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FRACTURE OF THE FEMORAL NECK IN CHILDREN

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Fracture of the femoral neck in children is exceedingly seldom. In our general surgical department, treating a large number of inpatients yearly (1971: 3988 inpatients in all, of whom 165 had fracture of the femoral neck) only 6 patients were encountered during the 17-year period 1955-72. (In the same period, only one child with a pertrochanteric femoral fracture was encountered.) They are reported below and a short review of the pertinent literature is given.

MATERIAL, TREATMENT AND RESULTS

Most patients had the more usual lateral location of the fracture in the femoral neck and only two cases of slipped epiphysis were seen (Table 1). The patients were operated upon as soon as possible, viz., in a few days, using a TV screen as an aid for perfect reduction and positioning of the implants. We have found the AO cancellous screws very satisfactory. A hole is drilled in the lateral cortex in an appropriate position and with TV monitoring screw holes are drilled, tapped, and the screws driven home to the epiphyseal plate (Figure 1, a-f). After a few days, the patient is up on crutches. No weight-bearing is allowed for 3 months. The patients are followed up clinically and roentgenologically and the implants later removed.

No postoperative complications were seen. In two patients open reduction was necessary. It was unsuccessful in one of them, who later had a cup arthroplasty performed (Case 2). The other developed avascular necrosis of the femoral head (Case 5) (Figure 2, a-i).

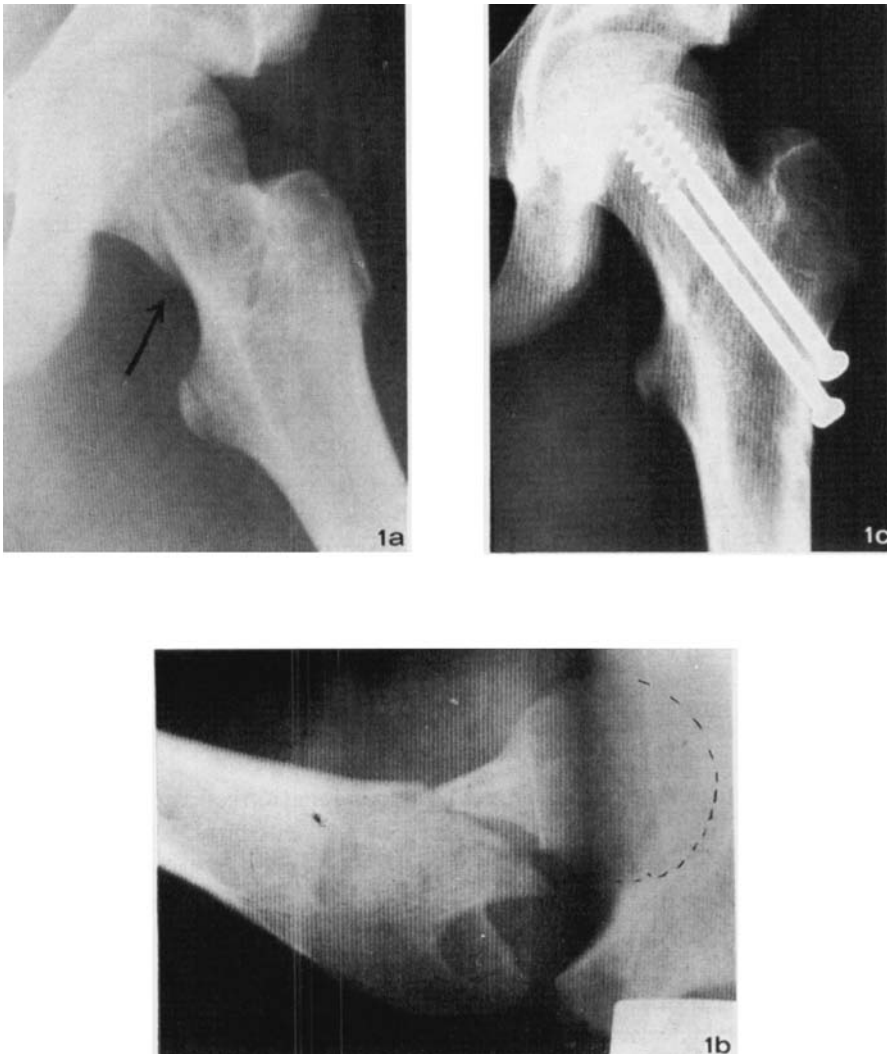
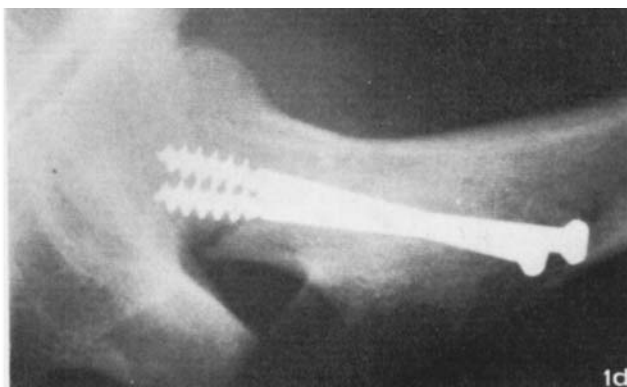


