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Supplement

Ligamentum teres reconstruction with labrum and capsule repair after posterior acetabular wall fracture: a case report

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ABSTRACT

The aim of this case study is to present arthroscopic treatment of recurrent hip instability after acute post-traumatic posterior hip dislocation with a fracture of the posterior acetabular wall. A male patient aged 35 suffered a dislocation of the right hip joint with a fracture of the posterior acetabular wall due to an accident. The fracture was stabilized during emergency surgery with a locking compression plate, and the patient was released home in a hip brace. Multiple dislocations of the hip joint followed with the implant being confirmed as stable. Decision was made to qualify the patient for a right hip arthroscopy. During the surgery, ligamentum teres was reconstructed using gracilis and semitendinous muscle grafts, followed by the labrum and joint capsule repair, where the surgery that stabilized the acetabular wall fracture had damaged them. There were no complications following the procedure. Short-term follow-up of 3 months demonstrates the patient has a stable hip, reduced pain and has returned to pre-injury activities.

INTRODUCTION

A 35-year-old man underwent a traumatic dislocation of his right hip with a posterior fracture of the acetabular wall due to a severe traumatic fall. After the injury, he immediately underwent emergency trauma surgery with an open reduction and internal fixation using a locked compression plate (LCP). Post-operatively the right hip was immobilized in a hip brace. Ten days after the hip fracture surgery, he suffered another right hip dislocation while removing the brace. He was taken to local emergency room, where he had successful reduction under short sedation and was discharged from the hospital with a hip brace. Seven days later, he suffered another posterior hip dislocation and was admitted to the hospital again.

During the physical examination, the patient had severe pain in the right hip and there was no possibility to perform physical examination due to extreme pain. During the hospital stay, X-ray and computed tomography images showed no displacement of the posterior wall fracture; the locking plate remained stable. Patient was scheduled for a right hip arthroscopy to repair the intra-articular lesions.

SURGICAL TECHNIQUE

Hip Arthroscopy is performed on a traction table with the patient in the modified supine position. The joint was easily distracted. The arthroscope was introduced trough the anterolateral portal (AL), a thorough intra-articular diagnosis was made; the ligamentum teres (LT) was completely torn, the labrum presented a complex tear from the 8–12 o'clock position and there was a posterior capsule tear in the same position in the vicinity of the LCP plate stabilizing the posterior wall of the acetabulum. The acetabular

labrum and the posterior capsule were repaired from the posterior portal (PL), which was also used to clean the acetabular fossa and to debride the LT remnants (Fig. 1). The second stage of the surgery involved the ligamentum teres reconstruction (LTR). Autograft of the semitendinosus and gracilis muscle tendons was harvested in a standard fashion and prepared like an anterior cruciate ligament graft with a cortical button suspensory device. A Femoral head specific aiming guide was introduced trough the PL portal (Mazek-Salas LTR/AVN aiming guide, Parcus Medical, Sarasota, FL, USA) using fluoroscopic guidance to position the centre of the femoral head at the fovea in the LT footprint, in order to passage the guide pin posteriorly to create the femoral tunnel (Fig. 2 and Fig. 3). The hip was positioned in 20° of abduction and 15–20° of internal rotation to visualize the entire femoral neck, posteriorly retrograde femoral head reamers area (from 8 to 10 mm), this to create the femoral tunnel canal for graft passage. Through the femoral tunnel, the specific acetabular reamer (Mazek–Salas LTR/AVN aiming guide, Parcus Medical, Sarasota, FL, USA) was passed by gentle rotational hand manoeuvres to create the 10-mm acetabular tunnel under fluoroscopic guidance (at the acetabular foot print of the LT) [15]. Hip arthroscopy was performed with fluid management pressure at 25–30 mmHg to prevent extravasation to the pelvis through the acetabular tunnel. A cortical fixation suspensory device with a specific long loop was pushed through the femoral tunnel with a hip grasper towards the acetabular tunnel under X-ray control (Fig. 2). The prepared graft was placed through the loop in the same fashion as during Anterior Cruciate Ligament (ACL) reconstructionprocedures and pulled in through the femoral tunnel and locked into the button. Dynamic rotation manoeuvres of the hip were performed to examine the behaviour of the LT, traction was then released and the graft is fixed in 10° of extension, 60° of external rotation with a PEEK 9/30 mm interference screw. The posterior capsule was closed with 2 sutures (Parcus braid, Parcus Medical, Sarasota, FL, USA), The labrum was repaired with three 2.8 knottless anchors and the femoral head asphericity (cam impingement) was resected in a standard fashion (Fig. 3) the hip was immobilized in a brace locked from 0° to 60° of flexion. The operation lasted about 2.5 h. Traction time was about 90 min.

