Arthroscopic-Assisted Percutaneous Fixation of a Femoral Head Fracture (Pipkin II)

A Case Report

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Abstract

Case: Fractures of the femoral head are infrequent injuries with potentially devastating complications. Pipkin type II fractures often require surgical fixation. It involves intraarticular approaches that may increase the inherent morbidity of these fractures. Hip arthroscopy minimizes surgical aggression and allows for direct control of fracture reduction. We present a case report of an arthroscopic-assisted percutaneous fixation of a Pipkin-II femoral head fracture. A hip arthroscopy without traction and percutaneous screw fixation was conducted under arthroscopic and fluoroscopic guidance.

Conclusion: Arthroscopic-assisted percutaneous fixation is a useful technique for optimal femoral head fracture treatment and may also minimize surgical morbidity and optimize early recovery.

Femoral head fractures are uncommon fractures that are usually related to hip joint dislocation from a high-energy trauma. Moreover, they tend to affect young high-functioning demanding patients[1-5]. This type of lesion is associated with a high rate of severe complications such as posttraumatic osteoarthritis and avascular necrosis of the femoral head[6].

The first and most widely used classification of this type of fracture was described by Pipkin in 1957. The fractures are classified according to the relationship between the fracture line and the fovea and the presence of an associated femoral neck fracture or a posterior hip dislocation[7] (Fig 1). If a fracture of the femoral head is suspected, a computed tomography (CT) scan study is essential for proper classification and correct treatment[5].

The treatment of these fractures remains controversial in the literature. Thus, aspects such as the indication for surgical treatment, convenience of fixing or excising the fracture fragment, or even the surgical approach to be used have not yet been clearly established[8]. However, like in any intraarticular fracture, the principle that an anatomical reduction likely leads to better outcomes also applies to these fractures[9].

If surgical treatment is necessary, it may require aggressive approaches that increase the possibility of therapeutic morbidity[10]. Although it has become more common for the treatment of various hip disorders in the recent years[11], arthroscopy is not widespread in trauma applications and a few cases have been reported[4,12-15]. In this study, we present a case report of arthroscopic-assisted percutaneous fixation of a type II Pipkin femoral head fracture.

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

Case Report

A 45-year-old man presented with a posterior hip fracture dislocation due to a motorcycle accident (Figs. 2-A and 2-B). The CT scan showed a Pipkin type II fracture of the right femoral head with a free fragment affecting 40% of the femoral head (Figs. 2-C and 2-D). A plain x-ray showed the presence of an ipsilateral intramedullary femoral nail that had been put in place as the treatment of a diaphyseal fracture the patient had sustained 10 years before the present episode.

After an emergent closed reduction, fixation of the fracture was indicated and performed within 24 hours of the trauma. For this purpose, an outside-inside hip arthroscopy was performed. The patient was placed on a traction table although no traction was

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/B915).

Keywords pipkin fracture; hip arthroscopy; percutaneous fixation; intraarticular hip approach; femoral head fracture; parcelar head femoral fracture

