

Clinical and radiographic outcome of femoral head fractures

30 patients followed for 3–10 years

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ABSTRACT – The aim of this study was to evaluate the outcome of 30 femoral head fractures. We modified Pipkin's classification into 4 types: I (5 cases) small fracture of head distal to fovea centralis, which was too small or too fragmented to be fixed with screws; II (18 cases), larger fracture of head distal to fovea centralis; III (4 cases), large fracture of head proximal to fovea centralis, and IV (3 cases), comminuted fracture of head.

Excision of the head fragment was done in all 5 cases of type I and in 9 type II fractures. Fixation of the head fragment was performed in 9 type II and in all 4 type III cases. The femoral head was replaced in all 3 type IV fractures. After a mean follow-up of 3–10 years, the clinical outcome, according to Epstein et al.'s criteria, were excellent in 7, good in 15, fair in 4 and poor in 1, except in type IV, and the radiographic outcome was excellent in 15, good in 7, fair in 4 and poor in 1.

On the basis of our findings, we conclude that excision of the small fragment is a good choice of treatment in type I. Early accurate reduction with stable internal fixation in type II or III permits bony union. Arthroplasty seems to be indicated in type IV.

Femoral head fracture, associated with a traumatic fracture-dislocation of the hip joint, is rare, Kelly and Lipscomb (1958) reported 2 cases/million/year, corresponding to approximately 7% of all hip dislocations (Roeder and DeLee 1980).

Pipkin's (1957) classification is most commonly used to evaluate head fractures. Improved classifications have been introduced by Brumback et al. (1987) and Moehring (1993). We propose a new

simple classification femoral head fractures based on Pipkin's classification. We also reviewed our clinical and radiographic results with femoral head fracture in relation to our new classification and describe our experience of treatment.

Patients and methods

We treated 30 patients with a fractured femoral head between 1990 and 1997. 24 were men and the average age was 41 (14–70) years. The causes of injury were motor-vehicle accidents in 24 and a fall from a height in 6. Major associated injuries were found in 13 patients. Knee ligament injury was present in 3, head injury in 2, tibia fracture in 2, multiple rib fractures in 2, humerus fracture in 2 and sciatic nerve injury in 2 patients.

They were followed for a mean 5.5 (3–10) years. The outcome was evaluated with Epstein et al.'s method (1985), except in 3 patients in whom femoral head replacement was performed (Table).

We classified the femoral head fractures into 4 types, depending on the location, size and degree of fragmentation.

Type 1 (5 cases). A small fragment of the head distal to the fovea centralis (usually below one-fourth of the articular surface). The fragment(s) was/were too small to be fixed with screws.

Type 2 (18 cases). A larger fragment of the head distal to the fovea centralis (usually more than one-fourth of the articular surface).

Type 3 (4 cases). A large fragment of the head proximal to the fovea centralis.

Demographic data and results in 30 patients

Case	Age/Sex	Type of femoral head fracture	Acetabular fracture +/-	Treatment of femoral head	Follow-up (months)	Results	
						Clinical	Radiograph
1	14/F	2	-	Excision	122	Good	Excellent
2	22/M	4	-	Hemiarthroplasty	-	-	-
3	23/M	2	-	Herbert screw	108	Good	Excellent
4	34/F	2	-	Herbert screw	83	Excellent	Excellent
5	24/F	2	-	Herbert screw	81	Excellent	Excellent
6	34/M	2	-	Herbert screw	87	Good	Good
7	26/M	2	-	Excision	37	Good	Excellent
8	46/M	2	-	Herbert screw	76	Good	Excellent
9	27/M	3	-	Malleolar screw	59	Fair	Fair
10	50/M	1	+	Excision	64	Fair	Good
11	40/F	1	+	Excision	48	Good	Excellent
12	31/M	2	-	Herbert screw	56	Excellent	Excellent
13	70/M	4	-	Hemiarthroplasty	-	-	-
14	32/M	2	+	Excision	47	Good	Excellent
15	63/M	2	-	Herbert screw	37	Good	Good
16	34/F	2	-	Excision	68	Excellent	Excellent
17	57/M	2	-	Excision	54	Fair	Fair
18	37/M	1	-	Malleolar screw	86	Good	Excellent
19	58/M	3	-	Excision	59	Poor	Poor
20	47/M	2	-	Excision	52	Good	Excellent
21	37/M	1	-	Excision	88	Excellent	Excellent
22	29/M	2	+	Herbert screw	42	Excellent	Excellent
23	43/M	3	-	Malleolar screw	52	Good	Good
24	54/M	3	-	Excision	58	Good	Excellent
25	48/M	2	-	Excision	83	Fair	Fair
26	40/M	2	+	Excision	39	Good	Good
27	51/M	1	-	Malleolar screw	49	Excellent	Excellent
28	54/M	2	-	Hemiarthroplasty	83	Good	Good
29	56/F	4	-	Excision	-	-	-
30	59/M	2	-	Malleolar screw	45	Good	Good

