SUBSPECIALTY PROCEDURES

SURGICAL HIP DISLOCATION FOR EXPOSURE OF THE POSTERIOR COLUMN

Klaus-Arno Siebenrock, MD, Marius J.B. Keel, MD, Moritz Tannast, MD, Johannes D. Bastian, MD

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Abstract

Background: Surgical hip dislocation is performed for safe and efficient management of acetabular fractures predominantly involving the posterior column. The dislocation of the femoral head allows for direct visualization of the hip joint during fracture treatment.

Description: The patient is placed in the lateral decubitus position with sterile preparation and draping of the ipsilateral leg to allow for dislocation. The skin incision is straight and centered over the greater trochanter. After the skin incision, the interval between the gluteus maximus and medius muscles is developed. The sciatic nerve is identified, and special attention to the course of the medial circumflex femoral artery is given during dissection of the piriformis and triceps coxae muscles (obturator internus and superior and inferior gemelli muscles). The latter are incised 2 cm posterior to their insertion on the posterior aspect of the greater trochanter. The vastus lateralis muscle belly is elevated from the lateral femoral shaft, and a trochanteric osteotomy is performed. The trochanteric medallion is rotated 90°, and the gluteus minimus muscle is released from the capsule. After complete exposure of the hip capsule, a z-shaped capsulotomy is performed whereby any injury to the posterior capsular attachments of a posterior wall fragment is avoided. The posterior column and the greater and lesser sciatic notches are exposed, with the sciatic nerve under protection. The femoral head is dislocated either anteriorly or posteriorly to obtain direct visualization of the hip. Reduction begins at the articular surface, in cases of marginal impaction, and proceeds to the posterior wall and/or posterior column and the anterior column, when involved. For fixation, 3.5-mm cortical screws acting as positioning or lag screws and reconstruction plates are used. The capsule is sutured, the trochanteric fragment is reduced anatomically and stabilized with two 3.5-mm cortical screws, the piriformis and triceps coxae muscles are sutured, and a layered closure is performed.

Alternatives: The Kocher-Langenbeck approach might be used instead.

Rationale: Surgical hip dislocation facilitates assessment of cartilage damage at the acetabulum, marginal impaction, labral tears and femoral head lesions, removal or reinsertion of free intra-articular fracture fragments, direct visualization of the accuracy of reduction, and verification of extra-articular screw placement.

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Introductory Statement

Surgical hip dislocation is a powerful and safe approach, allowing for simultaneous treatment of intra-articular pathologies, either preexisting or as a result of trauma, and improving long-term results¹⁻⁵.

Indications & Contraindications

Indications

- Displaced acetabular fractures involving predominantly the posterior column:
 - Posterior wall.
 - Transverse.
 - Transverse and posterior wall.
 - Posterior wall and posterior column.
 - T-shaped.
- Marginal impaction.
- Comminuted posterior wall.
- Removal of intra-articular fragments.
- Anterosuperior acetabular rim fracture.
- Visual control of the accuracy of reduction.
- Placement of anterior column screw.
- Pipkin fractures.
- Quantification of cartilage damage and final treatment decision-making.
- Treatment of cartilage damage with osteochondral transplantation.
- Treatment of labral tear.
- Treatment of cam-type deformity in patients with femoroacetabular impingement.

Contraindications

- Patient not ambulatory.
- Local infection.
- Patient unfit for surgery.
- Symptomatic preinjury osteoarthritis (relative contraindication).

Step-by-Step Description of Procedure

Step 1: Preoperative Planning, Case Presentation, Patient Positioning, Setup, and Skin Incision.

Assess the acetabular fracture pattern, plan the operation, prepare the patient, and identify the surgical landmarks for skin incision.

- For preoperative planning, it is important to review all radiographs (Fig. 1, Video 1) and to perform additional computed tomography (CT) (Fig. 2, Video 1), which has been noted to provide important preoperative information⁶⁻⁸.
- Determine the accurate diagnosis of the acetabular fracture pattern, according to Judet et al., and assess the main direction of displacement⁹.
- Be aware of factors associated with poor outcomes in acetabular fracture treatment such as nonanatomic reduction, involvement of the posterior wall, a femoral head cartilage lesion, marginal impaction, and joint incongruence¹⁰.
- When there is a posterior dislocation of the femoral head, reduce the dislocation immediately to restore femoral head blood flow and to minimize further articular trauma.
- Be aware of gross hip instability in fractures with large posterior wall fragments.
- Be aware of the potential for a locked posterior dislocation requiring open reduction¹¹.