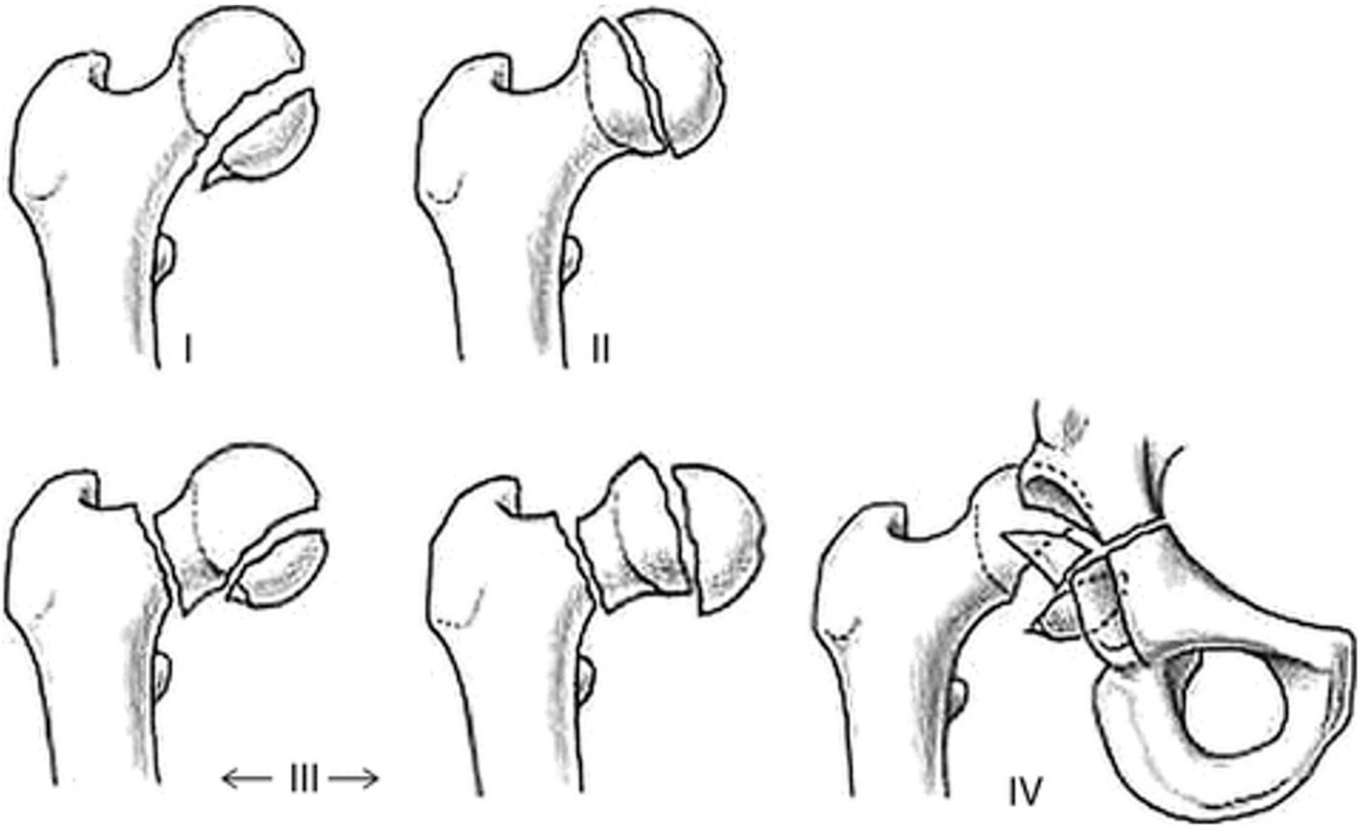

Fig. 1
Pipkin classification of femoral head fractures.

initially applied. An anterolateral portal (ALP) was used as a viewing portal, and midanterior (MAP) and posterolateral (PLP) portals were used as working portals. From the ALP and MAP, a fluoroscopic-assisted triangulation was performed in the extracapsular space of the anterior aspect of the hip joint. Muscle and soft tissue were removed from the hip capsule with a shaver, and the reflected head of the rectus femoris was identified. Then, a capsulotomy perpendicular to the rectus femoris head was performed using a radio frequency hook probe and traction sutures were placed on both sides of the capsulotomy for better visualization. In that way, the fracture site was exposed. From there, with direct vision of the fracture site along with fluoroscopic guidance, gentle reduction maneuvers were performed until the best reduction was obtained with complete extension and slight internal rotation of the hip.

Fixation was performed through the PLP under fluoroscopic control using 2 headless compression screws (Acutrak-Acumed, 4.7 × 40 mm and 4.7 × 45 mm). After careful evaluation of the fracture line in the CT scan, the PLP was chosen because it offered the best angle for screw insertion. Direct vision through the ALP made it possible to check for effective compression at the fracture site (Figs. 2-E and 2-F). Once performed, stability for hip flexion, extension, and rotation maneuvers was checked. Fluoroscopic images in the anteroposterior and lateral views were obtained to check accuracy of reduction on both planes (Figs. 2-G and 2-H).

