UNRECOGNISED DISLOCATION OF THE HIP
IN FRACTURES OF THE FEMORAL SHAFT

B. HELAL, ENFIELD, ENGLAND, and X. SKEVIS, ATHENS, GREECE

When fracture of the femoral shaft and dislocation of the hip occur in the same limb the dislocation is often missed. In this paper we offer a way to avoid this diagnostic pitfall. It has been estimated that combined femoral shaft fracture and hip dislocation occur once in every 100,000 cases of fracture (Wiltberger, Mitchell and Hedrick 1948). In a century and a half a total of eighty-one such injuries have been reported. Since Sir Astley Cooper described the first in 1823, isolated cases and small series have been recorded (Bainbrigge 1846; Fergusson 1852; Malgaigne 1855; Delagarde 1866; Murdoch 1878; Kammerer 1889; Wiltberger, Mitchell and Hedrick 1948; Detzel 1953; Mau 1953; Zarotti and Albertini 1953; Verbrügge 1955; Bürkle de la Camp and Rostock 1956; Trojan and Persch 1956; Merle d’Aubigné and Lord 1957; Padovani 1957; Cataneo 1958; Salem 1961; Schönbauer 1961; Wadsworth 1961; Nikolai 1962). There have been two major reviews of the subject, the first by Henry and Bayumi in 1934 and the other by Dehne and Immermann in 1951. We have seen two patients with this combined injury and have collected the records of a further twelve unpublished cases. Table I summarises the available relevant information on these patients.

![chart]

**FIG. 1**
The incidence of injuries to flexed limbs that could have transmitted an axial force to the femoral shaft.

**MECHANISM OF INJURY**
Kammerer (1889) believed that the combined injury was the outcome of two separate traumatic events. We endorse this opinion. Like Henry and Bayumi (1934) we obtained no clue to the sequence of events from the patients' history. We have tried to produce the combined injury experimentally, using a method modified from that devised by Pearson and
Hargadon (1962). We found that posterior dislocation could be produced only by the application of a considerable force along the axis of the femur with the thigh flexed and adducted. This axial force was applied by impact to the flexed knee of the supine cadaver. As for the shaft of the femur, heavy direct impact to the thigh with the cadaver lying on the "uninjured" side produced a transverse fracture. Any diffuse force or indirect force produced fractures of a different obliquity. We found that it was easier to produce the fracture with the hip dislocated, because there was less of a buttress provided by the other limb. We failed in all our attempts to produce the combined injury by a single "resultant force."

In modern times this combined injury seems to happen mostly to the young motor cyclist. A collision whilst riding a motor cycle is perhaps the most effective cause, firstly, of an axial force on the femur (this, aided by the usual crouched position of the rider, could produce a hip dislocation); and secondly, in consequence of the fall, a direct lateral force which fractures the shaft of the femur transversely.

An injury suggesting the axial force was present in most of the cases that we record (Fig. 1). A further injury at right angles to the femoral shaft is suggested by the transverse nature of the shaft fractures (Alms 1961).

VARIATIONS

The dislocation—There has been one case described in which the hip dislocation was both compound and anterior (Trojan and Perschl 1956). In one case the injury was bilateral. Otherwise all the dislocations have been posterior and unilateral.

The fracture—This can occur at any site in the femoral shaft and among our cases are examples of fractures in the subtrochanteric and supracondylar areas, as well as in the mid-shaft (Figs. 2 to 4). The fracture was always transverse.
### TABLE I
**Relevant Clinical Details in Fourteen Patients**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Side</th>
<th>Accident</th>
<th>Site of fracture</th>
<th>Femur</th>
<th>Hip dislocation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>27</td>
<td>M</td>
<td>Right</td>
<td>Pit accident</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Commminated</td>
<td>Adducted</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>F</td>
<td>Left</td>
<td>Road accident</td>
<td>Sub-trochanteric</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>5</td>
<td>27</td>
<td>M</td>
<td>Left</td>
<td>Lorry crash</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>M</td>
<td>Left</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>7</td>
<td>22</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Lowest third shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>M</td>
<td>Left</td>
<td>&quot;dodgem car&quot;</td>
<td>Lower femoral metaphysis</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>M</td>
<td>Right</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>12</td>
<td>?</td>
<td>F</td>
<td>Left</td>
<td>Motor cycle</td>
<td>Mid-shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>13</td>
<td>17</td>
<td>F</td>
<td>Left</td>
<td>Motor cycle (pillion)</td>
<td>Upper third shaft</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>M</td>
<td>Left</td>
<td>Motor cycle</td>
<td>Supra-condylar</td>
<td>Transverse</td>
<td>Adducted</td>
</tr>
</tbody>
</table>

