LONG-TERM FOLLOW-UP OF CHILDREN WITH FEMORAL NECK FRACTURES

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Of 92 children reviewed three to five years after treatment for fractured neck of femur (Lam 1976), we have been able to reassess 41, both clinically and radiographically, at 13 to 23 years after injury.

The earlier clinical results had been excellent, despite a high incidence of complications; but the new, later review shows an 83% incidence of radiographic abnormality while 24% of the patients have pain, a limp or leg shortening. We present a recommended policy for management of this rare but potentially serious childhood injury.

A personal series of 92 cases of fractured neck of femur in children aged 4 to 17 years was reported some years ago (Lam 1976); the types of fractures included 2 trans-epiphyseal, 46 transcervical, 26 cervico-trochanteric and 18 intertrochanteric. Undisplaced fractures were treated in a plaster spica and displaced ones by reduction and multiple pinning. The early results were excellent; all the fractures healed and all the patients were able to walk on discharge. Some complications were encountered in over half the patients within a follow-up period of three to five years (Table I), but most of these did not cause significant symptoms at that time.

The present study is a continuation of the previous one, and the aim is to identify the long-term results and complications arising from fractures around the neck of the femur.

MATERIALS AND METHODS

Since most of the patients studied previously were not regularly followed up, we had great difficulty tracing them; changes of address and apathy combined to make clinical contact a problem. Nevertheless, a total of 41 patients (45%) were seen for clinical assessment and radiographic examination.

A standard assessment chart was used to record the basic data obtained from the clinical examination: this chart was an expanded version of Charnley's scoring system, with additional data regarding the knees and ankles.

Patients were checked for pain and for gait abnormalities. They were then examined for hip movement, lower limb-length discrepancies and deformities; finally, anteroposterior and lateral radiographs were taken of both hips.

The previous records of these patients were reviewed and 25 of the 41 patients had old films available for comparison.

Table I. Complications in the first five years (Lam 1976)

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number</th>
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<tbody>
<tr>
<td>Septic arthritis</td>
<td>2</td>
</tr>
<tr>
<td>Premature epiphyseal fusion</td>
<td>3</td>
</tr>
<tr>
<td>Coxa vara</td>
<td>20</td>
</tr>
<tr>
<td>Avascular necrosis</td>
<td>15</td>
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<tr>
<td>Delayed union</td>
<td>12</td>
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</tbody>
</table>

RESULTS

Of the 41 patients examined, 23 were male and 18 female. Their ages at review varied from 18 to 37 and their ages at injury from 5 to 14 years; follow-up was 13 to 23 years, averaging 18 years. The types of fractures fell into three groups: transcervical, cervico-trochanteric and intertrochanteric; there were no trans-epiphyseal fractures.

Twelve patients with grossly displaced fractures had been treated by open reduction and internal fixation, using Moore's pins in seven cases and Knowles pins in five. The other patients were all treated non-operatively, either by bed rest with or without skin traction, or by closed reduction followed by traction, with or without plaster. In general, the slightly displaced fractures were treated by closed reduction followed by traction with or
without plaster and the undisplaced fractures by bed rest (Table II).

The occupation of these patients varied, but they could be broadly classified as manual labourers (27), sedentary workers (10) and students (4). All but one claimed to have normal or nearly normal working ability.

Using the Charnley grades 22 patients had no pain in the injured hip; 9 had some discomfort while the hip was under stress; and 10 had obvious pain and a limp (the gait score ranged from 3 to 5).

Of the 22 symptom-free patients, 10 had some limitation of hip movement when examined clinically. Those who experienced discomfort on stress showed significant limitation of movement. Three patients from these two groups also had limb shortening of about 1 cm. In the group who limped hip movements were markedly limited and shortening varied from 2 to 8 cm. None of these patients had obvious problems in their knees or ankles.

**Radiography.** The appearances demonstrated a fascinating variety, including the following.

1. Normal (3 = 7%): the femoral head, neck, calcar angle and acetabulum all appeared normal; the old fracture site could no longer be detected (Fig. 1).

2. Almost normal (4 = 10%): there was just a suggestion of the previous fracture and the femoral neck showed some degree of irregularity or thickening (Fig. 2).

3. Coxa magna (5 = 12%): a flattened femoral head with a short neck was seen (Fig. 3).

4. Coxa vara (4 = 10%): the neck–shaft angle of the fractured side was compared with that of the normal side. Two cases showed significant decrease in the angle (Fig. 4); in the other two cases the difference was mild. All the cases of avascular necrosis (8) and of coxa magna (5) also showed coxa vara.