Next, gentle traction was applied, and the central hip compartment was revised. Some blood clots caused by ligamentum teres disruption were found above the acetabular pulvinar. Small chondral fragments, which came from the fracture site, were debrided. No labral detachment was found. Finally, capsule closure was performed using nonabsorbable sutures.

The postoperative CT scan showed correct screw positioning and optimal fracture reduction. At 8 weeks, the patient began weight-bearing. At the 72-month follow-up visit, the patient remained asymptomatic, had an excellent functional score (96 on the non-Arthritic Hip Score), and showed radiographic consolidation of the fracture without signs of avascular necrosis in x-rays and CT scans (Figs. 2-I, 2-J, and 2-K).

Discussion

This is a case of a type II Pipkin fracture treated with arthroscopic-assisted percutaneous fixation under fluoroscopic guidance. The fixation approach used is uncommon for this type of fractures. No evidence of similar cases has been found in the literature.

Pipkin fractures have been associated with devastating consequences with varying incidence rates depending on the series: posttraumatic osteoarthritis (8%-94%), avascular necrosis of the femoral head (0%-23%), nerve injury (10%-23%), and heterotopic ossification formation (6%-64%)[9,10,16-19].

The treatment of femoral head fractures is controversial. Nonsurgical management of femoral head fractures is acceptable for Pipkin type I fractures (infrafoveal fractures) or for nondisplaced type II fractures. However, conservative treatment can