### TABLE II
**The Three Reviews of the Injury Complex**

<table>
<thead>
<tr>
<th>Reviewers</th>
<th>Cases reported</th>
<th>Cases reviewed from the literature</th>
<th>Total</th>
<th>Missed dislocations (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henry and Bayumi (1823–1934)</td>
<td>1</td>
<td>15</td>
<td>16</td>
<td>50</td>
</tr>
<tr>
<td>Dehne and Immermann (1934–51)</td>
<td>16</td>
<td>26</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>Helal and Skevis (1951–65)</td>
<td>14</td>
<td>23</td>
<td>37</td>
<td>54</td>
</tr>
</tbody>
</table>
DIAGNOSIS

Our interest in the diagnosis of this injury was stimulated by the fact that one of our two patients reached us four weeks after injury with the hip dislocation still undiagnosed. What seems more incredible was that the femoral shaft fracture had been fixed by a medullary nail without the dislocation being noticed. However, enquiry has led to the discovery that such a delay in diagnosis of the dislocation is common. In fact, Dehne and Immermann (1951) confessed that they discovered a missed dislocation in one of their patients after their excellent article on this very subject had just been submitted for publication. It seems that diagnosis is not made because the characteristic deformity of an uncomplicated hip dislocation is absent. The femoral shaft fracture, as well as providing an obvious injury which may by itself distract attention from other injuries, also acts like a “corrective” osteotomy and so masks the typical deformity.

Delay in diagnosis of the dislocation—The time that elapses before diagnosis of the hip dislocation can vary widely. Detzel (1953) described a patient in whom the diagnosis of dislocated hip was made five years after the injury, as an incidental discovery during a life insurance examination. It has also been described as a fortuitous finding at necropsy many years after injury (Murdoch 1878).

The findings in our series of cases suggest that if the dislocation is not discovered in the first few days then it remains unnoticed until the patient starts to walk after the fractured femur has healed. Table II shows the percentage of missed dislocations in all the cases described in the literature, together with the series of cases we present. Henry and Bayumi (1934) took into account all the cases recorded before their publication. The other two surveys included all the cases reported since the previous review. The Table shows that in at least half the cases the dislocation had escaped notice. It also illustrates the fact that between 1823 and 1934 fewer dislocations were missed than in the subsequent period. It will be recalled that the earlier period included a time before radiography came into general use. It may be that in those bygone days more reliance was placed upon clinical examination and acumen. The Table further illustrates the fact that the percentage of cases in which the dislocation...
Safeguards is always femoral from proximal manipulation.

We have found examination of the radiograph of the femoral shaft fracture alone to be of great value in drawing attention to a dislocation. The fracture patterns of 127 femoral shaft fractures without hip injury were examined. These features emerge. In 85 per cent the proximal fragment of the shaft was abducted; in 14 per cent it was adducted. In those with an abducted proximal shaft fragment the fracture line constantly ran downwards and medially from the lateral cortex (Fig. 5). By contrast, in those cases with a femoral shaft fracture and a hip dislocation (including all those whose radiographs have been published), the proximal femoral shaft fragment is always adducted and instead of being oblique the fracture line is always transverse. (This remained true of the proximal fragment even when the fracture was comminuted.) Therefore, when a transverse fracture of the femoral shaft occurs in association with an adducted proximal shaft fragment a diagnosis of posterior dislocation of the hip must be made (Fig. 6).

We found that other signs such as absence of overlap of the fractured femoral shaft fragments, flexion of the proximal shaft fragment, and failure to align the proximal shaft fragment by traction are often present, but are not specific to the combined injury.

