SUBSPECIALTY PROCEDURES

THE ILIOINGUINAL APPROACH

State of the Art

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Introduction

The ilioinguinal approach is the standard approach for the open reduction and internal fixation of the majority of displaced, anteriorly based acetabular fractures as it offers wide access to the acetabulum, is extensile, and has been associated with enhanced recovery.

The anterior ilioinguinal approach as described by Letournel in 1961¹ is the approach of choice for the exposure, reduction, and fixation of fractures involving the anterior column of the acetabulum and the inner surface of the innominate bone²⁻⁵. Access to these structures through the ilioinguinal approach requires the opening of the inguinal canal and the mobilization of the external iliac vessels with the subsequent development of 3 “working windows.” The first or lateral window extends from the sacroiliac joint to the lateral aspect of the iliopsoas muscle, providing access to the sacroiliac joint, the internal iliac fossa, and the proximal pelvic brim. The second or middle window is defined laterally by the medial aspect of the iliopsoas muscle and the femoral nerve and medially by the external iliac artery, offering access to the distal pelvic brim, the quadrilateral surface, the anterior acetabular wall, the iliopsoas gutter, and the iliopectineal eminence. The third or medial window is developed between the external iliac vein and the lateral aspect of the rectus abdominis muscle, allowing access to the space of Retzius, the pubic symphysis, and the superior pubic ramus from the pubic tubercle to the pectineus recess. Extensile maneuvers can offer broader exposure of the anterior wall, the anterior hip capsule, the quadrilateral surface, and the external iliac fossa.

The anatomical muscle-sparing ilioinguinal approach offers wide access to the acetabulum, is extensile, and has been associated with enhanced recovery. Disadvantages include the need to mobilize the external iliac neurovascular bundle, the need to open the inguinal canal, and the limited access to the inner aspect of the posterior column and inferior quadrilateral surface. Moreover, the direct visualization of the acetabular articular surface is not possible through the ilioinguinal approach. Consequently, the quality of the articular reduction relies on the quality of cortical osseous reductions of the innominate bone and the confirmation provided by intraoperative fluoroscopy.

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Described complications include damage to the external iliac neurovascular bundle, bladder injury, anterior thigh numbness, inguinal hernia, thromboembolism, and infection^{6,7}. The risk of heterotopic ossification is low.

The ilioinguinal approach does not allow for visualization of the acetabular articular cartilage. The management of anteromedial dome impaction is best addressed with the anterior intrapelvic approach. If an ilioinguinal approach is used, an independent iliac corticotomy is necessary. Additionally, posterior marginal impaction and displaced posterior wall fractures are difficult to manage with the classic ilioinguinal approach and the surgeon should consider other options such as a double (anterior and posterior) approach to the acetabulum⁸. Various modifications of the ilioinguinal approach have been described in the literature, and the surgeon should be familiar with them in order to address any potential intraoperative difficulties⁹.

Indications & Contraindications

Indications

- Anterior wall acetabular fractures.
- Anterior column acetabular fractures.
- Transverse acetabular fractures with the major displacement occurring at the anterior column.
- Both-column acetabular fractures.
- Anterior element reduction and fixation in T-type acetabular fractures.
- Anterior column and posterior hemitransverse acetabular fractures.
- Anterior column and anterior wall acetabular fractures.

Contraindications

- Posterior wall acetabular fractures.
- Posterior column acetabular fractures.
- Posterior column and posterior wall acetabular fractures.
- Transverse and posterior wall acetabular fractures.
- Transverse acetabular fractures with the major displacement occurring at the posterior column.
- Posterior element reduction and fixation in T-type acetabular fractures.

Step 1: Preoperative Planning

Review the patient's general condition and imaging studies and plan the sequence of reduction and fixation.

- Review the patient's general condition (events surrounding the traumatic event; pertinent medical, surgical, social or family history; and results of a complete physical examination).
- Review the imaging studies (radiographs and computed tomography [CT] scans) (Video 1).
- Plan the sequence of reduction and fixation.
- Make sure that all of the necessary equipment (operating table, instruments, and implants) is available.
- Plan the sequence of reduction and fixation in a dry bone pelvic model.

Video 1 Indications and imaging studies.

Step 2: Preparation and Patient Positioning

Position the patient supine on the fracture table, induce anesthesia, prepare the surgical field, administer intravenous antibiotics, and apply traction.

