Treatment of ipsilateral femoral shaft fractures and hip fractures

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Ipsilateral femoral shaft fractures and hip fractures are difficult to treat. The treatment protocols are diversified. We report the results of treating 16 such fractures. The diaphyseal fractures are fixed with intramedullary locked nails and the hip fractures with cannulated lag screws. The average follow-up period is 21.8 months. The results show that all diaphyseal fractures healed, one proximal fracture had delayed union. Functionally, 14 (87.5 per cent) patients had good results and two (12.5 per cent) had fair results; additional procedures may be necessary if the treatment of fractures is delayed. It is concluded that the present treatment protocol gives predictable good results for these fractures. The use of the newly available long gamma nail is also discussed and illustrated.

Introduction
Ipsilateral femoral shaft fractures and hip fractures are rare combinations (Zettas and Zettas, 1981; Bucholz and Rathjen, 1985) and the treatment of these fractures is difficult. They usually happen in high-energy injuries that result in multiple injuries. The standard treatment for unstable diaphyseal fractures of the femur is the use of locked intramedullary nails (Wiss et al., 1986; Zuckerman et al., 1987). This method gives predictable good results irrespective of the comminution. The use of the cannulated screws in the treatment of femoral neck fractures has also been advocated in recent years (Bray and Chapman, 1984). With the increased incidence of high-energy trauma, we are seeing more of such combinations of fractures. Between 1987 and 1990, we treated 227 femoral fractures, of which there were 22 cases of ipsilateral femoral diaphyseal fractures and hip fractures. This paper reports the results of treating the 16 fractures with a standard protocol of intramedullary locked nails for diaphyseal fractures and lag screw fixation of the hip fractures. The other six were also treated with the same protocol but their follow-up period is too short for analysis.

Patients and fractures
There were 16 patients, with an age range of 21 years to 53 years (average 29.8 years), they were all males. Nine patients sustained the fractures in road traffic accidents. Six patients were passengers in the vehicles and three were pedestrians. The other seven patients fell from a height; two of them attempted suicide. All except two had multiple injuries (Table I). The injury severity score (ISS) for the multiply-

Table I. Incidence of concomitant injuries

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injuries</td>
<td>12</td>
</tr>
<tr>
<td>Multiple fractures</td>
<td>9</td>
</tr>
<tr>
<td>Chest injuries</td>
<td>5</td>
</tr>
<tr>
<td>Abdominal injuries</td>
<td>6</td>
</tr>
<tr>
<td>Extensive soft tissue injuries</td>
<td>5</td>
</tr>
</tbody>
</table>

Table II. Displacement of fractures of the hip

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Cervical</th>
<th>Basal</th>
<th>Trochanteric</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undisplaced</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Displaced</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

Injured patients ranged from 26 to 57 with an average of 38.7. One patient had a road accident in mainland China where only the diaphyseal fracture was splinted by open intramedullary pin. The femoral neck fracture was not fixed. He was transferred to our hospital 7 months after the injury. All the diaphyseal fractures were unstable. By the Hansen–Winquist classification (Hansen and Winquist, 1978), six were type II, seven were type III and three were type IV. The hip fractures were classified anatomically: five were cervical fractures, seven were basal neck fractures and four were intertrochanteric fractures. The degree of displacement of these hip fractures is shown in Table II. There were three open diaphyseal fractures. All were Gustilo–Anderson (Gustilo and Anderson, 1976) type II open fractures. One cervical neck fracture was missed during the initial treatment of the diaphyseal fractures (Figure 1). The fracture was fixed with a delay of 5 days. One patient transferred from China had the cervical fracture untreated for 7 months (Figure 2).