Fig. 1

Fig. 2

Fig. 1 Radiograph showing the traumatic posterior dislocation of the left hip in a 30-year-old male patient who sustained an acetabular fracture (posterior wall) in a fall during downhill mountain biking.

Fig. 2 CT scans showing axial sections at the level of the acetabular dome (**Fig. 2-A**) and the hip joint (**Fig. 2-B**). The large and displaced posterior wall fragment is shown.

Video 1 Case presentation.

- Place the patient in the lateral decubitus position (Fig. 3-A, Video 2) and place pillows between both legs to stabilize the ipsilateral leg. Administer intravenous antibiotics preoperatively.
- Start with disinfection from the foot up to the costal arch superiorly. Prepare and drape the ipsilateral leg to facilitate reduction (Video 2).
- Stand posteriorly to the patient with the first assistant and place up to 2 further assistants anterior to the patient.
- Identify the essential landmarks: anterior superior iliac spine, outline of the iliac crest, and greater trochanter. (The outline of the iliac crest provides an impression about the direction of the abductor muscle fibers running from the iliac crest to the greater trochanter.) The incision is straight, approximately 20 cm in length, and centered on the greater trochanter (Video 2).

Fig. 3-A

Figs. 3-A through 3-G Schematic drawings of aspects of the surgical procedure. **Fig. 3-A** Schematic drawing showing the placement of the patient in the lateral decubitus position. The incision is centered over the greater trochanter and is approximately 20 cm in length.

Video 2 Patient positioning and setup.

Step 2: Superficial and Deep Dissection

Expose the fascia lata, develop the Gibson interval, approach the retrotrochanteric area, and control the medial circumflex femoral artery (MCFA) and the sciatic nerve.

- Incise the skin according to the landmarks and continue with subcutaneous dissection to expose the tensor fasciae latae (Video 3).
- To develop the interval between the gluteus maximus and medius muscles (the Gibson interval)¹², incise the fascia lata at the distal aspect of the wound, above the vastus lateralis muscle (Fig. 3-B), and proceed proximally with the incision. When incising the fascia lata above the gluteus medius muscle, dissect anteriorly to the branches of the inferior gluteal artery (Video 3).
- Be familiar with the anatomic course of the MCFA providing the blood supply to the femoral head^{2,13} (Video 4). The MCFA originates from the deep femoral artery and supplies the femoral head from a posterior course. It runs along the inferior border of the obturator externus muscle, is covered by the quadratus femoris muscle (Fig. 3-C), crosses under the triceps coxae muscles (obturator internus and superior and inferior gemelli muscles), and enters the joint capsule between the superior gemellus and piriformis muscles with 4 to 5 retinacular vessels. Identify the anastomosis of the inferior gluteal artery (piriformis branch) with the MCFA at the inferior border of the piriformis muscle and identify the trochanteric branch from the deep branch of the MCFA at the cranial border of the quadratus femoris muscle.
- Identify the sciatic nerve, which is located posterior to the quadratus femoris muscle. The sciatic nerve passes anteriorly to the piriformis muscle to enter the infrapiriform foramen of the greater sciatic foramen. Anomalies in neural anatomy of the sciatic nerve include a bifid sciatic nerve or a penetration of the substance of the piriformis muscle by the nerve. Ensure that no direct pressure or stretching is exerted on the nerve.

Fig. 3-B

Fig. 3-C

Fig. 3-B Schematic drawing showing the exposure after incision of the fascia lata and the development of the Gibson interval (1), with the vastus lateralis muscle (2), gluteus maximus muscle (3), greater trochanter (4), and gluteus medius muscle (5).

Figs. 3-C and 3-D Schematic drawings showing the retrotrochanteric area. **Fig. 3-C** The vastus lateralis muscle (1), trochanteric branch of the MCFA (2), gluteus medius muscle (3), quadratus femoris muscle (4), triceps coxae muscles (5), and piriformis muscle (6).

Video 3 Skin incision, superficial dissection, and Gibson interval.

Video 4 Retrotrochanteric exposure and trochanteric osteotomy.

