Preoperative embolisation in benign bone tumour excision

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ABSTRACT

Purpose. To assess the role of preoperative embolisation in benign bone tumour excision.

Methods. 3 men and 3 women aged 19 to 35 (mean, 23) years with either a giant cell tumour or an aneurysmal bone cyst in limb girdle sites underwent preoperative embolisation a day prior to wide local excision by the same surgeon. Tumour size, blood loss, wound healing, infection, and tumour recurrence were assessed.

Results. The mean total blood loss was 391 (range, 100–980) ml. No blood transfusion was needed. No patient had any surgery- or embolisation-associated complication. No tumour recurred within a minimum 5-year follow-up. All patients had satisfactory limb function.

Conclusion. Preoperative embolisation is useful in the management of vascular and aggressive bone tumours located around a limb girdle where a tourniquet cannot be used.

Key words: blood loss, surgical; bone cysts, aneurysmal; bone neoplasms; embolization, therapeutic; giant cell tumor of bone; hemorrhage; tourniquets; vascular neoplasms

INTRODUCTION

Embolisation is useful in (1) treatment of vertebral haemangiomas,1 (2) palliative treatment of bone pain in metastases,2 (3) reduction of intra-operative blood loss in bone metastases from renal cell carcinoma,3,4 and (4) treatment of vertebral metastases.5,6 Preoperative embolisation of benign lesions in the spine and sacrum is reported to reduce blood loss, aid surgery, and act as a primary treatment modality.7–9 Only 8 patients who underwent preoperative embolisation for primary benign bone tumours in locations other than the spine have been reported.7,10–12 We report 6 further patients with benign tumours located around a limb girdle where a tourniquet could not be used.

MATERIALS AND METHODS

Between 1997 and 2000, 76 patients underwent resection of benign primary bone tumours in our hospital. 21 of them had tumours proximal to the mid-arm or mid-thigh, which precluded the use of tourniquet. Among them, 3 men and 3 women aged 19 to 35 (mean, 23) years underwent preoperative embolisation before excision (Figs. 1 to 3). The decision to embolise was made by the operating surgeon based on the tumour size, its location, and aggressiveness.
Figure 1  A 19-year-old woman undergoes embolisation followed by \textit{en bloc} resection of a giant cell tumour in the right proximal femur. She has a history of pathological fracture treated with a Jewett nail plate. Angiographs (a) before and (b) after embolisation show the tumour blush and its obliteration. Radiographs reveal (c) the pathological fracture (arrowhead) and the soft tissue extent of the tumour (arrows), and (d) after a hybrid total hip arthroplasty with allografts.

Figure 2  A 23-year-old man with an aneurysmal bone cyst involving the left scapula except the glenoid fossa undergoes a subtotal scapulectomy after embolisation: (a) preoperative radiograph, (b) angiographs before and after embolisation showing the extent of tumour vascularity, (c) intra-operative photograph, and (d) postoperative radiograph.

Figure 3  A 20-year-old woman with an aneurysmal bone cyst involving the right pubic ramus undergoes \textit{en bloc} resection after embolisation: (a) the preoperative computed tomographic scan showing the extent of tumour (arrows) and (b) postoperative radiograph.
All patients underwent plain radiography, bone scintigraphy, and computed tomography or magnetic resonance imaging, and had bleeding parameters that were within normal limits. Percutaneous needle biopsy was performed along the proposed surgical incision under local anaesthesia and sedation. Embolisation was performed one day prior to surgery, using a 4-French (F) tempo cordis catheter, after percutaneous cannulation of the contralateral femoral artery. Under image intensifier guidance, the catheter was advanced using digital subtraction angiography and blood flow control. Angiografin was used to visualise the extent of the tumour and locate all the feeder vessels. 10 g of Gelfoam slurry with a particle size of 250 to 400 microns was used. Three patients required the use of the 2.8-F fastracker microcatheter. The procedure lasted 2 to 4 hours until sludging occurred. No complications ensued thereafter.

According to the Enneking classification, all patients had aggressive tumours. Three had giant cell tumours (GCTs) in the proximal femur (in one the tumour recurred). Three others had aneurysmal bone cysts (ABCs) in the scapula, pubic ramus, and clavicle. All underwent en bloc resection by the same surgeon. Although en bloc resection is debatable for GCTs, in patients with pathological fractures whose joint anatomy cannot be restored, this procedure and prosthetic reconstruction is an acceptable option. In ABCs, en bloc resection has the least risk of recurrence, and is the treatment of choice if the lesions arise in non-essential, expendable bones.

