicating recurrence on plain radiography typically shows the fresh tumour as a

high signal on T2-weighted images and a low signal on T1-weighted images. Cementomas do not degrade MR images as much as CT scans, in which there is substantial beam-hardening artefact.⁵ They appear as a signal void on all MRI sequences (Figs 1d and 1e).

Of the nine lesions which did not show clinical recurrence, none had a lytic rim of 5 mm or more. A complete sclerotic rim was seen around four cementomas at a mean

Fig. 3a

Fig. 3b

Case 11. Successful cementing after curettage of a giant-cell tumour in the lateral tibial condyle. The complete sclerotic rim shown on the anteroposterior (a) and lateral (b) radiographs was identified ten months after operation and no recurrence was seen after four years.

of 7.25 months (5 to 10) after operation (Fig. 3). None of these showed any evidence of recurrence. The presence of an incomplete sclerotic rim had no prognostic significance, since it is seen around most cementomas between two and eight months after surgery.

DISCUSSION

The recurrence rate of 30.8% in our study is similar to that reported in larger series,^{7,8} but higher than the 8% to 14% reported in others.^{4,9} This is probably due to the high proportion of patients who had failure of procedures performed elsewhere. The site of recurrence, on the diaphyseal side of the cementoma rather than into the joint, was perhaps due to the natural barrier posed by articular cartilage. All our recurrences presented within a year as did most reported in the literature.^{4,5,8} We made no attempt to grade tumours since it has been shown that recurrence rates are independent of the Campanacci grade.⁷

Recurrence of GCT after curettage and cementing is detected earlier radiologically than clinically by an average of four months, which may allow further attempts to conserve the joint rather than proceeding to *en bloc* resection and massive prosthetic replacement. Although the width of the normal lucent rim has been described as only 1 to 2 mm,³ a gap of 3 to 8 mm was shown to denote recurrence in only three out of five cases in a small study.⁵ In our patients a width of 5 mm or more was not associated with any false-positive diagnosis. A number of suggestions have been put forward to explain the development of a lucent zone around cement including vascular injury during reaming, thermal injury during polymerisation, the cytotoxic effect of the methylmethacrylate monomer, postoperative infection, and granuloma-

matous reaction and bone resorption due to stimulation of macrophages attracted to cement.¹⁰⁻¹² Production of the sclerotic rim is probably a normal host response to physical and thermal damage during cementing. The formation of a complete sclerotic rim around the cement suggests that recurrence is unlikely and further radiological review will not be required. Failure to form a complete rim in patients with no recurrence of tumour may be due to stress-induced remodelling and is probably of no significance.

Since cement resists invasion by tumour, lysis of the surrounding bone is inevitably produced in a recurrence (Figs 1 and 2). MRI shows this clearly (Fig. 1) and should be used when plain films suggest recurrence. It is particularly helpful in assessing joint involvement although care should be taken in the interpretation of effusions which may be reactive or due to infraction (Fig. 1). MRI will also distinguish recurrent tumour from focal osteoporosis resulting from altered stresses since the latter should not result in signal changes around the cementoma.

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