RECONSTRUCTION NAILING FOR PATHOLOGICAL SUBTROCHANTERIC FRACTURES WITH COEXISTING FEMORAL SHAFT METASTASES

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We describe the use of intramedullary reconstruction nails in the treatment of 14 patients with pathological subtrochanteric fractures and coexisting metastases in the femoral shaft. After nailing, all patients were free from pain and regained mobility. They were followed up clinically and radiologically until death from the primary disease. There were no mechanical failures even when a less than ideal reduction had been achieved.


Recent advances in the treatment and prognosis of malignant neoplasms have led to improved longevity. The incidence of skeletal metastases has increased and the complications create difficult problems of management. Complete or impending pathological fractures of the subtrochanteric region of the femur with other metastases in the more distal shaft are very difficult to stabilise (Habermann and Lopez 1989) although the availability of modern reconstructive intramedullary nails has been of great benefit (Levine et al 1989).

We present our clinical experience using different types of reconstructive femoral nail in the management of a selected group of patients with pathological fractures of the subtrochanteric region combined with mid-shaft metastases.

PATIENTS AND METHODS

Between March 1988 and December 1991 we treated 14 patients with fractures or impending fractures of the subtrochanteric region associated with metastases in the shaft of the femur, using locked reconstruction nails. All 14 patients had malignant tumours (Table I) with skeletal metastases. The extent of involvement of the femur and the rest of the skeleton was assessed by a complete radiographic survey and bone scan. The patients had a mean age of 66.5 years (50 to 77); there were ten women and four men. The primary malignant tumour was in the breast in ten, in the lung in three and in the prostate in one. The average time from diagnosis of the tumour to operation was eight years.

Twelve of the patients presented with a subtrochanteric fracture and metastases in the femoral shaft. In one the shaft had fractured below a subtrochanteric tumour, and in one a subtrochanteric secondary tumour seemed likely to fracture and there were secondary deposits in the shaft of the femur as well. Our criteria for the prophylactic nailing of the two impending subtrochanteric fractures were similar to those proposed by Harrington et al (1976).

All 14 patients had internal fixation with intramedullary nails. We used six Russell-Taylor reconstruction nails (Fig. 1; R-T, Richards Medical Company, Memphis, Tennessee), and seven Uniflex reconstruction nails (Fig. 2; Biomet Inc, Warsaw, Indiana). In one case, because of lack of equipment, we used a modified AO universal nail (Fig. 3; Synthes, Waldenburg, Switzerland). Two oblique holes were made in its proximal end to accept two 6.5 mm AO cannulated screws.

The length of the nail was assessed from preoperative radiographic measurement of the opposite femur. Both ends of the nail were statically locked in all patients. Postoperatively, all patients underwent courses of local radiotherapy under the care of radiotherapists and were
followed up clinically and radiologically until they died as a result of the primary tumour.

**Operative techniques.** Operations were performed using the technique recommended by Russell and Taylor (1988) for their nail, and by the Department of Orthopaedics, University of Southern California for the Uniflex nail (Biomet Inc, Warsaw, Indiana). The patient was in the lateral position in three cases, and in the supine position in 11. The femoral canal was overreamed by 1.5 mm in all cases. Difficulties with the visualisation of the proximal femur were overcome by careful placement of the image intensifier. Twelve nailings were by a closed technique; in the other two a semi-open technique allowed augmentation of deficient bone stock with polymethylmethacrylate (PMMA) cement (Fig. 4).

**RESULTS**

In two patients, incomplete reduction of the fracture was achieved. The radiographs of the first patient showed 1 cm of destruction at the fracture site, and that of the second is shown in Figure 4.

After the operation, 11 of the patients were mobilised at once, fully weight-bearing but using crutches as required. Two were mobilised early, fully weight-bearing using a Zimmer frame because of their poor general health. One patient (Fig. 4) was kept non-weight-bearing for six weeks. All patients had marked reduction in the pain, and recovered a full range of painless movements at hip and knee.

Postoperative complications were frequent (Table I). One patient had a fatal air embolism, confirmed at autopsy, during the prophylactic nailing of the contra-lateral femur two weeks after the insertion of a Russell-Taylor nail. All the other patients died from generalised carcinomatosis at 1.5 to 24 months after operation. During follow-up, no definite callus formation or fracture healing was apparent on the radiographs, but at the time of death, the reconstruction nails were functioning well and the limbs were painless.
RECONSTRUCTION NAILING FOR MULTIPLE FEMORAL METASTASES

Table 1. Details of 14 patients treated for multiple femoral metastases by reconstruction nailing. All patients were painfree with a full range of movement: all but case 9 had full weight-bearing