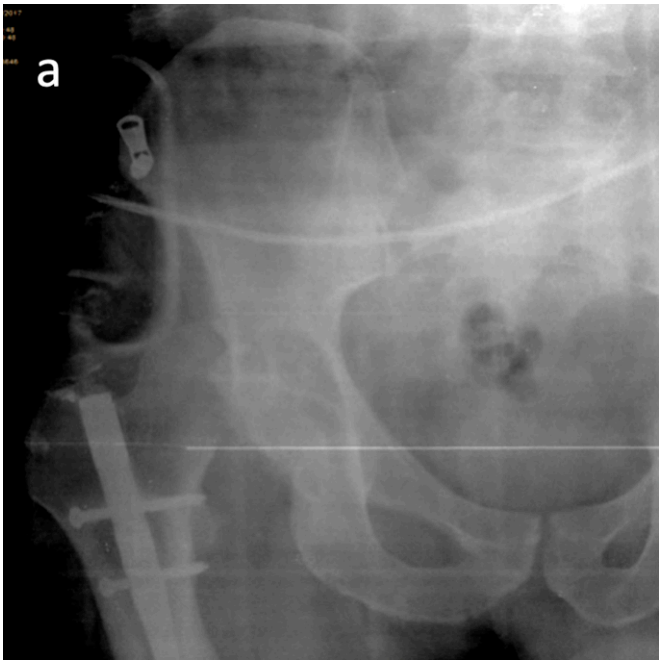

Fig. 2-A

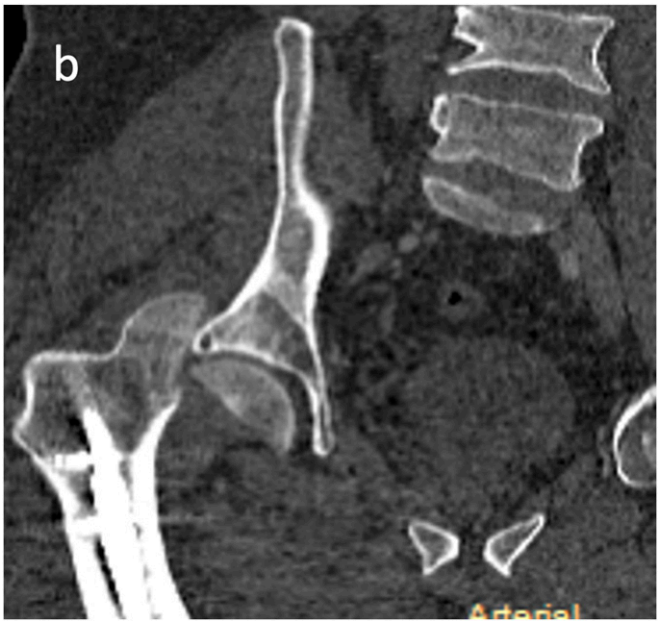

Fig. 2-B

Fig. 2-C

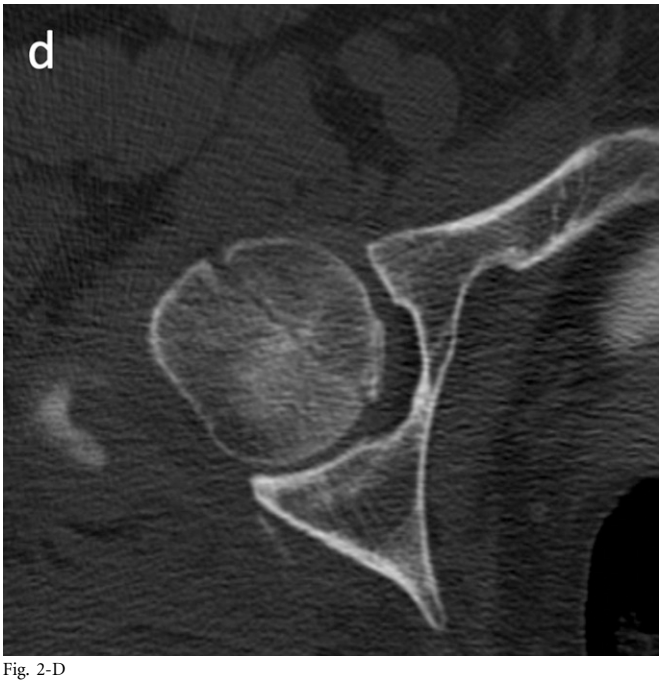

Fig. 2-D

lead to secondary displacement or suboptimal consolidation and requires a long non–weight-bearing and rehabilitation period[14].

Surgery is indicated in the case of nonanatomic reductions, in the presence of intraarticular free fragments or a suprafoveal fracture line. There is a lack of consensus on whether type I fracture fragments should be fixed internally or simply removed[5]. There is also no consensus on the optimal approach for this type of fracture because osteonecrosis or heterotopic ossification is a frequent complication after surgery and is associated with poor functional results[20]. Surgical dislocation by digastric trochanteric osteotomy has been postulated as the approach that allows for the best visualization of the fracture while respecting the vascularization of the femoral head[21].

A few cases of other femoral head fractures treated with arthroscopic assistance have been described in the literature. Park et al. and Kekatpure et al. satisfactorily treated Pipkin type 1 fractures[4,12]. Lansford and Munns treated 2 Pipkin type I fractures with hip arthroscopic excision of the fragments[8]. In