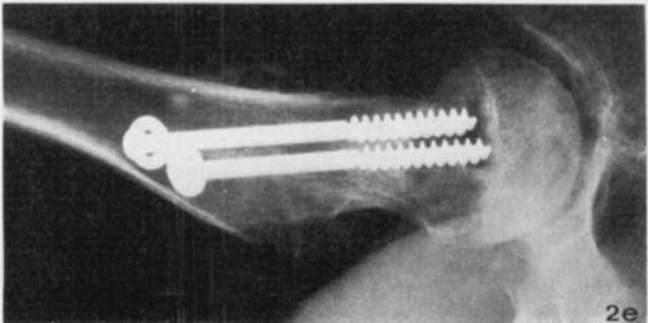
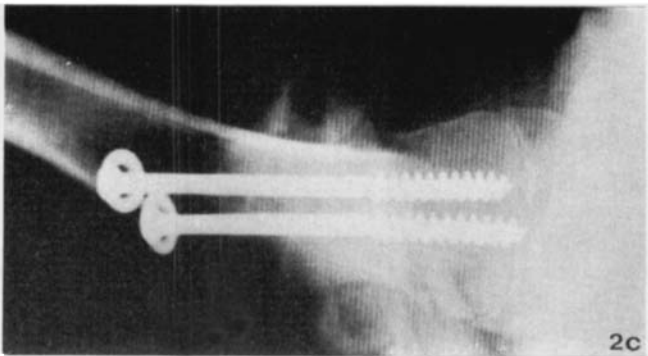
Figure 1. Case 4. Typical lateral femoral neck fracture. (a) Anterior view. (b) Lateral view. (c) Percutaneous rigid internal fixation with 2 AO cancellous screws, not crossing beyond the epiphyseal plate (anterior view). (d) Lateral view. The screws are not centrally located, and a small diastasis persists posteriorly. (e) Two years after the accident and removal of the implants. The fracture is healed in normal alignment. No sign of avascular necrosis. Anterior view. (f) Lateral view.



DISCUSSION

Previous reports (Weiner & O'Dell 1969) emphasize the severe trauma necessary to fracture the femoral neck in children, usually from traffic accidents. In the present series, three were injured in severe trauma. Our patients were older than those usually reported (Weiner & O'Dell 1969).

Due to the very uncommon occurrence of these injuries, no truly large series originating from one institution is available. Wilson (1940), Carrell & Carrell (1941), Allende & Lezama (1951) and Hamilton (1961) reported small series of 10, 12, 8, and 9 patients, respectively. Over a period of 23 years, 24 patients were seen at the Campbell