Step 3: Exposure of the Retrotrochanteric Area

Develop the interval between the gluteus medius and piriformis muscles and release the external rotators and piriformis muscles.

- Incise the bursa at the greater trochanter and define the posterior borders of the gluteus medius and vastus lateralis muscles (Video 3).
- Identify the inferior border of the gluteus minimus muscle along the superior border of the piriformis muscle. Detach the gluteus minimus muscle sharply from the hip joint capsule (Video 4).
- Isolate the piriformis muscle tendon and triceps coxae muscles. Cut tendons with a minimal distance of 2 cm to the posterior aspect of the greater trochanter to avoid injury to the deep branch of the MCFA (Video 4)².
- Release and reflect the piriformis and triceps coxae muscle bellies from the posterior joint capsule.

Step 4: Trochanteric Osteotomy

Identify the landmarks for trochanteric osteotomy and perform a plane or step-cut osteotomy using an oscillating saw.

- Elevate the vastus lateralis muscle epiperiosteally from the femur and leave the tendinous origin from the tubercle intact (Video 4).
- Inscribe the line of the osteotomy in the periosteum with electrocautery for reference. The osteotomy starts at the posterosuperior tip of the greater trochanter, ends distally 10 to 15 mm distal to the lateralis tubercle, and runs along the posterior insertion of vastus lateralis and gluteus medius muscles (Video 4).
- Ensure that a small part of the most posterior portion of the gluteus medius tendon remains initially attached to the proximal part of the femur (Video 4). Never start medial to the tip of the trochanter nor enter the trochanteric fossa, to protect the MCFA.
- Note that the correct anteroposterior plane for the osteotomy of the greater trochanter is parallel to the lateral surface of the trochanter and that the wafer-shaped trochanteric fragment should be at least 1.5 cm thick.
- Perform a planar osteotomy with an oscillating saw (Fig. 3-D), leaving a medallion of the greater trochanter. To increase primary stability, perform a step-cut osteotomy¹⁴.
- Rotate the trochanteric medallion 90° (Fig. 3-E), cut sharply the posterior portion of the gluteus medius tendon at the proximal part of the femur, and retract the fragment anteriorly using a small Hohmann retractor placed over the anterior edge of the stable trochanter. We have not observed any abductor weakness from nerve problems other than that related to the initial postoperative restrictions (due to immobilization).
- Further detach the gluteus minimus muscle from the joint capsule.

Fig. 3-D

Fig. 3-E

Fig. 3-D The site and direction of the trochanteric osteotomy with the vastus lateralis muscle (1), greater trochanter (2), gluteus medius muscle (3), quadratus femoris muscle (4), triceps coxae muscles (5), and deep branch of the MCFA (6).

Figs. 3-E and 3-F Schematic drawings showing the exposure after the trochanteric osteotomy. **Fig. 3-E** The exposure after the trochanteric osteotomy with the vastus lateralis muscle (1), mobile fragment of the greater trochanter (2), gluteus medius muscle (3), joint capsule (4), gluteus minimus muscle (5), quadratus femoris muscle (6), MCFA (7), triceps coxae muscles (8), and piriformis muscle (9).

Step 5: Exposure of the Posterior Column and Capsulotomy

Protect the sciatic nerve, place retractors in the sciatic notches, and perform the capsulotomy.

- Reflect the already released short external rotators posteriorly from the origin along the ischium, protect the sciatic nerve, and expose the ischial spine and the greater and lesser sciatic notches.
- Expose the posterior column using retractors inserted in the greater and lesser sciatic notches.
- To completely visualize the joint, perform an anterior and superior capsulotomy in a z-shaped manner (Fig. 3-F, Video 5) to protect the retinacular vessels; start posterosuperiorly close to the acetabular rim without damaging the labrum, then proceed with the incision along the axis of the neck of femur, and extend the incision anteroinferiorly.
- In cases with a torn capsule (e.g., patients presenting with traumatic posterior hip dislocation), modify the capsulotomy so that residual capsular attachments to the acetabular wall fragments remain intact.

Fig. 3-F

Fig. 3-F The course of the z-shaped capsulotomy from posterosuperior to anteroinferior with retraction of the piriformis muscle (1) to expose the capsule (2) after retraction of the gluteus minimus muscle (3) and the gluteus medius muscle (4).