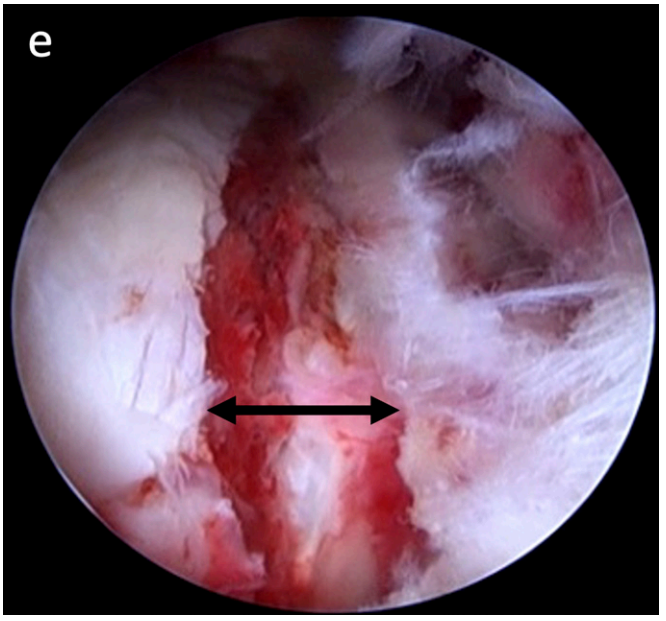

Fig. 2-E

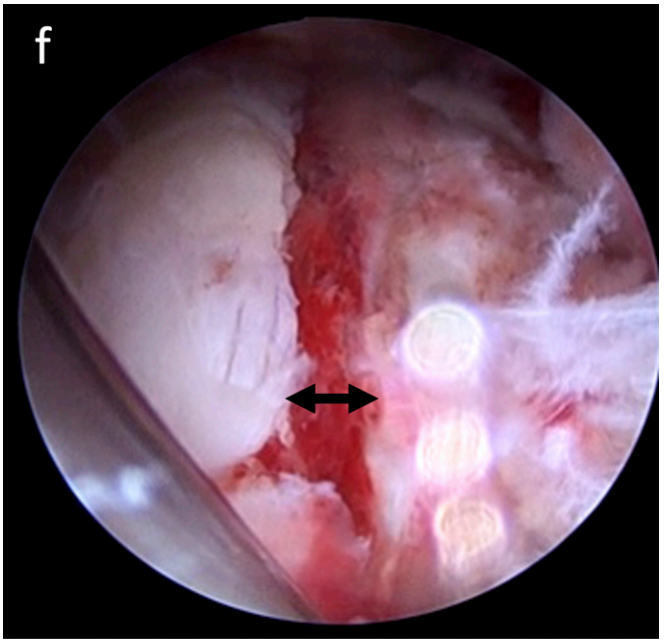

Fig. 2-F

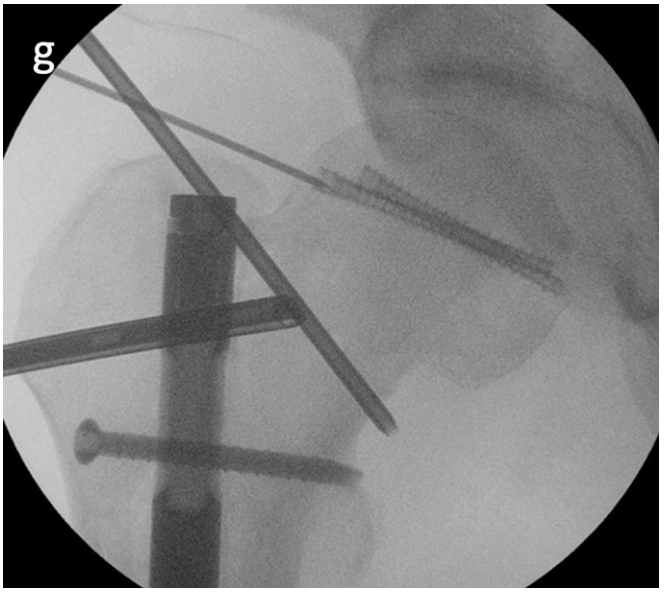

Fig. 2-G

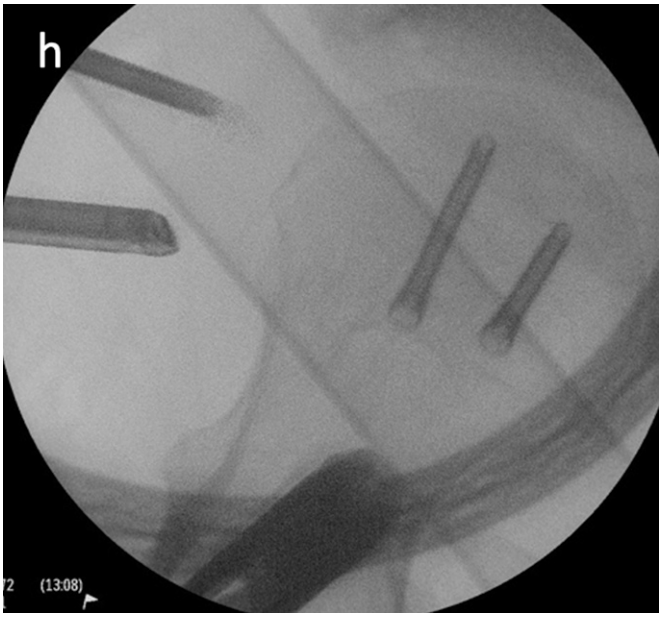

Fig. 2-H

addition, Matsuda reported a rare case of an osteochondral fracture in the suprafoveal area[13] (Table I).