Method
All patients were resuscitated in the accident and emergency department. Temporary skeletal traction was set up via a tibial Steinmann pin. The life-threatening conditions were treated by the general surgeons and the neurosurgeons. Once the patients were stabilized, treatment of the fractures was carried out. Prophylactic antibiotics with cephazolin...
were used in all closed fractures. Open fractures were treated with second-generation cephalosporins (e.g., cefazolin). All fractures were treated in the same operative session. The diaphyseal fractures were treated with Grosse-Kempf intramedullary locked nails. Primary nailing was carried out for open fractures. The diaphyseal fracture of the patient from China was also revised with a locked nail. The hip fractures were treated with cannulated screws. For the patient from China, because the fracture was displaced (Garden IV) and the preoperative bone scan showed photon deficiency in the head region (Figure 3), a vascularized pedicle iliac crest graft was performed during the same operation (Leung, 1989). The pedicle vessels were the deep circumflex iliac artery and vein which were re-routed under the iliopsoas musculotendinous structure. With anterior capsulotomy, the 50 mm x 5 mm x 5 mm graft was transferred to a trough on the anterior surface of the head and neck. Since the surgical technique of locked nailing and that for the cannulated hip screws were well established, only a few technical points are given here.

All patients were supine on a traction table. The diaphyseal fractures were fixed first (Schatzker and Barrington, 1968). The reduction was done carefully with the femoral traction pin under fluoroscopic control. The proximal fractures were left alone for the time being, provided there was no excessive displacement during the manipulative reduction of the femoral shaft fractures. The medullary canal is entered just lateral to the tip of the greater trochanter in the frontal plane and in alignment with the mid-line of the femur in the lateral plane. This entry point in the proximal femur must be located accurately with the help of the image intensifier. This is most important in patients with intertrochanteric fractures. Static locking was done in all patients. Distal locking was done with a C-arm mounted targetting device. After the diaphyseal fractures were fixed, closed reduction was carried out for the displaced hip fractures. Substantial internal rotation had to be performed in order to reduce the hip fractures as anatomically as possible. The proximal fractures were fixed with two or three cannulated lag screws. The entry point for these screws is best monitored with the image intensifier positioned to give a lateral view of the proximal femur. The cannulated screws were passed anterior or posterior to the proximal part of the intramedullary nail. They were arranged as parallel as possible in both the frontal and lateral planes in order to facilitate impaction of the fractures. One of the screws must be placed near the calcar of the neck either anteriorly or posteriorly (Figure 4). Anterior capsulotomy was done routinely for cervical fractures (Soto-Hall et al., 1964).

Postoperatively, non-weight-bearing walking was allowed for the first 4 weeks and then graduated weight bearing for the next 4 weeks before proceeding to full weight bearing walking. Dynamization of the diaphyseal fractures was done in the early period of the study by removing the distal locked screws only. All patients were seen regularly in the trauma clinic. Apart from the regular plain radiographs to detect fracture union, bone scans were carried out at 3 months and 6 months for patients with cervical fractures.
Results

The period of follow-up averaged 21.8 months (range 18–36 months). All diaphyseal fractures healed (Figure 5). In the early period of the study, two of the patients had
dynamization of the diaphyseal fractures done by removal of the distal locked screws 6 months after the operation. For the proximal fractures, all cervical fractures healed. Serial bone scan showed no signs of avascular necrosis. The one with delayed treatment also showed signs of revascularization (Figures 3, 4). No segmental collapse was observed. There was one delayed union in the basal neck fractures. This happened in a patient with severe head injury. He behaved violently during the convalescent period and did not obey the non-weight-bearing walking exercise. As a consequence, the fracture became varus and union was delayed. The fracture was then revised with a dynamic condybar screw without bone grafting after removal of the locked nail and the hip screws 6 months after the first operation. The fracture finally united with 100° neck-shaft angle. There was uneventful healing of all the trochanteric fractures.

Functionally, the patients were assessed with the system used by Friedman and Wyman (Friedman and Wyman, 1986): good, i.e. no limitation of activities of daily living (ADL), no pain, less than 20 per cent loss of hip or knee motion; fair, mild limitation of ADL, mild to moderate pain, 20–50 per cent loss of motion; and poor, moderate limitation of ADL, severe pain, more than 50 per cent loss of motion.