Video 5 Dislocation of the femoral head.

Step 6: Dislocation and Assessment of the Hip Joint

Dislocate the hip, and then assess and treat any hip joint injuries.

- Dislocate the femoral head posteriorly by skeletal traction and adduction and external rotation of the leg and transect the femoral head ligament (if intact). Alternatively, dislocate the femoral head anteriorly (Fig. 3-G, Video 5).
- Inspect the joint (Fig. 4-A) and detect any cartilage damage at the acetabulum, especially at the weight-bearing dome and/or the femoral head, detect any marginal impaction, and remove or reinsert any free intra-articular fracture fragments (Video 5). (An arthroscope is not necessary.)
- Assess for traumatic labral avulsion from the stable rim¹⁵.
- Assess and correct a cam-type femoroacetabular impingement pathomorphology, which predisposes to posterior dislocation (Video 5)¹⁶.
- In patients with severe femoral head impaction injuries, consider the transfer of osteochondral shell autograft in hips (TOSAH) procedure as described in a previous publication¹⁷.

Fig. 3-G

Fig. 4-A

Fig. 3-G Schematic drawing showing the patient in the lateral decubitus position. After dislocation of the affected hip, the leg is placed in a sterile bag in flexion, adduction, and external rotation.

Figs. 4-A and 4-B Intraoperative images using an arthroscopic camera. L = labrum, PW = posterior wall, and FH = femoral head. **Fig. 4-A** The acetabular socket with the femoral head dislocated following surgical hip dislocation before reduction of the posterior wall fragment (arrow).

Step 7: Reduction and Fixation Techniques

Check the accuracy of reduction and extra-articular screw placement by direct intraoperative visualization into the hip joint.

- For reduction, use ball spike pushers, Jungbluth clamps, bone hooks, angled pointed reduction clamps, a collinear clamp, and/or a Schanz screw (Video 6).
- Plan the site for placement of all reduction tools, screws, and plates to avoid any conflicts in placement of the definitive osteosynthetic material.
- Start at the articular surface with the reduction and remove all loose bodies, elevate impacted fragments, and fill any defects. Reduce the marginal impaction before reduction of the posterior wall, for example, to ensure anatomic reduction.
- Check the accuracy of reduction by direct visualization into the joint in the dislocated hip (Fig. 4-B) and by palpation inside the greater sciatic notch alongside the quadrilateral plate (Video 6).
- For fixation, use lag screws in large fragments or spring hook plates in fragments that are too small and/or too peripheral for lag screws. For fixation, use reconstruction plates and 3.5-mm cortical screws to buttress the posterior wall; under-contouring will apply compression to the fracture site (Fig. 5).
- Place a Weber clamp anteriorly around the anterior horn of the acetabulum to reduce the anterior column in transverse fracture types. Place the anterior column screw with the entry point at the gluteus medius pillar of the innominate bone in line with the posterosuperior acetabular rim. Ensure extra-articular screw positioning by direct visualization into the joint.
- In the presence of a labral lesion, the labrum is reattached to the acetabular rim using anchors. (An arthroscope is not necessary.)

Fig. 4-B

Fig. 5

Fig. 4-B The acetabular socket with the femoral head dislocated following surgical hip dislocation after reduction.

Fig. 5 Schematic drawing showing the exposure of the acetabulum after dislocation of the hip ensuring placement of a lag screw from posterosuperior to the anterior column (1), direct view on fracture lines (2), the anterior column (3), cartilage of the femoral head (4), and in the joint to facilitate extra-articular screw placement during fixation of the posterior column using a reconstruction plate (5).

Video 6 Exposure of the posterior column, fracture reduction, and fixation.

Step 8: Wound Closure and Postoperative Care

Suture the capsule and the external rotators, reduce and fix the trochanteric fragment, place a suction drain if necessary, and perform a layered closure; postoperatively, allow no more than toe-touch weight-bearing for the first 6 weeks.

