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Original article

Arthroscopic reduction and fixation of partial posterior wall acetabular fractures

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Abstract. *Background and aim:* Reduction and fixation of partial posterior wall fracture is usually performed with an open posterolateral approach. When the fragment may be fixed without a plate (with screws only), reduction and fixation may be also achieved via hip arthroscopy. To our knowledge no study described this technique. Aim of our study is to describe the surgical technique and to present the achieved outcomes and the occurred complications. *Methods:* Six cases of arthroscopic fixation of partial posterior wall fracture have been reviewed for the purpose of this study. Patients were treated arthroscopically if the fragment was not bigger than 25% of the posterior wall. Patient demographic, injury, and surgical variables as well as complications were recorded and retrospectively evaluated. Radiographic outcome was scored according to Matta's criteria on postoperative radiographs and clinical outcomes were evaluated with the modified Harris hip score. *Results:* Fracture reduction was classified as anatomic on post-operative x-rays in all patients. The mean clinical score was 98 points at one year follow-up. No patient developed symptomatic femoral head AVN, none had heterotopic ossification. In one patients a screw breakage occurred without clinical complications. *Conclusions*: Arthroscopic reduction and fixation of partial posterior wall fracture is an effective treatment and showed good outcomes if a careful patients' selection is done. (www.actabiomedica.it)

Key words: acetabular fracture, hip arthroscopy, posterior wall fracture, hip arthroscopic portal, hip dislocation.

Introduction

Isolated posterior wall fractures involve the rim of the acetabulum while the posterior column remains intact, they usually present multiple fragments or marginal impaction or incarcerated fragments (1). In fractures without those features, choice of treatment may be challenging. Conservative treatment offered to simple minimally displaced fractures has its burden. Prolonged bed rest with continuous traction rest can lead to bedsores, thromboembolism, pin track infections, orthostatic pneumonia and urinary infections (1,2). Furthermore, conservative treatment does not present good outcomes if the fragment is displaced.(2,3)

Traditional open approaches allow anatomical reduction and rigid fixation but are accompanied with considerable complications as they require extensive exposure, which may be complicated by infection, blood loss, wound complications, sciatic nerve injury, abductor weakness and heterotopic ossification (4). In selected case with less than 25% of the posterior wall involved and a single fragment without impaction, there is a need for a third minimally invasive option, minimizing the surgical trauma and at the same time, avoiding the risks of wide surgical exposure. Hip arthroscopy is a good candidate to fill this gap (5,6).

Arthroscopy has been successful in assisting fixation of a variety of intra-articular fractures including tibial plateau and ankle fractures with the advantages of direct visualization of joint space, decreased invasiveness and simultaneous ability to deal with cartilage and soft tissue injuries (7,8). Hip arthroscopy has un-

dergone considerable advancement overtime. It is now considered the gold standard for diagnosis and treatment of multiple intra-articular pathologies such as femoro-acetabular impingement, septic arthritis and pigmented villo-nodular synovitis (9,10).

Now there is an expanding evidence for its safety and efficacy in management of certain traumatic condition of the hip including: pipkin fracture, intra-articular loose bodies, osteochondral lesions and labral tears (11,12). The gained benefits of arthroscopy include: direct and superior visualization of the joint and the ability to perform joint lavage and precise debridement in addition to little invasiveness and avoidance of surgical dissection (13). However, there are a few reports in literature about labral fixation for posterior wall fractures denoting its valuable role in improving general outcome with cautious patient selection (6,14)

In this study we present a case series of posterior wall fractures (with a displaced single fragment, whose dimensions were less than 25% of the posterior wall surface) that underwent reduction and fixation using hip arthroscopy. Aim of our study is to describe the surgical technique and to present the achieved outcomes and the occurred complications.