In all, 14 out of 16 patients (87.5 per cent) were rated good and two of the 16 patients (12.5 per cent) had fair results. These included the patient who had delayed union of the basal neck fracture which needed revision. The final range of hip motion was satisfactory, but there was only 10–100° of knee motion. There was also shortening of 20 mm due to the varus deformity of the hip. The other patient who had a fair result was the patient with 7 months delay in the fixation of the cervical fracture and treated with vascularized iliac bone grafting. Hip flexion was limited to 90° and was probably due to the prominence of the graft in the anterior part of the neck (Figure 4). The other parameters were normal. No patient was rated poor.

There was no infection or implant failure.

Discussion

The treatment of ipsilateral fractures of hip and diaphysis is difficult and the protocols for the management of these fractures are also very diversified (Cook et al., 1984; Swiontkowski et al., 1984; Barquet et al., 1985; Swiontkowski, 1987; Gill et al., 1990). Numerous combinations of treatments have been advocated. With better understanding of the role of early fixation of the fractures in multiply-injured patients (Goris et al., 1982; Phillips and Conteras, 1990) and the common association of these fractures with high-energy trauma, operative treatment for these fractures is well accepted (Casey and Chapman, 1979; Bucholz and Rathjen, 1985; Friedman and Wyman, 1986). The problem with such an approach is the method of fixation. There are very few reports of the results from the standard protocol (Delaney and Street, 1953; Ashby and Anderson, 1977; Bucholz and Rathjen, 1985). As a result, fractures were treated by various methods of fixation and the results cannot be compared. It is therefore difficult to have a recommended treatment for these difficult fractures. The use of locked nails in the management of the unstable diaphyseal fractures in long bones is perhaps one of the major advances in the management of musculoskeletal trauma. The advantages of closed treatment of fractures with locked nails are well documented (Wiss et al., 1986; Zuckerman et al., 1987). In this series, all diaphyseal fractures were unstable types and they were all fixed with locked nails. The excellent healing of all the diaphyseal fractures, which included three open fractures, again proves the usefulness of locked nails. Locked nails are specially indicated in these double fractures because they provide excellent stability which is particularly important in multiply-injured patients. The locked nails at the same time allow dynamic loading of the fracture site for callus formation and healing of fractures (Wiss et al., 1986; Zuckerman et al., 1987).

The use of cannulated lag screws in the fixation of femoral neck fractures is again the treatment of choice (Bray and Chapman, 1984). In this series, all the proximal fractures were fixed using this method. No ischaemic necrosis developed in the follow-up period. This is in agreement with the results of other studies (Swiontkowski, 1987). The possible explanation is that most of the proximal fractures result from relatively low-energy trauma as most of the energy is dissipated by the diaphyseal fracture. The proximal fractures are usually minimally displaced and hence the blood supply to the proximal fragment is affected to a lesser extent in cervical fractures. This may be one of the reasons accounting for the high incidence of missing proximal fractures during initial assessment (Swiontkowski et al., 1984; Swiontkowski, 1987). The technique of inserting the screws around the proximal end of the intramedullary nail requires optimal radiographic control. Every effort should be made to place the screws parallel and one of the screws should be as near as possible to the calcar femoris. The use of cannulated screws greatly facilitates such a manoeuvre and decreases the trauma to the neck and head.

Figure 6. Patient with concomitant trochanteric fracture and diaphyseal fractures treated with a long gamma nail.
The very satisfying results of using a combination of locked intramedullary nails and cannulated lag screws in the treatment of ipsilateral fractures of the hip and femoral shaft fractures illustrates the advantages of fixing fractures by this method. The present series is the first report of this technique as the standard treatment protocol for these fractures. The recent availability of other intramedullary fixation devices such as the long gamma nail could be another promising technique (Figure 6). It combines the sliding lag screw for the fixation of the proximal fractures and the locked intramedullary nail for the diaphyseal fractures. Clinical experience is limited and the rigid intramedullary nail increases the difficulty of insertion. The potential complication of fracturing the femoral diaphysis and the subsequent osteopenia should be taken into account when using such implant. Further clinical studies should be conducted before it can be recommended as the standard treatment.

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References


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