5. Avascular necrosis of the femoral head (8 = 20%): avascular necrosis with total collapse of the femoral head was seen, leading to late osteoarthritis (Fig. 5).

6. Late displacement of the epiphysis or premature epiphysal fusion (2 = 5%): signs of epiphysal displacement and/or fusion were seen (Fig. 6).

7. Long neck (6 = 15%): apparent lengthening of the neck was found to be quite common. This ranged from less than 1 cm to more than 2 cm (Fig. 4).

8. Short neck (4 = 10%): a short neck was common with avascular necrosis; the shortening varied from a few millimetres to 1.5 cm (Figs 3, 6 and 7).

9. Cup arthroplasty (2 = 5%): the old records indicated that cup arthroplasty had been performed as treatment for extensive avascular necrosis of the femoral head; both these patients had painful stiff hips and a marked limp.

**DISCUSSION**

A fractured neck of femur is uncommon in children and the limited experience of individual surgeons has made standardisation of treatment impossible (Sullivan 1953; Durbin 1959; Ratliff 1962, 1978). From his personal experience, one of the authors (SFL), at the end of his previous study, concluded that displaced fractures must be reduced; otherwise the results were catastrophic and the disability permanent. Fixation of reduced fractures could be achieved by either internal or external means.

A short-term follow-up showed excellent results, but when these patients were seen again 13 to 23 years after the injury, a different picture was presented by those who returned for follow-up. A significant proportion (24%) now presented with a severe limp, pain in the hips and shortening. The remainder had no gross symptoms, but a high proportion (22%) suffered from discomfort when the affected hip was put under stress during prolonged walking or squatting. Remarkably, however, all except one of the 41 patients had worked normally throughout their adult life.

All the patients with severe symptoms and with deformity were among those who had initially had a displaced fracture that required reduction; 70% of this group had had open reduction and internal fixation. The serious complications were found to be unrelated to age, but the fractures were either transcervical or cervicotrochanteric. Three patients with avascular necrosis were known to have had this complication during the earlier study; their initial treatment had been considerably delayed. The other patients with avascular necrosis had had no radiographic evidence of avascularity earlier.

The patients who were symptom-free or who had only very mild symptoms when the hips were under stress all had undisplaced or mildly displaced fractures, and only three had been treated by pinning. No correlation...
Radiograph 10 years after left femoral neck fracture shows no evidence of the fracture.

Evidence of previous cervico-trochanteric fracture in the right femur 16 years after injury.

Coxa magna with short neck 17 years after injury.

Coxa vara with long neck 15 years after injury.

Avascular necrosis has led to osteoarthritis 18 years after injury.

Epiphyseal deformity and short neck as a result of femoral neck fracture 15 years earlier.

A short neck resulting from neck fracture 20 years before.
could be found between this group with satisfactory results and their age, type of fracture, or the method of external splintage used. These observations emphasise the need for the utmost caution in the use of internal fixation in treating children with displaced fractures of the neck of the femur.

The incidence of significant radiographic abnormalities was alarmingly high (83%) and although avascular necrosis and arthritic changes are always associated with severe symptoms, some grossly abnormal radiographs were unrelated to clinical symptoms. However, it may well be that patients with such radiographic changes as a displaced epiphysis, coxa vara or coxa magna, though without symptoms at present, may develop them in the future. One may also wonder whether some of the growth changes could have been avoided.

A study of the literature suggests that the incidence of complications in fractured neck of the femur is high (Ingram and Bachynski 1953; McDougall 1961; Rigault et al. 1966). In the Bristol study (Ratliff 1978), one or more complications occurred in 87 of the 126 displaced fractures (69%), and in 33% of fractures without initial displacement.

The most serious complication in our series appeared to be avascular necrosis: 20% of the patients reviewed showed marked collapse and deformity of the femoral head. The long period of weight-bearing after the development of avascular necrosis had seriously compressed the femoral heads and it was impossible to type them according to the method recommended by Ratliff (1962).

McDougall (1961) stated that there was a marked tendency to coxa vara after fracture of the femoral neck. Strange (1965, p. 219) reported that sometimes the angle might even be reduced to below 90°, in which case growth could progressively increase the leg shortening. In Lam's series (1976), coxa vara was the commonest complication (22%). In this present follow-up study only 10% showed simple coxa vara only, but other cases of coxa vara all showed other significant pathology such as coxa magna or avascular necrosis; if these are included, then coxa vara was seen in 41%.

Since the clinical pictures and radiographs of the same patients changed so significantly in a period of 13 to 23 years, it is difficult to correlate morphological changes with symptoms. Another 20 years of follow-up may well be necessary to throw more light on this rare but interesting childhood injury.

REFERENCES