Type 4 (3 cases). Comminuted fracture of the head.

The hip was dislocated in 24 patients and was treated with closed reduction in 15 and open reduction in 9 cases. Closed reduction was prevented by buttonholing of the head through the capsule and short external rotator muscles in 5 cases, interposition of the head fracture fragment in 2 and interposition of the acetabular fracture fragment in 2. 6 head fractures were combined with a posterior acetabular wall or column fracture which were treated with open reduction and fixation.

There was no loss of fixation or nonunion. The first 5 consecutive patients were operated on with malleolar screw fixation. In the following 8 patients, we used the Herbert screw.

The head fragment was excised in all 5 cases of type I and in 9 of 18 type II fractures. Fixation of the head fragment was done in 9 of 18 type II and

in all 4 cases of type III. The femoral head was replaced in the 3 type IV fractures.

Results

According to Epstein et al.'s criteria, the overall clinical outcomes were excellent in 7, good in 15, fair in 4 and poor in 1. The radiographic outcomes were excellent in 15, good in 7, fair in 4 and poor in 1. The patient with a poor clinical outcome had moderate limitation of joint motion with tolerable pain.

All fractures healed in the 13 patients in whom internal fixation was done. 3 patients had limited hip motion which was not severe enough to restrict daily activity. Avascular necrosis of the head fragment occurred in 2 patients after open reduction and internal fixation. 1 of them had mild discom-

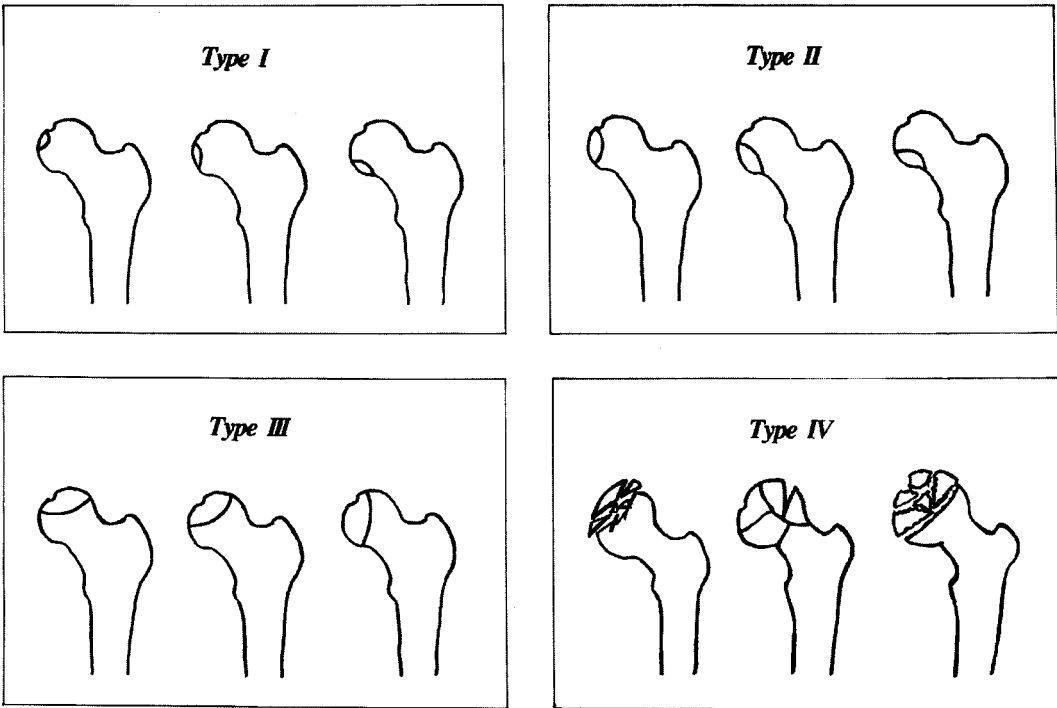


Figure 1. Authors' classification of femoral head fracture.