REHABILITATION PROTOCOL

The patient began our rehabilitation protocol without weight bearing and hip rotational restrictions of more than 10°, with the use of a continuous passive motion machine

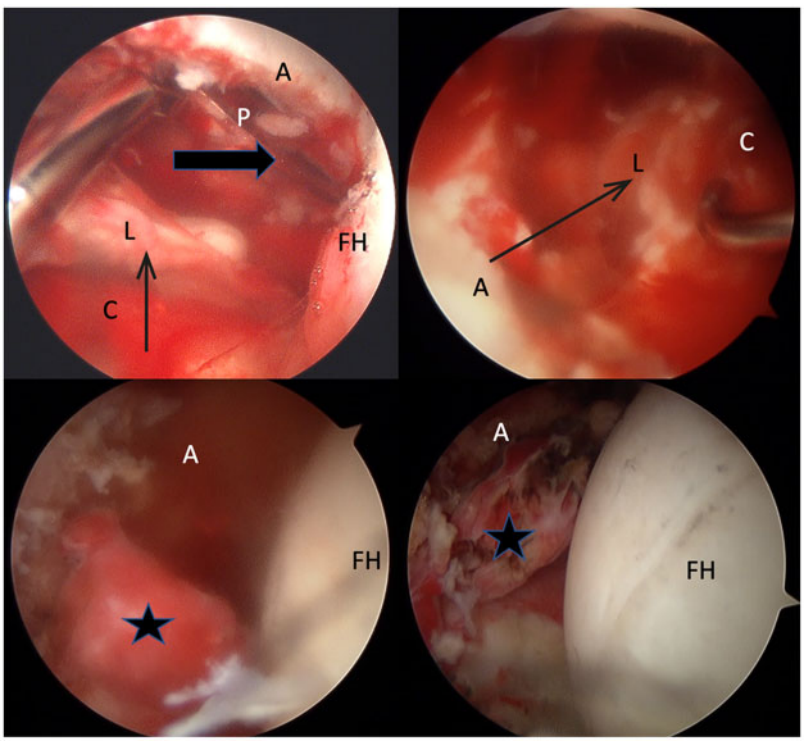

Fig. 1. LT lesion (asterisk), detachment of the labrum and capsule in the posterior part of the joint (thin arrow), Synthes plate stabilizing the fracture of the posterior wall of the acetabulum (thick arrow). A, acetabulum; L, labrum; FH, femoral head; C, capsule; P, Synthes plate.

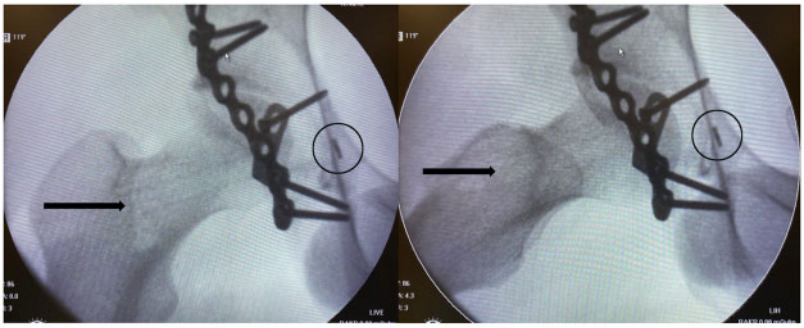

Fig. 2. Intraoperative control using the C-arm: in the circle the endobutton stabilizing the graft on the medial wall of the acetabulum, the arrow marks the channel through which the graft is inserted into the femoral neck.

Fig. 3. Reconstruction of intra-articular injuries: 1—suturing of the labrum and capsule, 2—LT reconstruction with the use of a sight and 3—reconstructed LT. A, acetabulum; L, labrum; FH, femoral head; C, capsule; G, graft. Yellow arrows indicate implants which stabilize labrum and capsule.

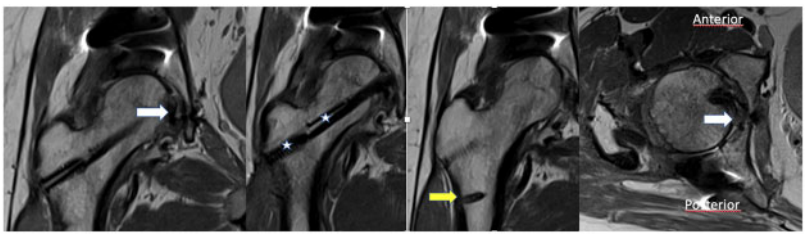

Fig. 4. MRI image of 1.5 T (pd_tse_cor) 3 months following the reconstruction the white arrow marks the graft. White arrow, LT graft; asterisks, two PEEK screws; yellow stars, knotless stabilizing sutures in the femoral cortex.

for 3 weeks with the range of 0–60° in hip flexion. After 3 weeks, we allowed toe-touch weight bearing and gradual increase in hip flexion. Patient received 200 MG of celecoxib daily for 2 months to prevent formation of heterotopic ossification (HO).

After 6 weeks, the hip brace was removed, and full weight bearing with full range of motion was allowed with the aid of crutches. The post-operative course was uneventful. The joint stability and full range of movement were restored, with high patient satisfaction and return to pre-injury activities at 3 months. Ten weeks after the surgery, magnetic resonance imaging (MRI) of the hip joint was performed to assess the graft, which showed that it has remained *in situ* (Fig. 4).

DISCUSSION

The aim of this case was to present a method of arthroscopic treatment of recurrent hip instability after acute post-traumatic posterior hip dislocation with concomitant fracture of the posterior acetabular wall.