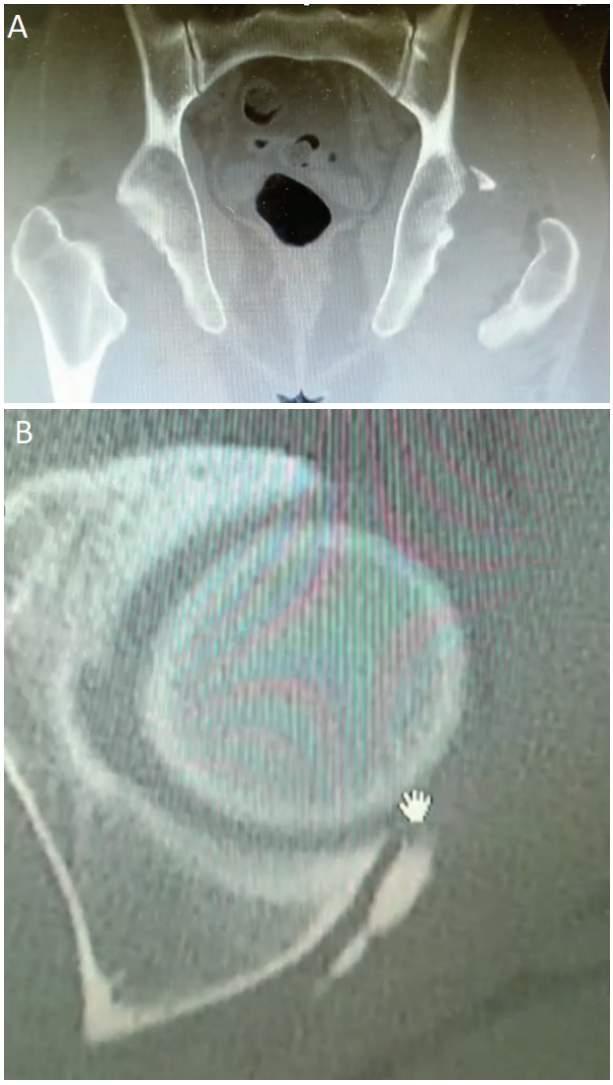

Figure 1. A (coronal) and B (axial) preoperative CT-SCAN showing dimensions and displacement of the fragment.

Materials and Methods

Between 2017 and 2020, we used hip arthroscopy selectively to manage posterior wall fracture with those features: displaced single fragment, whose dimensions were less than 25% of the posterior wall surface (Fig.1A,B). Patients who underwent an arthroscopy were asked to give their informed consent to the use of an unconventional approach and all participants provided written informed consent to participate in this study.

This study was conducted under the principles of the Declaration of Helsinki and was approved by the local ethical committee.

All patients treated with this technique were included and underwent a preoperative CT scan, this exam was performed after femoral head reduction if dislocation was present at arrival (15). Exclusion cri-

Figure 2. Patient position.

teria was a follow-up of less than 1 year. Patient demographics, injury, follow-up and surgical variables as well as complications were recorded and retrospectively evaluated. Fracture reductions were evaluated according to Matta's criteria (16) by measuring the residual postoperative displacements on the two plain radiographs (AP and lateral views). For each of these radiographs, the maximum displacement seen at any of the normal radiographic lines of the acetabulum or the femoral head was recorded in millimeters, and the highest of the three values was used to grade the reduction according to one of three categories: anatomical (0–1 mm of displacement), imperfect (2–3 mm), or poor (more than 3 mm). Radiographs taken at the last follow-up were also classified according to the Tönnis classification (17). Clinical outcome was evaluated with the modified Harris hip score (18) by an orthopedic surgeon independent from the pelvic team and blinded to surgical findings (MB). The presence of heterotopic ossification was recorded and graded according to the Brooker classification (19).