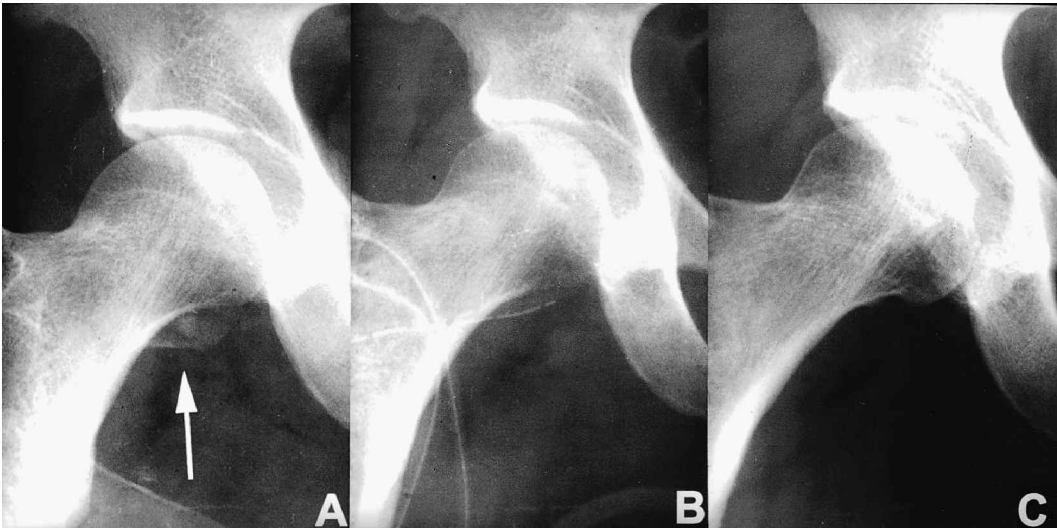


Figure 2 (case 18). A. Type 1 head fracture in a 37-year-old male patient
B. After excision.
C. At 7-year follow-up.

fort of the hip, and the other, a moderate degree of collapse. Hitherto, no patient has undergone a secondary operation, such as replacement surgery.



Figure 3 (case 4). A. Type 2 head fracture with anterior dislocation of hip in a 34-year-old female patient
B. After Herbert screw fixation.
C. At 7-year follow-up.

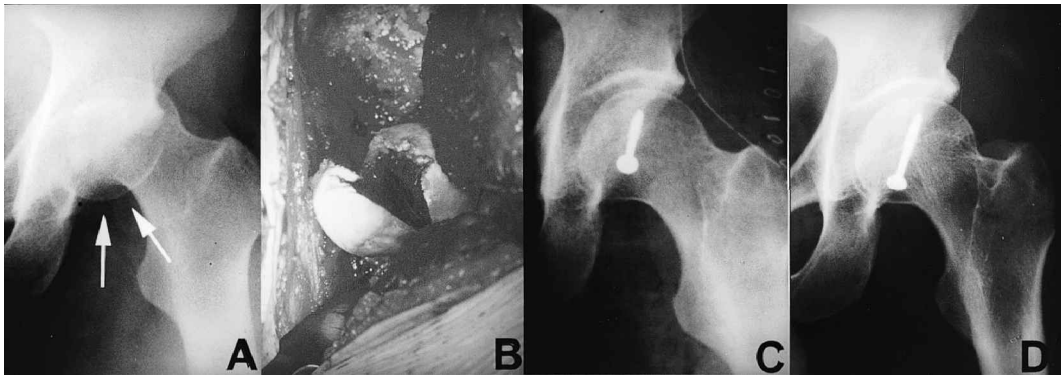


Figure 4 (case 24). A. Type 3 head fracture and dislocation in a 54-year-old male patient.
B. At operation.
C. After fixation.
D. At 5-year follow-up.

