INTRAMEDULLARY NAILING FOR IMPENDING PATHOLOGICAL SUBTROCHANTERIC FRACTURES

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We reviewed ten patients with metastatic carcinoma and impending pathological fractures of the subtrochanteric region of the femur who had prophylactic insertion of the Russell–Taylor reconstruction nail. There were no operative complications or long-term mechanical failures.

This reconstruction nail has some technical and biomechanical advantages over other implants and is ideal for the management of such cases.

Metastatic tumours are common in the proximal femur; it has been reported that about 23% of pathological fractures occur in the subtrochanteric region of the femur (Harrington et al 1976). The detection and treatment of impending pathological fractures has steadily improved. Prophylactic surgical stabilisation of such lesions before fracture is of great benefit to patients with metastases, and results in an improved quality of life (Mickelson and Bonfiglio 1976; Zickel and Mouradian 1976; Behr, Doboz and Badrinath 1985; Harrington 1987; Fasano, Olysav and Stauffer 1988; Levine et al 1989).

The Russell–Taylor reconstruction nail (RTRN, Richards Medical Company, Memphis, Tennessee) is effective, but no clinical trial of its efficacy has been published. This device combines static locking of the femoral shaft with proximal fixation of the femoral head and neck. We made a retrospective review of its use in ten carefully selected patients.

MATERIALS AND METHODS

We reviewed the medical records, pathology reports, and radiographs of ten patients treated at the Veterans Administration Medical Center in Nashville, Tennessee, and the Vanderbilt University Medical Center, defining the subtrochanteric region as that extending up to 5 cm distally from the lesser trochanter (Seinsheimer 1978).

An impending pathological fracture was diagnosed when radiographs showed a destructive lesion at least 3 cm in diameter, a lytic lesion with destruction of over 50% of the cortex, avulsion of the lesser trochanter, or persistent pain at the site of a destructive focus regardless of its radiographic appearance (Harrington 1986).

Operation was advised for all patients with an impending pathological fracture (Fig. 1) and a life expectancy of more than three months, with the aims of improving the quality of life, alleviating pain, retaining or restoring the ability to walk, and preventing fracture.

Technique. Operation is performed with the patient...
supine on a fracture table. An open biopsy of the lesion was performed in seven of the ten patients to establish the diagnosis. In two patients femoral reamings were sent for pathological examination. One patient known to have metastatic lung cancer did not have a biopsy prior to nailing.

Once the diagnosis of metastatic carcinoma has been confirmed, the incision is extended 10 cm proximally from the greater trochanter, and the glutei split to expose the pyriform fossa. A curved awl is used to broach a central starting hole under image intensifier control. A flexible intramedullary reamer over a bulb-tipped guide is then used to over-ream the medullary canal by 1.5 to 2.0 mm. The proximal 10 cm of the femur is over-reamed to 15.5 mm to accommodate the expanded portion of the nail. A guide pin is placed along the anterior femoral neck to ensure the proper position of rotation of the nail during insertion. The proximal bolts are then placed into the femoral head.

The distal bolts for static locking are inserted only when the integrity of the femoral isthmus is in question. In one patient a free-hand technique was used because there was a second pathological lesion involving the same femoral shaft (Fig. 2). In four patients the biopsy site was filled with polymethylmethacrylate cement.

Prophylactic antibiotics were given to all patients, and protected weight-bearing was enforced for six weeks. The entire femur was given radiation therapy in all patients after operation.

RESULTS

Table I summarises the tumour histology, duration of symptoms, and the need for walking aids of the patients. All patients still living had symptomatic relief prior to hospital discharge and at three months after surgery, five of the ten achieved at least one stage of improvement in their walking ability. Five patients died postoperatively at two, six, seven, 11 and 14 months respectively, as a result of their metastatic disease. Follow-up ranged from six to 24 months in the remaining five patients. All wounds healed, and there were no mechanical failures of the nail.