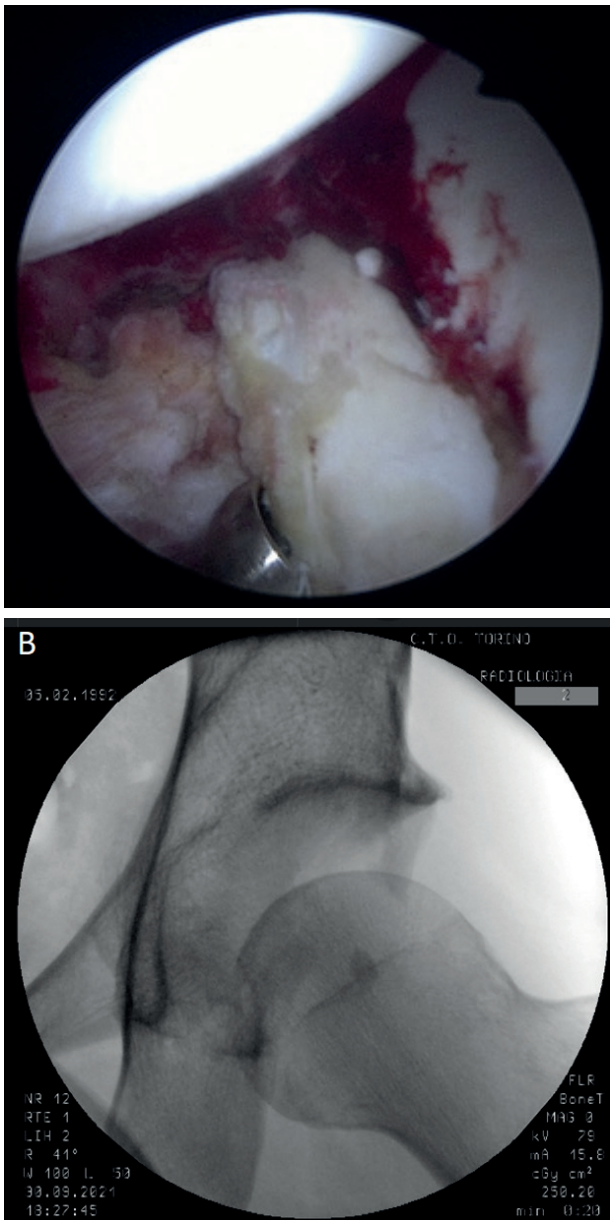

Figure 3. (A) Intraoperative fragment identification; (B) Fluoroscopic view of the fragment.

Surgical techniques

Hip arthroscopy was performed on a traction table with the patient in lateral position (Fig. 2).

Standard arthroscopic technique was used to assess the central compartment using the anterolateral portal and a posterolateral portal, an accessory portal (more distal to the posterolateral one) was used for fracture fixation (20). The anterolateral portal has been used to visualize the procedure while, through the posterolateral portal, a horizontal capsulotomy was performed with a posterior enlargement of the capsulotomy, then the fragment has been isolated with radiofrequency and a shaver without detaching it from

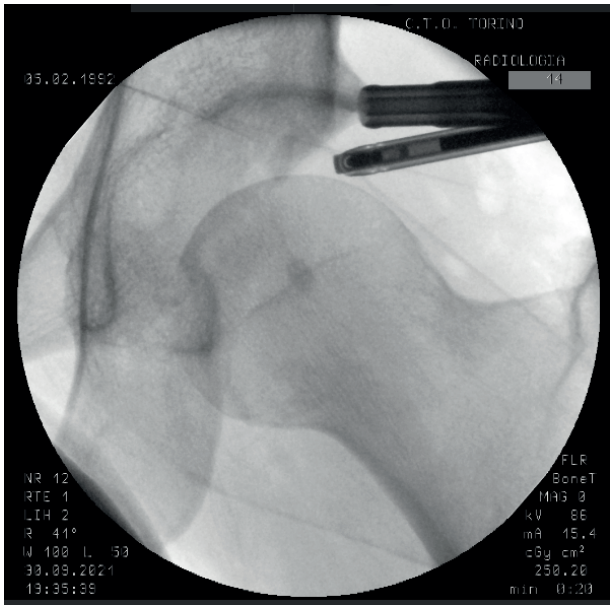

Figure 4. Fragment reduction intraoperative view.

the labrum (Fig. 3A,B). Fracture was reduced with a ball-spike or a microfracture-pick pushing it against the healthy part of the acetabulum from the external border (Fig.4).

If an appropriate reduction was not achieved, two Herbert screw guide pins were placed in the free fragment and used as joysticks to reduce the fracture. Eventually, the fragment was fixed with two cannulated Herbert screws with specific attention to avoid intra-articular penetration (Fig. 5 and 6). The only post-operative restriction was to avoid weight-bearing on the affected side for 40 days.

Results

This study reviewed eight cases of arthroscopic fixation; no patient was lost before the minimum follow-up (12 months). Mean age was 24 years old and mean follow-ups was 16 months. Four patients were males. The mean surgical time was 92 minutes (SD, 20). Fracture reduction on x-rays on x-rays as anatomic in all hips. The mean clinical score was 98 points (SD, 5). No patient developed femoral head AVN and none underwent total hip arthroplasty; no signs of arthritis (Grade I according to Tönnis classification) were found and no heterotopic ossification was recorded.

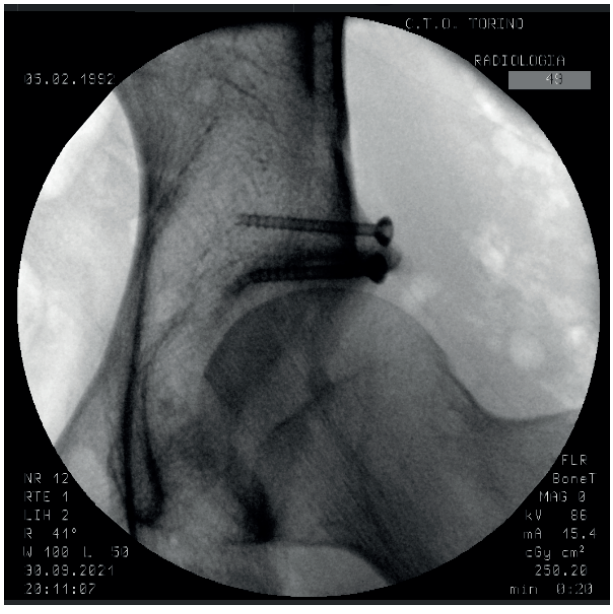

Figure 5. Fixation with screws intraoperative view.