In addition to the often-diagnosed fracture of the acetabulum, post-traumatic posterior hip dislocation is frequently accompanied by numerous intra-articular injuries: rupture of the articular capsule, damage to the labrum, rupture of LT, fractures in the femoral head area [1, 2]. Each of these intra-articular structures plays significant role in stabilizing the hip joint. In the discussed case, after the first stage of stabilization of the posterior wall fracture using LCP, the posterior hip joint dislocation occurred twice

during patient's sleep and while taking the hip brace off. Because the MRI did not show the exact intra-articular damage due to the artefacts of the LCP and screws, the decision was made to perform a diagnostic and therapeutic hip arthroscopy. The arthroscopy showed extensive rupture of the posterior capsule with detachment of the hip labrum and complete rupture of the LT. The hip capsule, labrum and the LT are well known to be important stabilizers of the hip joint and its damage leads to cause instability [3, 4].

The studies done on the LT function highlight its importance in maintaining stability during flexion and external rotation and during extension and internal rotation [3, 5–7]. In our example, the stability, despite correct fixation of the fracture of the posterior acetabular wall, has been completely compromised by the rupture of three internal stabilizers of the hip: the joint capsule, the acetabular labrum and the femoral head ligament [14].

In the case of our patient, the instability was so severe that there was a full recurring posterior dislocation, but even long-standing micro-instability can lead to the further development of joint arthritis. The impaired stabilizing function of the articular capsule interferes with the function of the joint and leads to instability, which manifests itself in pain, the feeling of skipping and clicking and this in turn leads to the development of degenerative changes. Fagotti *et al.* [8] presented the results of joint capsule reconstruction in 36 patients who had dramatically damaged joint capsules after previous arthroscopies and felt pain and instability in their operated hip joint.

Shu and Safran [3] described the issue of post-traumatic and non-traumatic instability. The stability of the joint is maintained by its structure: concave acetabulum and convex femoral head recessed into it and also by the joint capsule, the labrum and ligament of the femoral head [3, 5, 7]. The stabilizing function of the head ligament is under discussion; however, studies depicting instability in connection with ligament impairment confirm its role as a stabilizer [5, 9, 10]. The ligament counteracts the posterior dislocation during internal rotation and the anterior dislocation during external rotation.

The literature described cases confirming hip joint instability with dislocation including a completely ruptured LT with accompanying other intra-articular injuries [9, 11]. Increasingly, there are reports of reconstruction of the LT, which restores stability and prevents hip dislocation [9–13]. Brady *et al.* [12] presented the proper anatomical location of the graft during reconstruction in the acetabulum and in the femoral head. Only the accurate position of the implant in the joint allows the correct stabilizing function of LT to be reproduced and the correct range of motion in the joint to be achieved [5, 12]. The correct location and use of the adapted special hand drill make the procedure safe and prevents damage to vessels, nerves and other anatomical structures behind the medial wall of the acetabulum. The drill's laser mark allows for the control of the drilling in the acetabulum to a depth of 10 mm, which is sufficient to insert a stabilizing endobutton into the medial wall. In comparison, there are different techniques for stabilizing the allograft at the proximal end of the femur and acetabulum described. O'Donnell *et al.* [13] and Philippon *et al.* [12] stabilizing the graft in the acetabulum with screws, Benjamin Domb [11], White *et al.* [9] and Villar [6] have used an cortical button implants fixating the graft with interference screw at the proximal femur.

There are no specific indications for LT reconstruction in the literature. The main recommendation is clinical instability of the hip joint in the course of a completely ruptured ligament. Other proposed indications of LTR in hypermobile joints and in the case of reduced bone stability [11]. Cadaveric study carried out by Martin [7] confirmed the function of the femoral head ligament in controlling and stabilizing rotational movements.

The case presented by us gives a new perspective on the management of traumatic hip dislocations, where hip arthroscopy after ORIF treatment seems vital. The restoration of the joint capsule together with the labral and LT reconstruction should be considered when treating post-traumatic instability. A hip joint dislocation with a fracture of the posterior acetabular wall is a severe hip injury, which, as in our case, may result in further dislocations. Considering that the traumatic dislocations of the hip joints occur mostly in people at a younger age, it is imperative that the correct procedure is applied in order to protect the hip joint. The ideal procedure in these cases is to combine the fracture stabilization and reconstruction of the intra-articular structures involved.

CONCLUSIONS

The presented case demonstrates a technique of LTR reconstruction accompanied with posterior capsule repair and labral repair in a patient who presented a fracture of the posterior acetabular wall following surgical fixation.

The technique prevents subsequent dislocations, and while still requires further observation, the results of treatment are encouraging. After 3 months from surgery, full stability and normal painless movement of the hip joint were achieved. After acute hip dislocation with a fracture of the acetabular wall, one should always remember about the damage within the internal structures of the hip joint, which may be the underlying source of the subsequent instability.

CONFLICT OF INTEREST STATEMENT

No author has any conflict of interest related to this work.

DATA AVAILABILITY

All relevant data are within the paper and its Supporting Information files.

Level IV evidence study.

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