Intra-operative blood loss was measured by weighing the sponges used during surgery and the volume collected in the suction bottle. Postoperative blood loss was measured from the wound drains, which were removed 48 hours after surgery. The size of the tumours, wound healing, blood loss, transfusion requirement, and tumour recurrence were recorded. All 6 patients were followed up for at least 60 months.

RESULTS

The mean total blood loss was 391 (range, 100–980) ml: intra-operative (range, 75–830 ml) and postoperative (range, 25–150 ml) [Table]. No patient received a blood transfusion or had any surgery- or embolisation-associated complication. No tumour recurred within 5 years. All patients had satisfactory limb function.

DISCUSSION

Embolisation is useful for (1) definitive treatment of benign lesions such as haemangiomas or arteriovenous malformations, (2) reduction of tumour vascularity prior to biopsy or surgery, (3) palliative control of pain or bleeding from inoperable tumours, and (4) retention of selectively delivered anti-mitotic agents or monoclonal antibodies deep into the tumour substance.

ABCs and GCTs are benign in nature, but very vascular and locally aggressive. When they occur in limb girdles (clavicle, proximal humerus, pelvis, and proximal femur), surgical management can be difficult. Multiple anastomoses formed by branches of major vessels located in such sites can make surgical haemostasis a very strenuous exercise. Precise excision of large tumours close to neurovascular and other visceral structures is difficult.

Randomised controlled studies on tumour embolisation are not available, because of the logistic and ethical problems of devising appropriate protocols in small numbers of patients. Our study provides a limited insight regarding the effect of embolisation on total blood loss, transfusion requirements, wound

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Sex/age (years)</th>
<th>Site</th>
<th>Tumour</th>
<th>Size (cm)</th>
<th>Blood loss (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F/19</td>
<td>Right proximal femur</td>
<td>GCT</td>
<td>10x8x4</td>
<td>140</td>
</tr>
<tr>
<td>2</td>
<td>F/35</td>
<td>Left clavicle</td>
<td>ABC</td>
<td>9x8x2</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>M/22</td>
<td>Right proximal femur</td>
<td>GCT</td>
<td>10x10x4</td>
<td>380</td>
</tr>
<tr>
<td>4</td>
<td>M/21</td>
<td>Left proximal femur</td>
<td>GCT</td>
<td>12x8x7</td>
<td>980</td>
</tr>
<tr>
<td>5</td>
<td>M/23</td>
<td>Left scapula</td>
<td>ABC</td>
<td>13x11x6</td>
<td>270</td>
</tr>
<tr>
<td>6</td>
<td>F/20</td>
<td>Right pubic ramus</td>
<td>ABC</td>
<td>7x5x4</td>
<td>475</td>
</tr>
</tbody>
</table>

* GCT denotes giant cell tumour, and ABC aneurysmal bone cyst
infection, and tumour recurrence in patients with benign primary bone tumours located in limb girdle sites. Only 8 patients who had preoperative embolisation for primary bone tumours in limb girdle sites have been reported. One with a GCT in the ischium, another with an ABC in the ischium, 2 others with an ABC in the pubic ramus underwent embolisation and did not need further surgery, but were followed up for only 21 and 8 months. The remaining 4 patients had ABCs in limb girdle sites (in one the pubic ramus was involved and healed after 2 embolisations), but the resulting blood loss or tumour size were not detailed.

Embolisation reduces tumour vascularity and assists in tumour excision with an adequate margin. In our study, the blood loss was reduced as anticipated. Blood transfusion was avoided and thus morbidity reduced; about 20% of patients receiving transfusions encounter some type of adverse effect. Reduced bleeding also makes dissection and tissue plane identification easier. This is particularly advantageous for patients with rare blood groups or those prone to transfusion reactions.

The complications of embolisation include dissection of the femoral artery at the site of puncture, pain due to ischaemic necrosis of the tumour, accidental embolisation into non-tumour vessels, infection, and post-embolisation syndrome. However, the corresponding risks and side-effects are usually substantially lower than those of alternative procedures.

CONCLUSION

Preoperative embolisation is useful for treatment of benign bone tumours that are vascular and aggressive, or located around a limb girdle site where a tourniquet cannot be used. The consequential minimisation of blood loss offers several direct and indirect benefits.

REFERENCES