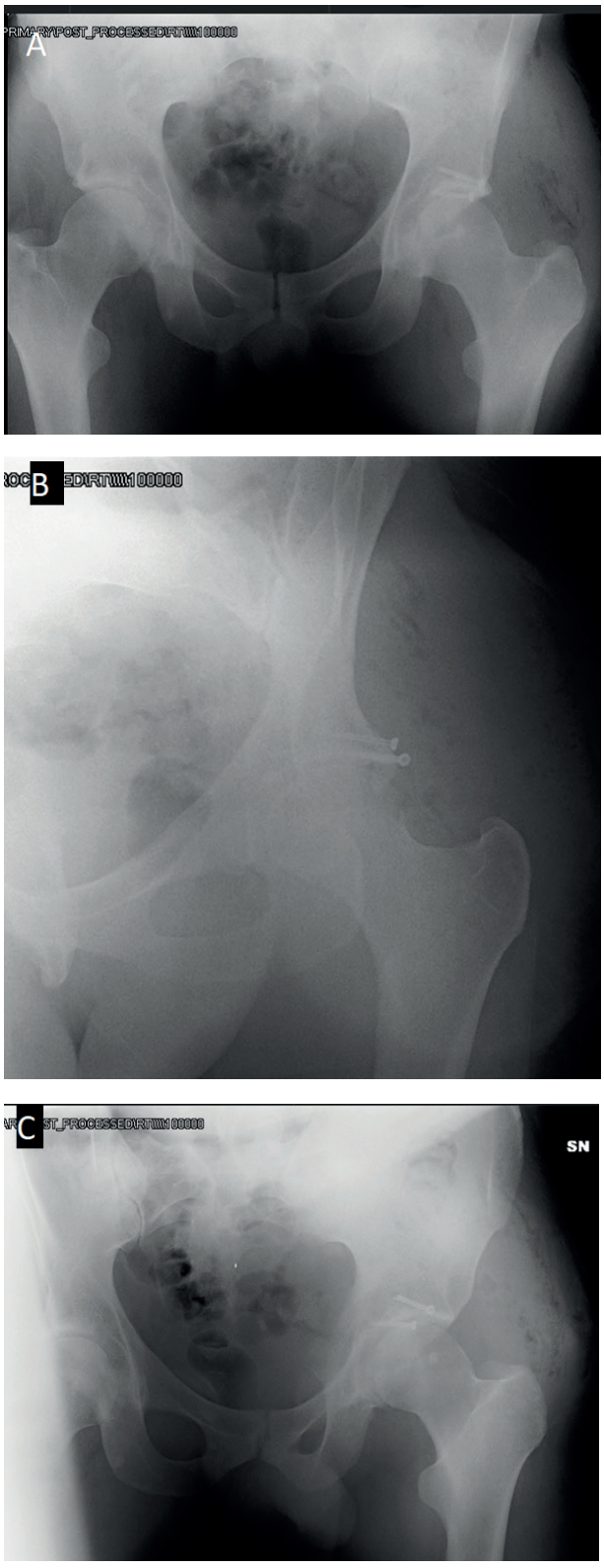

Figure 6. Post-operative views (A anteroposterior view, B obturator view, C iliac view)

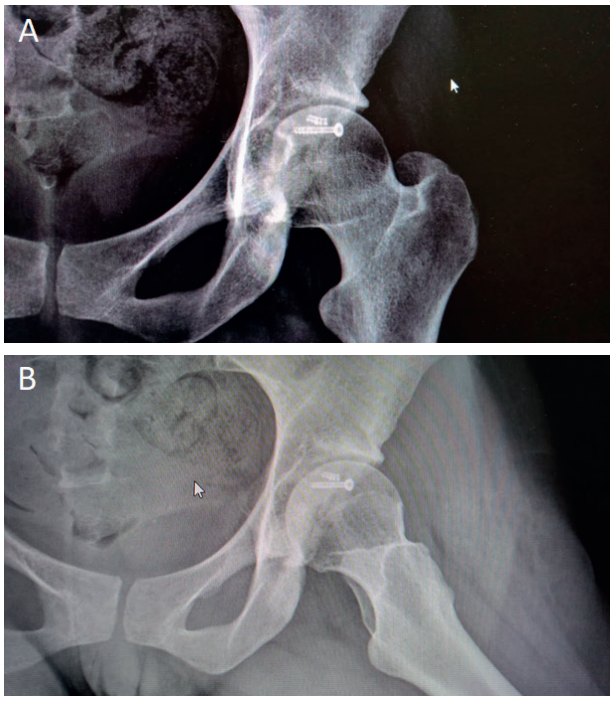

Figure 7. Post-operative view of the fracture where screw breakage occurred (A: anterolateral view, B: lateral view).