- Suture the capsule and the external rotators (Video 7).
- Debride soft tissues with removal of any necrotic tissue to decrease the risk for heterotopic ossifications.
- Reduce the trochanteric fragment anatomically and use two 3.5-mm cortical screws for fixation (Video 7).
- If necessary, place a suction drain in the Gibson interval and remove the drain once the drainage is <40 mL per 24 hours postoperatively.
- Perform a layered closure of the subcutaneous and cutaneous tissues (Video 7).
- Restrict the mobilization for the first 6 weeks after surgery to no more than toe-touch weight-bearing, no active abduction, no passive adduction, and no flexion of the hip to >70°.
- Prescribe low-molecular-weight heparin for this period as prophylaxis against deep venous thrombosis and, for patients without contraindication against nonsteroidal anti-inflammatory drugs, ibuprofen to prevent heterotopic ossifications for 14 days. These recommendations reflect the authors' own preferences; other options are available to address these needs.
- Follow the patients clinically and radiographically for 6 to 12 weeks after surgery (Figs. 6 and 7, Video 8). In the presented case, radiographs showed no signs of posttraumatic osteoarthritis 1 year after surgery (Fig. 7, Video 8).
- If consolidation of the trochanteric osteotomy and the fractures is evident 6 weeks postoperatively on radiographs, allow a stepwise increase (as pain tolerates, within an additional 6 weeks) in weight-bearing up to full weight-bearing with the assistance of a physiotherapist.

Fig. 6

Fig. 7

Figs. 6-A, 6-B, and 6-C Radiographs showing the anatomic postoperative reduction in the anteroposterior (**Fig. 6-A**), iliac oblique (Judet) (**Fig. 6-B**), and obturator oblique (Judet) (**Fig. 6-C**) views, as described by Letournel and Judet²⁰.

Figs. 7-A, 7-B, and 7-C Radiographs showing no signs of posttraumatic osteoarthritis 1 year after surgery in the anteroposterior (**Fig. 7-A**), iliac oblique (Judet) (**Fig. 7-B**), and obturator oblique (Judet) (**Fig. 7-C**) views, as described by Letournel and Judet²⁰.

Video 7 Wound closure.

Video 8 Postoperative evaluation and follow-up.

Results

The technique of surgical hip dislocation for the treatment of selected acetabular fractures allows for enhanced visualization of the fracture lines with visual control of fracture reduction^{4,5}. Anatomic reduction was achieved in 93% of 60 patients (61 hips) with a mean age of 36 years (range, 14 to 80 years) who presented with complex fracture patterns (38% of the patients), marginal impaction (35%), and posterior wall comminution (43%)¹. No relevant complications related to the approach were observed, as femoral osteonecrosis did not occur in any case and revision for the trochanteric osteotomy was 0.9%¹⁴. Heterotopic ossification was reported in 33% of the patients¹, compared with rates as high as 52% reported in the literature^{18,19}, probably because of the gentler soft-tissue handling obtained by the trochanteric flip extension. The cumulative 10-year survivorship, with total hip arthroplasty as the end point, was 91% (95% confidence interval, 84% to 99%). In summary, the approach described in the present study is safe and provides favorable results.

Pitfalls & Challenges

- Osteonecrosis of the femoral head may develop if the trochanteric osteotomy plane is misplaced, thereby injuring the MCFA and femoral head blood supply. Otherwise, osteonecrosis has not been observed to date.
- Nonunion, delayed union, and malunion of the trochanteric fragment can occur. A stepped osteotomy (with a step of 6 mm) of the trochanter ensures stable, anatomic refixation without the risk of nonunion or malunion.
- Multifragmentary fractures of the quadrilateral plate cannot be addressed. In these cases, consider the need of an additional approach from anterior.

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Klaus-Arno Siebenrock, MD¹

Marius J.B. Keel, MD^{1,2}

Moritz Tannast, MD¹

Johannes D. Bastian, MD¹

¹Department of Orthopaedic and Trauma Surgery, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland

²Trauma Center Hirslanden, Clinic Hirslanden, Zürich, Switzerland

E-mail address for J.D. Bastian: johannes.bastian@insel.ch

ORCID iD for K.-A. Siebenrock: [0000-0003-3627-4313](https://orcid.org/0000-0003-3627-4313)

ORCID iD for M.J.B. Keel: [0000-0003-4951-4507](https://orcid.org/0000-0003-4951-4507)

ORCID iD for M. Tannast: [0000-0002-2761-565X](https://orcid.org/0000-0002-2761-565X)

ORCID iD for J.D. Bastian: [0000-0002-0708-4097](https://orcid.org/0000-0002-0708-4097)

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