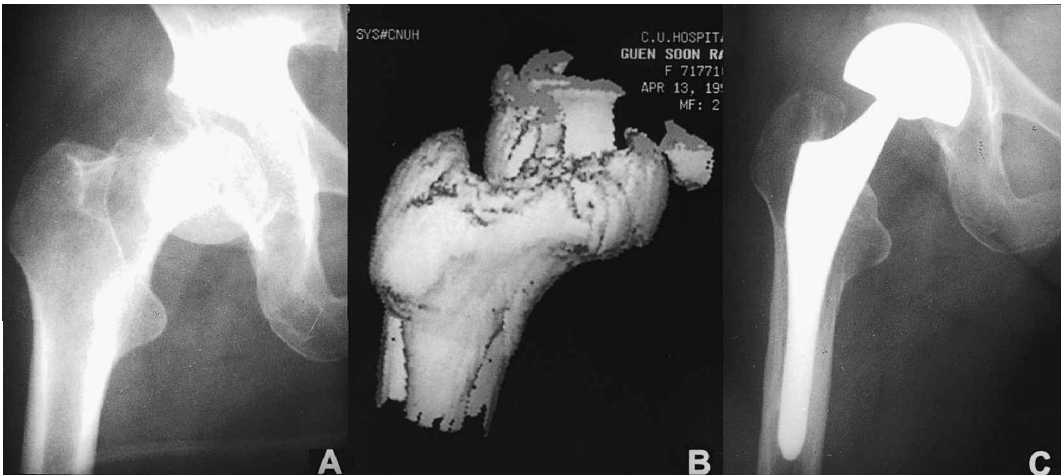


Figure 5 (case 29). A. Type 4 head fracture in a 56-year-old female patient.
B. 3-D CT.
C. At 4 years after bipolar hemiarthroplasty.

Discussion

Femoral head fracture together with traumatic fracture-dislocation of the hip joint was reported for the first time by Birkett in 1869, who found this fracture during dissection of a cadaver. Less than 265 cases had been reported in the English literature until 1985 (Brumback et al. 1987). However, with the increase in high-energy trauma, femoral head fracture seems to have become commoner. In Epstein et al.'s report (1985), femoral head fracture was found in about 10% of all fracture-dislocations of the hip.

Thompson and Epstein (1951) classified their posterior dislocations into 5 types, the fifth type involved a fracture of the femoral head. Stewart and Milford (1954) classified dislocations with associated fractures of the femoral head as type IV injuries. Pipkin (1957) subdivided femoral head fractures with dislocations into 4 types. Thereafter, Brumback (1987) proposed an improved classification modifying the earlier system. Moehring (1993) divided femoral head fractures into five subcategories. He included a small osteochondral fracture, chondral abrasion and also compression or indentation fracture, the last-named being difficult to evaluate on plain radiographs or CT. He thought that the Brumback classification, which does not include all possible combinations, is somewhat laborious and uses an outmoded nomenclature.

We modified Pipkin's classification to give guidelines for treatment. The cases with Pipkin type I could be divided into two groups: one group comprising a very small fragment or several fragments below the fovea centralis. In this group, the fragments must be removed. In the other types, the fragment is relatively large although located below the fovea centralis. We thought that the fragment should be anatomically reduced and fixed because it is an intraarticular fracture.

Several authors have recommended initial closed treatment for Pipkin type 1 fracture-dislocations of the hip (Epstein 1973, Brumback et al. 1987). If the hip joint is incongruous or unstable after closed reduction, surgical treatment is necessary and the head fragment may or may not be removed. Most authors recommend excision of the fragment for Pipkin type I since it lies below the fovea centralis (Sarmiento and Laird 1973, Roeder and DeLee

1980, Epstein et al. 1985). However, we believe that if the fracture fragment is very small (our type I), excision may be the best treatment. However, if the fracture fragment is large even though it is located below the fovea centralis (our type II), the fragment should be fixed because it is intraarticular. We performed internal fixation in half of our type II cases. No fixation loss, malunion or non-union developed in these 9 cases.

In Pipkin type II cases, although some authors recommend closed treatment if the fracture fragment is reduced by closed means (Brumback et al. 1987), we believe they should be reduced by open reduction and internally fixed to achieve better anatomical reduction and early rehabilitation.

A femoral head fracture is necessarily associated with hip dislocation and acetabular fractures. If open reduction of a dislocated hip or fixation of a posterior acetabular wall fracture is necessary, we recommend excision of the head fragment, even in type II because it is hard to fix the fragment posteriorly.

On the basis of our findings, we think that our classification provides sufficient information as to the treatment to be used. In cases with sufficiently large enough fragments, early accurate reduction and stable internal fixation of the fracture permit good bony union and early rehabilitation.

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.

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