Complications. One patient showed radiographic evidence of local tumour progression at nine months and thus represents a failure of radiotherapy. This did not

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Primary neoplasm</th>
<th>Duration of symptoms (mth)</th>
<th>Walking aids Pre-op</th>
<th>At 3 mth</th>
<th>Result</th>
<th>Follow-up (mth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>Bile duct</td>
<td>11</td>
<td>Walker</td>
<td>None</td>
<td>Alive, pain-free</td>
<td>6</td>
</tr>
<tr>
<td>85</td>
<td>Lung (squamous)</td>
<td>6</td>
<td>Walker</td>
<td>Walker</td>
<td>Died</td>
<td>7</td>
</tr>
<tr>
<td>62</td>
<td>Ampulla of Vater</td>
<td>2</td>
<td>Walker</td>
<td>Died</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>66</td>
<td>Prostate</td>
<td>2</td>
<td>Walker</td>
<td>Crutches</td>
<td>Died</td>
<td>11</td>
</tr>
<tr>
<td>64</td>
<td>Pancreas</td>
<td>3</td>
<td>Walker</td>
<td>Walker</td>
<td>Died</td>
<td>6</td>
</tr>
<tr>
<td>79</td>
<td>Prostate</td>
<td>4</td>
<td>Crutches</td>
<td>None</td>
<td>Died</td>
<td>14</td>
</tr>
<tr>
<td>78</td>
<td>Prostate</td>
<td>6</td>
<td>Walker</td>
<td>Walker</td>
<td>Alive, pain*</td>
<td>24</td>
</tr>
<tr>
<td>40</td>
<td>Unknown</td>
<td>3</td>
<td>Crutches</td>
<td>Cane</td>
<td>Alive, pain-free</td>
<td>6</td>
</tr>
<tr>
<td>74</td>
<td>Breast</td>
<td>1</td>
<td>Walker</td>
<td>Walker</td>
<td>Alive, pain-free</td>
<td>6</td>
</tr>
<tr>
<td>57</td>
<td>Breast</td>
<td>3</td>
<td>Walker</td>
<td>Crutches</td>
<td>Alive, pain-free</td>
<td>6</td>
</tr>
</tbody>
</table>

* Osteoarthritis of the hip
progress to mechanical failure, however, and the patient died of metastatic disease at 11 months postoperatively.

One patient developed clinical and venographic evidence of deep-venous thrombosis, but this was successfully treated with heparin, followed by Warfarin (Coumadin, Du Pont, USA). The same patient also had persistent pain after nailing, but this was considered to be due to osteoarthritis of the hip.

DISCUSSION

The Zickel nail is the usual implant for lesions in the subtrochanteric region of the femur, but gives some problems. These include difficulty with insertion (Shatzker and Waddell 1980), and removal (Yelton and Low 1986; Ovadia and Chess 1988), leg-length inequality, and failure of fixation (Zickel and Mouradian 1976; Zickel 1980). Other devices such as Ender's nails (Pankovich and Tarabishy 1980) and Jewett nail plates (Harrington 1976) are unsatisfactory when used to stabilise the subtrochanteric region, largely because of mechanical weakness.

The biomechanics of the subtrochanteric femur necessitate the use of an implant which is able to withstand long-term cyclic loading. This is especially true in patients with metastatic carcinoma where healing of the lesion is not expected.

The Russell-Taylor reconstruction nail, because of its load sharing properties, is biomechanically suited for the subtrochanteric area and the bending strength of its shaft is comparable to the Zickel nail. For 13 mm nails the Zickel has a bending strength of approximately 120 Nm compared to the RTRN bending strength of 119 Nm (Richards Medical Company, personal communication 1988). In addition, the proximal bolt-shaft interface withstood laboratory loading for over 10^6 cycles at three times body weight.

Shortening, varus migration, and rotational instability are the main problems, and the RTRN can be statically locked by inserting both proximal oblique and distal transverse bolts. This prevents all three possibilities. Distal locking provides simultaneous treatment for coexistent or later developing lesions of the femoral shaft.

In certain situations total hip arthroplasty may be preferred to an RTRN. These include coexistent acetabular disease from tumour or osteoarthritis (Sim 1983). A long-stem femoral prosthesis can be used to treat ipsilateral diaphyseal or subtrochanteric lesions as well. This might have been a better choice for the patient in our series who, in retrospect, was found to have coexistent osteoarthritis of the hip.

Conclusions. The RTRN successfully met our goals of treatment for impending subtrochanteric fractures. There were no mechanical failures or technical complications. All patients walked better, and all but one had pain relief. The RTRN has definite advantages for treating these lesions.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


