Periacetabular malignant bone tumors managed by massive allografts

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Abstract

Four patients with a primary malignant pelvic tumor adjacent to the acetabulum were managed with a wide en bloc resection including most of the hemipelvis. A hemipelvic allograft was used for reconstruction. The mean follow-up was 7 (5-11) years. Three allografts had healed and were roentgenographically normal. One graft fractured. There was no local recurrence or infection.
Introduction

In the last twenty years, there has been increasing interest in limb-salvage surgery for bone sarcoma [18]. Progress in the treatment of pelvic sarcomas has been obstructed by the complexity of the structural integrity of the pelvic girdle [11]. In order to obtain a functional lower limb after wide resection of malignant pelvic tumors involving the acetabulum various reconstruction procedures have been reported [9,19,20]. However, most of them may result in serious complications, such as infection, breakage, loosening or recurrence [17]. The allografts offer the advantage of biological union to the host bone and makes muscle re-attachment easier [13,14].

The authors present their experience with hemipelvic allograft reconstruction in four primary bone sarcomas that we have reviewed retrospectively.

Materials and Methods

Four patients who had a malignant tumor of the pelvic bone adjacent to the acetabulum were managed with wide en bloc resection between January 1989 and January 1997. There were two men and two women, and the ages ranged from 20 years to 50 years. The mean follow-up was seven (5-11) years (Table 1).

We staged each lesion according to the criteria of the Musculoskeletal Tumor Society [5]. There were one conventional chondrosarcoma (Grade II), one mesenchymal chondrosarcoma (Grade III), one osteosarcoma (Grade III) and one solitary myeloma. A preoperative study was performed in each case with no other pathologic findings. According to Enneking extension classification system [5] all cases were type IIB. All except the conventional chondrosarcoma were treated with neoadjuvant chemotherapy.

In three cases the extension of the tumor affected zones I and II described by Enneking [6] (zone I: iliac wing; zone II: acetabulum; and zone III: pubic ramus) and in the last the lesion included all three parts.
The exposure for pelvic resection is the extended ilioinguinal approach, at
the level of the anterosuperior iliac spine with a vertical incision extending distally, laterally
and posteriorly to the greater trochanter [4]. The removal of the tumor involved zone I and II
[6] in two cases and all three zones in the remaining two.

The hemipelvis was reconstructed using a pelvic allograft. In three cases the allograft
was combined with a total hip prosthesis and in the remaining case the patient’s femoral
head articulated directly with the pelvic allograft. The grafts were fixed to the remaining
posterior ilium or the sacrum with reconstruction plates and screws. The pubic and ischial
bone were fixed with plates and screws except in one case.

The postoperative treatment included antibiotic therapy with two parenteral drugs for
two weeks followed by three to six months of oral treatment with one drug. Weight-bearing
was allowed at the three months.

Surgical margins were evaluated according to the Musculoeskeletal Tumor Society
system [5]. Wide margins were achieved in all cases.

Two different systems were used to evaluate the functional results. The one proposed
by the Musculoskeletal Tumor Association [7] evaluates pain, function, emotional
acceptance, support, walking ability and gait from 0 to 5 points. According to the system of
Mankin et al [15] the result is rated as excellent, good, fair, or a failure on the basis of both
oncological and functional criteria.

Results

In spite of the aggressive surgical treatment employed there were not immediate
severe complications. None of the patients experienced local tumor recurrence, infection or
deep vein thrombosis.

In one case the allograft fractured six months after surgery, which was followed by
removal of the allograft and implantation of an iliac prosthesis. Another patient developed
periarticular calcifications during the first ten years and had subsequently a prosthetic
replacement. There are no local recurrences.
The functional results [7] were: 77%, 33%, 63% and 66%, with an average of 60%. According to the system of Mankin [15], one patient had an excellent result; two had a good result; and one a failure.

Discussion

Reconstruction after excision of pelvic tumors involving acetabulum and the iliac wing poses difficult problems [22]. The ability to obtain a complete surgical resection is critical for any patient with a pelvic sarcoma. The average index of local recurrences ranges between 11% to 27% [3,8]. We achieved good local control with free margins in all and there were no local recurrences. This control may be related to the preoperative planning of reconstruction with a pelvic allograft that enables to sacrifice peritumoral structures that must be conserved in other surgical procedures.

Various methods have been reported for reconstruction of lower limb function after partial pelvectomy including the ilium and the acetabulum [1,3,9,19,20]. One of them is the internal hemipelvectomy without defect reconstruction, but the functional results communicated are poor [11]. Other common possibilities are iliofemoral and ischiofemoral arthrodesis [6] and resection hip arthroplasty [12]. These procedures require a shorter surgical intervention and a minimal amount of implants. The main disadvantages of these techniques are the necessary conservation of pelvic zones to fix the proximal femur [12], the great shortening of the affected limb and poor functional outcome [4]. Several types of endoprosthesis have been described for periacetabular reconstructions [1,19]. Major prosthetic replacement has a high morbidity, because of difficult attachment to the bone. The saddle endoprosthesis for oncological reconstructions has been widely used for revision of failed conventional endoprosthesis, its application in the oncological field is still limited [20]. The major concern is the risk of immediate instability and late loosening.

The use of an allograft offers the advantage of biological union to the host bone and makes muscle re-attachment easier. Series on hemipelvic allografts are rare, with few cases
and short follow-up [2,9,14,17]. There have been few long-term follow-up studies of patients who were managed with implantation of pelvic allograft.

Mnaymneh et al. [16] described a patient in whom a supra-acetabular chondrosarcoma was treated by resection of most of the pelvis and replacement with an allograft. The patient was followed up for 5.5 years.

Though some authors have good results [13,14] the complication rate is usually high [17]. Deep infection ranges from 10% to 30%, and half of the infected patients end up with an amputation [10,21]. In reconstructive procedures using hemipelvic allografts these rates are much more higher due to perioperative contamination, chemotherapeutic treatment and delay in wound healing [17]. In our small series we had no such complication. In these procedures we consider it important to have adequate soft-tissue coverage, in most cases achieved with the gluteus maximus muscle. An adequate antibiotic coverage until the end of chemotherapic treatments is also necessary.

In well selected patients this procedure is a reasonable option. Though difficult and technically demanding most patients achieve amazingly good functional results preserving the lower extremity with an acceptable functional outcome.

References


### Table 1

**Clinical details of the patients**

<table>
<thead>
<tr>
<th>Case</th>
<th>Tumor</th>
<th>Sex, Age (years)</th>
<th>Follow-up</th>
<th>Pelvic Resection *</th>
<th>Complications and treatment</th>
<th>Functional Result**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conventional chondrosarcoma</td>
<td>M, 45</td>
<td>11 years</td>
<td>I, II &amp; III</td>
<td>Osteoarthritis: primary arthroplasty (11 years)</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
<td>Solitary myeloma</td>
<td>M, 50</td>
<td>10 years</td>
<td>I, II</td>
<td>Fracture: prosthetic reconstruction (6 month)</td>
<td>Failure</td>
</tr>
<tr>
<td>3</td>
<td>Osteosarcoma</td>
<td>F, 21</td>
<td>5 years</td>
<td>I, II</td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>Mesenchymal chondrosarcoma</td>
<td>F, 30</td>
<td>5 years</td>
<td>I, II</td>
<td></td>
<td>Good</td>
</tr>
</tbody>
</table>

* According to the zones by Enneking [10]

** According to the system of Mankin [13]