In the present case, several factors favored surgical treatment. The factors were the presence of a suprafoveal fracture line affecting the loading area (Pipkin II), a large-sized fragment (40% of the femoral head) suitable for screw fixation, and a suboptimal reduction after the closed reduction of hip dislocation. The use of arthroscopy was considered because of the absence of concomitant lesions such as ipsilateral limb fractures or pelvis fracture that would have been a contraindication to such a procedure. In the authors' opinion, comminution at the fracture site, small fracture fragments (less than 15% of the femoral head), or fracture fragments that are not accessible percutaneously (e.g., those located at the superior pole of the head) should be considered as relative contraindications for an arthroscopic approach.

Arthroscopy without initial traction was chosen to avoid further fracture displacement and to minimize vascular damage to the femoral head caused by traction. Although abdominal trauma was not present in this case, the use of an outside-inside technique favors lower water pressure and minimizes intra-abdominal fluid extravasation (Table II).

Arthroscopic-assisted percutaneous fixation is an effective treatment that allows for direct control of the quality of the

Fig. 2-I

Fig. 2-J

Fig. 2-K

A 45-year-old man. Hip anteroposterior view (**Fig. 2-A**) and computed tomography (**Fig. 2-B**) shows a posterior fracture dislocation of the hip. Computed tomography after emergent reduction shows a Pipkin type II fracture affecting 40% of the femoral head (**Figs. 2-C and 2-D**). Arthroscopic view from the midanterior portal of the fracture line before (**Fig. 2-E**) and after (**Fig. 2-F**) fixation. Note effective fracture site compression (arrows). Intraoperative fluoroscopic images after fixation (**Figs. 2-G and 2-H**). Radiographic consolidation of the fracture without signs of avascular necrosis in the 72-month follow-up (**Figs. 2-I, 2-J, and 2-K**).

TABLE I Summary of Cases Reported in the Literature About ARIF in Femoral Head Fractures*

Author	Pipkin Type	Hardware	Portals Used for Fixation	Outcome
Park et al.[4]	Pipkin type I	1 cortical screw (3.5 × 30 mm length)	Distal accessory anterior portal	Full weight-bearing after 6 weeks. No scales measured
Kekatpure et al.[12]	Pipkin type I	1 headless compression screw (3.0 mm long)	Distal accessory anterior portal	Partial weight-bearing after 8 weeks. Full weight-bearing after 2 months. No scales measured
Matsuda[13]	Osteochondral fracture in the suprafoveal area	1 Herbert screw (3.0 mm) 1 mini-Herbert screw	Distal accessory anterior portal Fifth portal	Full weight-bearing after 6 weeks. No scales measured
Lansford and Munns[8]	Pipkin type I	Excision of the fragments	Accessory anterior portal	Immediate weight-bearing. No scales measured
Current case	Pipkin type II	2 headless compression screws (4.7 × 40 mm and 4.7 × 45 mm)	PLP	Full weight-bearing after 8 weeks. Non-Arthritic Hip Score: 96

*ARIF = Arthroscopically assisted reduction and internal fixation, PLP = posterolateral portal.

TABLE II Pearls and Pitfalls of a Pipkin Type II ARIF*

Pearls	Pitfalls
Consider fragment size and orientation "suitable" before indicating percutaneous OS	Limb traction may increase fracture displacement and vascular damage on the femoral head
Analyze CT to choose an adequate portal for screw insertion	Misreading of screw length may lead to poor fixation or intraarticular protrusion
Use of a traction table to get optimal fluoroscopic views	

*ARIF = Arthroscopically assisted reduction and internal fixation, CT = computerized tomography, OS = osteosynthesis.

reduction and minimizes surgical morbidity in selected cases of a fracture of the femoral head[4,12,13,15]. Although it has not been often reported, arthroscopic-assisted fixation of femoral head factures should be considered in selected cases. As has been the case with other joints, arthroscopic-assisted techniques will gain more relevance in traumatic pathology in the hip. ■

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