**TREATMENT**

Sir Astley Cooper (1823) was unique in deliberately delaying reduction of the dislocated hip in his patient until the femoral shaft fracture was sufficiently united to allow manipulation. He reported a satisfactory end-result. Nature is generally less kind to ordinary mortals. The most urgent consideration should be given to the reduction of the hip dislocation. Closed reduction may be achieved in one of the following ways, all of which have been employed with varying success. 1) Simple traction manipulation ignoring the femoral fracture has been used. This, however, involves distraction and angulation of the soft tissues at the fracture site, which apart from being mechanically inefficient could produce further damage to them. 2) A Steinmann’s pin can be used to transfix the trochanter and this affords some measure of control over the proximal femoral shaft fragment (Ingram and Turner 1954). 3) We believe that better leverage can be obtained by the use of a traction screw device (Smith 1964), which is screwed into the femoral neck.

When the hip dislocation is reduced the femoral shaft fracture may be treated either conservatively or by internal fixation. An alternative method is internal fixation of the shaft fracture by a bone plate and this can be followed by closed reduction of the hip dislocation...
Küntscher nail fixation, although more satisfactory for the fracture, may still permit distraction at the fracture site so that there may be insufficient leverage to reduce the dislocated hip. However, it may be possible to apply bone clamps to the proximal shaft fragment or, better still, to use a screw device into the proximal shaft medulla (Denness 1964) and so obtain sufficient leverage on the proximal shaft fragment to reduce the dislocation before inserting the Küntscher nail.

In the cases we report, closed reduction of the dislocated hip was invariably followed by a good result. Open reduction produced only one satisfactory result in ten cases (Fig. 7). We are aware that many factors may be responsible. However, the simple fact emerges that closed reduction of the hip is followed by infinitely better results than open reduction.

As the combined injury is rare, no one has had much experience of treatment. It seems to us, however, that internal fixation of the femoral shaft fracture should be advised because it allows early movement, and that the ideal method of fixation is by an intramedullary nail. At operation a Smith traction screw device inserted into the femoral neck, and another, as devised by Denness, screwed up into the medulla of the proximal shaft fragment, would afford excellent control of the proximal femoral shaft and so make reduction easier (Fig. 8).

Open reduction of the hip is indicated if closed methods fail and particularly if the sciatic nerve has been damaged. A posterior approach displays both the hip and the nerve. Dehne and Immermann (1951) pointed out that delay in reduction of a hip dislocation results in contraction of muscle and other soft tissues. They solved this difficulty in one of their patients by deliberate shortening of the femur at the fracture site. However, it has been observed that open reduction is associated with an increased risk of avascular necrosis to the femoral head; Henry and Bayumi (1934) put this as high as 40 per cent.
COMPLICATIONS

Femoral head necrosis is the most common complication (Table III). Merle d’Aubigné and Lord (1957) believed that a fracture-dislocation of the hip reduced within twenty-four hours is followed by femoral head necrosis in 30 per cent of cases, and that a longer delay than this invariably results in avascular necrosis. They further advised primary fusion or arthroplasty if the hip is not reduced by the fifteenth day. Based on our survey of forty-six posterior hip dislocations and the series of cases reported here, we would hesitate to draw such rigid conclusions, for the outcome appears to relate more to factors such as the method used to reduce the hip dislocation. Nevertheless it seems reasonable to assume that in general the longer the delay the greater the difficulty of reduction (owing to contracture of the soft tissues), and the less the chance of a good functioning hip. Sciatic palsy has been reported (Dehne and Immermann 1951) and it occurred in three of our cases. Recovery was incomplete. One of the patients in this series had delayed union. Non-union of the femoral shaft fracture has been reported and has been dealt with successfully by internal fixation and grafting (Dehne and Immermann 1951).

TABLE III
THE INCIDENCE OF LOCAL COMPLICATIONS IN FOURTEEN CASES

<table>
<thead>
<tr>
<th>Complications</th>
<th>Case numbers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avascular necrosis of the femoral head</td>
<td>1, 2, 3, 4, 7, 12</td>
<td>6</td>
</tr>
<tr>
<td>Sciatic nerve palsy</td>
<td>2, 7, 10</td>
<td>3</td>
</tr>
<tr>
<td>Delayed union of femoral shaft fracture</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

SUMMARY

1. The combination of femoral shaft fracture with dislocation of the hip in the same limb has been recorded in eighty-one patients since 1823.
2. A further fourteen cases are reported.
3. In over half the cases the hip dislocation was diagnosed late or not at all, and this error has occurred more often in modern times. The reasons for this are outlined.
4. The diagnostic physical signs of hip dislocation in the presence of a femoral shaft fracture are described.
5. The mechanism, sequels and treatment of this combined injury are discussed.

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REFERENCES


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