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age (yr)</th>
<th>Primary neoplasm</th>
<th>Duration of disease (yr)</th>
<th>Fracture</th>
<th>Other metastases</th>
<th>Nash used</th>
<th>Complications</th>
<th>Survival time (mth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>50</td>
<td>Breast</td>
<td>10</td>
<td>Impending L subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>Spine Humerus</td>
<td>R-T</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>70</td>
<td>Breast</td>
<td>4</td>
<td>R subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>Spine</td>
<td>R-T</td>
<td>Air embolism</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>72</td>
<td>Breast</td>
<td>4</td>
<td>Impending R subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>–</td>
<td>Un</td>
<td>–</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>56</td>
<td>Breast</td>
<td>10</td>
<td>R femoral shaft</td>
<td>Impending R subtrochanteric</td>
<td>Pelvis Spine</td>
<td>Modified AO</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>60</td>
<td>Lung</td>
<td>2</td>
<td>L subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>–</td>
<td>R-T</td>
<td>–</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>67</td>
<td>Breast</td>
<td>4</td>
<td>R subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>Pelvis</td>
<td>Un</td>
<td>Heart failure</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>77</td>
<td>Prostate</td>
<td>3</td>
<td>R subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>–</td>
<td>Un</td>
<td>Poor reduction</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>69</td>
<td>Breast</td>
<td>45</td>
<td>R subtrochanteric</td>
<td>Mid-shaft right femur</td>
<td>–</td>
<td>Un†</td>
<td>–</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>68</td>
<td>Breast</td>
<td>5</td>
<td>R subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>Spine</td>
<td>Un†</td>
<td>Poor reduction</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>72</td>
<td>Breast</td>
<td>4</td>
<td>L subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>–</td>
<td>R-T</td>
<td>Intraoperative collapse (recovered)</td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>65</td>
<td>Breast</td>
<td>6</td>
<td>L subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>Pelvis</td>
<td>R-T</td>
<td>–</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>70</td>
<td>Lung</td>
<td>7</td>
<td>L subtrochanteric</td>
<td>Mid-shaft left femur</td>
<td>Spine Ribs</td>
<td>R-T</td>
<td>Pneumonia</td>
</tr>
<tr>
<td>13</td>
<td>F</td>
<td>61</td>
<td>Breast</td>
<td>5</td>
<td>R subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>Spine</td>
<td>Un†</td>
<td>–</td>
</tr>
<tr>
<td>14</td>
<td>M</td>
<td>72</td>
<td>Lung</td>
<td>3</td>
<td>L subtrochanteric</td>
<td>Mid-shaft both femurs</td>
<td>Ribs</td>
<td>Un†</td>
<td>Pneumonia</td>
</tr>
</tbody>
</table>

* R-T, Russell-Taylor; Un, Uniflex
† augmented with polymethylmethacrylate cement

DISCUSSION

Modern internal fixation devices, custom-made prostheses, and the use of PMMA have improved the orthopaedic management of pathological fractures. Secondary deposits in the subtrochanteric region are relatively common, and it has been reported that 23% of pathological fractures occur in this region of the femur (Harrington et al 1976).

The eccentric loading of the subtrochanteric region creates severe problems of internal fixation, and the presence of other metastases in the femur makes it imperative to use a mechanically strong device. In the past the Zickel nail was often used, but it has produced problems with insertion and with implant failure (Schatzker and Waddell 1980; Zickel 1980). Extensive subtrochanteric lesions have been treated by resection and replacement with custom-made prostheses (Habermann and Lopez 1989). Neither of these techniques is applicable when there are coexistent lesions in the remainder of the femoral shaft.

The reconstruction type of intramedullary nail was initially introduced for the fixation of ipsilateral femoral neck and shaft fractures, and there is little reported evidence for its efficacy in the management of malignant bone disease (Levine et al 1989). Weikert and Schwartz (1991) found the R-T nail to be highly effective in ten cases of impending subtrochanteric fracture, but only one of their patients had a second pathological lesion in the same femoral shaft. Patients with this double lesion have a very poor prognosis: the survival in our series averaged only ten months so that early restoration of function is imperative. Adequate treatment must mechanically bypass the tumour. Healing may not occur (it was not seen in our series), and the implant is therefore subject to repeated cyclical loading.

We found that the reconstruction nails provided safe internal splintage which bypassed all the metastases and allowed early restoration of painfree function until the patient died from the primary disease.
visualisation of both the femoral neck and the guides to be made in both anteroposterior and lateral views. The technical problems which we encountered during insertion, especially with proximal locking, were similar to those previously reported (Coleman et al 1991). As with all newly developed devices, technical difficulties will eventually be avoided with experience.

The patient who developed a fatal air embolism during reaming has been described in detail elsewhere (Karachalios, Geeuricks and Newman 1993). We believe that this complication can be avoided by providing an escape route for the air which is pressurised during reaming for prophylactic intramedullary nailing.

Conclusions. We believe that standard reconstruction nails are effective in the treatment of metastatic femoral disease. We found no advantage of one nail over the others. The relief of pain and improvement in mobility greatly enhance the quality of the remainder of such patients’ lives.

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Fig. 4
Less than ideal reduction and fixation for extensive metastatic disease, using a Uniflex nail.

We preferred the supine position at operation because it allowed better visualisation of the proximal femur with the image intensifier. Correct entry into the piriformis fossa was essential to avoid cortical perforation by the guide wire and to allow correct reaming of the femoral canal. During nail insertion the proximal screw holes are visualised by the anteroposterior image intensifier as scalloping in the proximal part of the nail. The nail is driven until the lowest screw hole is adjacent to the inferior border of the femoral neck. In the lateral view rotational adjustment is difficult but can be facilitated by overreaming the femoral canal by 1.5 mm. We recommend that the driving devices, but not their attaching bolts, are removed from the nail before the insertion of the proximal drill guides. This allows the

REFERENCES