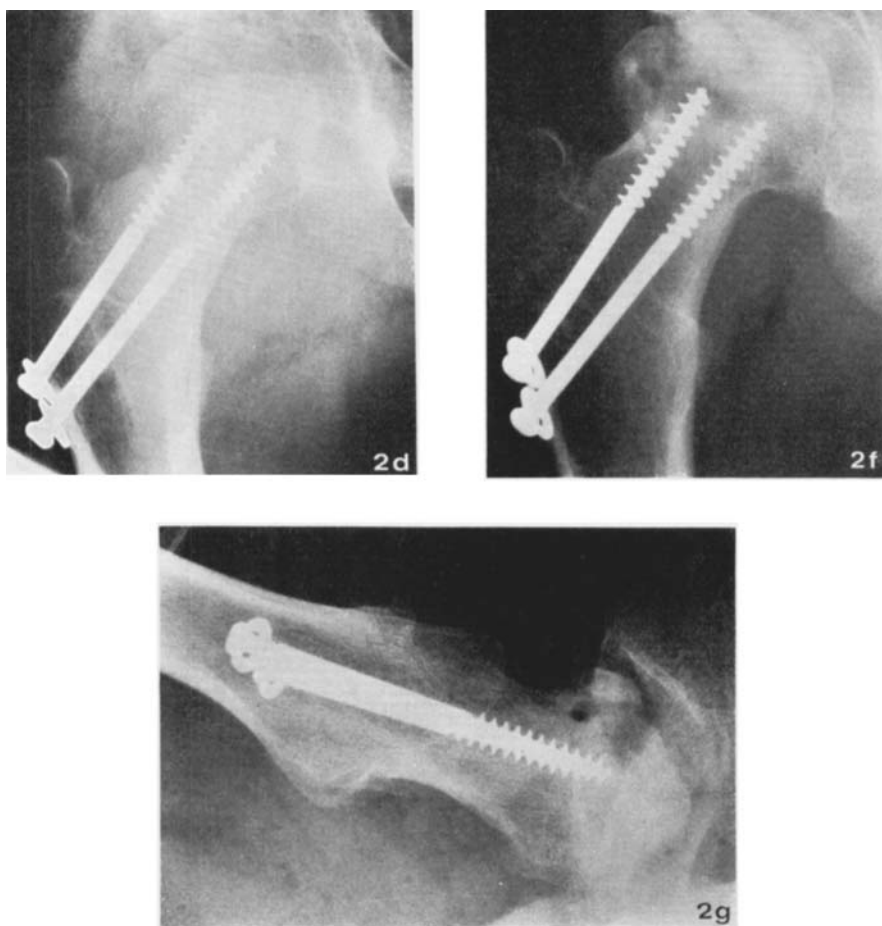


Figure 2. Case 5. (a) Anterior view. (b) Rigid internal fixation, after open reduction, with two AO cancellous screws. The threads of the lowermost screw is not completely beyond the fracture line. (c) Lateral view. (d) Anterior view four months later. Fracture healed. No sign of avascular necrosis. (e) Lateral view. (f) Fourteen months after the accident. Evidence of avascular necrosis. Anterior view. (g) Lateral view. (h) 21 months after the accident. Implants removed. Anterior view. (i) Lateral view.

Clinic (Ingram & Bachynski 1953), of whom 4 had bone weakened by pre-existing pathology. Weiner & O'Dell (1969) found 6 of 23 fractures to have occurred through such weakened bone. In the present small series no such case was seen.



The injury is associated with a very high incidence of complications as judged by three of the larger series reported. MacDougall (1961) found 14 cases of avascular necrosis of the femoral head in 24 patients, Ratcliff's (1962) 71 cases sustained avascular necrosis in nearly 30 per cent, and Weiner & O'Dell (1969) had 7 poor results in 23 patients. We experienced one case of avascular necrosis of the femoral head in our 6 patients, and in one patient the reduction was unsuccessful and cup arthroplasty was later performed.

All our patients except one were operated upon with internal fixation after closed reduction. This is the treatment of choice and should be performed as soon as possible. An early and adequate internal fix-

Table 1. Some data from 6 children with fracture of the femoral neck.

Case	years Age,	Sex	Year	Cause	Type of fracture	Treatment	Follow-up, time
1	14	♂	1966	Fall on the same level	Epiphysiolytic	Percutaneous nailing with 2 Nyström nails	Normal, 3 years
2	16	♂	1968	Traffic accident	Epiphysiolytic + luxation	Open reduction tried. Traction	5 months later Smith-Petersen's cup arthroplasty. 4 years later in full work in a printing house
3	13	♂	1969	Fall 4 m	Lateral	Percutaneous fixation with 2 AO cancellous screws	Normal, 2 years when implants removed
4	13	♀	1970	Fall while skiing	Lateral	Percutaneous fixation with 2 AO cancellous screws	Normal, 2 years when implants removed
5	13	♂	1970	Traffic accident	Lateral	Open reduction and fixation with 2 AO cancellous screws	Implants removed at 16 months, avascular necrosis. At 21 months, no pain, walking with a limp.
6	16	♂	1972	Fall 2 m	Lateral	Percutaneous fixation with 2 AO cancellous screws	Normal at 3 months; further observation necessary

tion will prevent non-union and the danger of growing disturbances (*coxa vara recurvata posttraumatica*). The Smith-Petersen nail is too large for use in the neck of femur in a young child and in older children the bone is too hard. Some (Blount 1955) find adjustable 3 mm nails entirely satisfactory. We have resorted to the AO cancellous screws, which secure compression and rigid fixation. The threads of the screw must grip only the cranial fragment. When two screws are used they should be inserted parallel to each other. The cancellous screws too, however, are too large for smaller children where the more slender AO malleolar screws seem more appropriate.

In an attempt to prevent avascular necrosis of the femoral head, Weber (1967) recommends lenient open reduction with opening of the capsula to evacuate hematoma and lessen the pressure.

The apparent reason for the high incidence of avascular necrosis noted in all series seems related to the vascular arrangement of the blood supply to the femoral head and neck. There is no significant anastomosis between the vessels supplying the epiphysis and those supplying the metaphysis in the child, as the epiphyseal plate acts as a barrier (Trueta 1968). The disruption of the lateral epiphyseal vessels will render the proximal fragment relatively avascular, except for the slight contribution from the ligamentum teres vessels. Since the lateral epiphyseal vessels are closely applied to the femoral neck, it does not seem necessary for the fracture to be displaced, but merely for the circulation in the vessels to be disturbed if the avascular changes are to be induced.

In conclusion, then, accurate reduction is mandatory in this fracture followed by firm internal fixation to secure healing in good position. The AO screws seem appropriate for this, but they are not capable of preventing the complication of avascular necrosis of the femoral head.

S U M M A R Y

Six children with femoral neck fracture are reported, five of whom were treated with internal fixation, using the AO cancellous screws in four. In one patient, the reduction was unsuccessful and cup arthroplasty was performed. One patient developed avascular necrosis of the femoral head. A short review of the literature is given and the high frequency of complication is stressed.

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