We reported one screw breakage during the procedure (Fig. 7), since the fragment was fixed already with one screw and no room for another screw was present, fixation was done with a single screw.

Discussion

The use of hip arthroscopy in hip trauma is providing a reliable less invasive option and is gaining more popularity over the years with an expanding variety of indications (2,11). Our results suggest that hip arthroscopy may be a good choice to treat selected posterior wall fractures. All patients had presented excellent clinical and radiological results improvement after at least one year from index surgery with no reported major complications affecting functional outcome. To our knowledge fixation with screw has never been reported.

In literature few papers described arthroscopic treatment of posterior wall fractures without a screw. Shi et al (6), presented a case of a 14-year-old boy with acetabular posterior wall fracture who was treated with hip arthroscopy in which fixation done using anchors. Two anchors were placed at the upper and lower ends of fracture bed and threads tied around the fragment, a third anchor was inserted into the fragment and the threads from all three anchors tied together. Patient showed full union at three months on follow up radiographs with no report of long term outcome (6). Stabile et al reported a case of a 46-year-old woman involved in a motor vehicle collision who sustained a posterior acetabular fracture-dislocation. Post reduction CT showed a non-concentric reduction and incarcerated loose bodies. With hip arthroscopy, loose bodies were removed and joint evaluation revealed an osseous bucket-handle labral tear. The labral-osseous fragment was reduced using a switch stick and fixed using a combination of anchors and loop sutures. The authors did not give any report about patient outcome (21). Zhong et al, reported a series of nine patients diagnosed with a posterior labrum tear with an attached bony fragment after traumatic posterior hip dislocation were treated by hip arthroscopic techniques utilizing suture anchor fixation of the fragment with no screw fixation. Additional maneuvers included loose body removal or micro fracture in exposed subchondral bone in some patients. Union occurred in all cases uneventfully with a mean modified Harris Hip Score of 81.8 (SD, 2) at 1 year postoperatively (14).

This study had a number of limitations. First, this study comprised a single center and was single expert team-based. Thus, there is concern about the reproducibility of this technique; the surgeon who performed all surgeries has been trained to perform the techniques and has experience either in acetabular and femoral head fracture treatment either in hip arthroscopy. Other limitations are the small number of enrolled patients. Eventually we used the modified Harris hip score, which has been criticized in the literature for its ceiling effect (18). Other scoring instruments such as the WOMAC or Hip disability and Osteoarthritis Outcome Score may be more applicable in these patients. However, we chose the Harris hip score here because it is used extensively worldwide, easy and familiar. We used the Matta classification (16) to evaluate acetabular fracture and shows a good correlation with posttraumatic arthritis development. Finally, arthroscopic technique itself also has some limitations, and these deserve comment. Importantly, there is not on the market a specific set of headless screw with the

desired dimensions (the actual presents guiding wire too little and flexible). Meticulous selection of patients with fractures amenable to arthroscopic fixation is the main key point. For acetabular fractures with large posterior wall fragment and gross hip instability, it is advisable to undergo formal open reduction and internal fixation. But, for partial posterior wall fractures with no gross displacements in which there is no biomechanics need to be fixed with a plate, open reduction carries a lot of unnecessary risk of complication (22,23).

On the other hand, arthroscopy can guide anatomical reduction and stable screw fixation with minimal invasiveness, not to the mention the added advantages of arthroscopy in evaluation of articular congruity and diagnosis and management of labral tears and intra articular loose bodies, which are common findings in hips with posterior wall fractures especially in case of hip dislocation (24,25).

Conclusions

We recommend arthroscopic fixation of selected posterior wall fracture. A displaced single fragment, whose dimensions are less than 25% of the posterior wall surface may be arthroscopically fixed with two screws by surgeons treating either a high volume of acetabular fractures either a high volume of hip arthroscopy. On the other hand, future studies are required to compare this approach with the gold standard in terms of outcome scores and complications with a higher level of evidence.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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