- Use the World Health Organization (WHO) Surgical Safety Checklist.
- Induce anesthesia.
- Administer intravenous antibiotics as per local hospital protocol.
- Insert a bladder catheter and shave the pubic hair.
- Position the patient supine on the fracture table (ProFx; Mizuho OSI) with a perineal post.
- Make sure that all of the osseous prominences are well padded.
- Ensure that all of the appropriate imaging studies (radiographs and CT scans) are available and properly displayed.
- Consider the application of ipsilateral distal femoral skeletal traction.
- Bring the C-arm image intensifier from the contralateral side and make sure that all of the necessary fluoroscopic views can be acquired.
- Prepare the surgical field. Ensure that the entire abdomen from the xiphisternum to the pubic symphysis is visible and accordingly prepared. The ipsilateral gluteal and proximal lateral femoral area must be included in the surgical field should percutaneous sacroiliac fixation and/or lateral traction through the greater trochanter be needed. Lateral traction through the greater trochanter via a percutaneously inserted Schanz pin is a very useful maneuver that neutralizes the deforming forces and aids in the fracture reduction.
- Apply traction only for the time period that it is needed (be mindful of traction neurapraxia).

Step 3: Ilioinguinal Approach

Make a long curvilinear incision over the affected lower flank, develop the 3 working windows, and reduce and stabilize the fracture while protecting the neurovascular structures and the bladder (Video 2).

- Palpable landmarks are the pubic symphysis, the anterior superior iliac spine (ASIS), the iliac tubercle, the iliac blade, and the greater trochanter.
- The incision begins at the midline approximately 3 to 4 cm (1 to 2 fingerbreadths) proximal to the pubic symphysis.
- Skin incision: Using a number-15 surgical blade, proceed from the midline to the ASIS. At the ASIS level, move the incision slightly distally and then proceed along and just below the iliac crest. Make sure that the incision is extended past the most convex point of the iliac crest.
- Subcutaneous tissue: Dissect the subcutaneous tissue and cauterize the subcutaneous vessels. Use self-retaining soft-tissue retractors to expose the entire length of the incision. At the medial part of the incision, identify the external oblique fascia and the lateral border of the ipsilateral rectus abdominis muscle. At the lateral part of the incision, identify the interval between the abdominal and hip abductor muscles.

Video 2 Superficial dissection and spermatic cord identification.

- At the medial part of the incision, identify the external inguinal ring (approximately 3 to 5 cm lateral to the pubic symphysis). Using a nonperforating dissecting instrument, isolate the contents of the inguinal canal, i.e., the spermatic cord in males or the round ligament in females and the ilioinguinal nerve. Place a Penrose drain around them and mobilize them while refraining from excessive retraction at all times.
- Continue the dissection with the development of the 3 windows. Decide on which window to develop first, considering the fracture location and the anticipated bleeding. Major bleeding is associated with the development of the lateral window because of the large fragment surfaces and bleeding from the nutrient artery of the iliac bone.
- To develop the lateral window of the approach, identify the interval between the hip abductors and the abdominal muscles, which is a white shiny line along the iliac crest that is incised using diathermy. The iliacus muscle is elevated off the internal iliac fossa using blunt dissection. The nutrient foramen of the iliac bone is identified, and bone wax is applied to control the bleeding. At this stage, bleeding from the cancellous fragments of the iliac bone should be anticipated. The superior surface of the sacroiliac joint is identified. Medial dissection over the lateral aspect of the sacrum is only required in cases of sacroiliac joint disruption. The L5 nerve root should be protected, and the dissection along the sacral ala should be kept within 1 cm of the sacroiliac joint (Video 3).
- The incision of the external oblique fascia that follows is located 1.5 to 2 cm proximal to the inguinal ligament and can be placed cranially, caudally, or even through the external inguinal ring. The medial end of the incision lies just lateral to the rectus abdominis when it is located cranial to the ring and at the pubic tubercle when it is located caudal to it. Note the diameter of the external inguinal ring so that this can be restored at the end of the operation. Reflect the external oblique fascia distally. Use soft-tissue holding forceps and pledgets to “unroof” the inguinal canal.
- Identify the floor of the inguinal canal extending from the pubic tubercle to the ASIS. The shiny inguinal ligament defines the most medial part of the floor. Using a number-15 blade, incise the inguinal ligament, making sure to leave a cephalad cuff of at least 3 to 4 mm to facilitate the reconstruction of the ligament at the end of the operation. Identify the lateral femoral cutaneous nerve (LFCN), which is usually located 1 to 2 cm medial to the ASIS. Its location varies and bleeding from the small accompanying vessels aids in identification of the nerve. Undue tension to the LFCN can be avoided by hip flexion and mobilization of the nerve for some distance proximally and distally. The dissection can proceed medially to the pubic tubercle or more laterally, depending on the fracture configuration and the anticipated reduction maneuvers and fixation.
- The characteristic direction of the iliopsoas muscle fibers is easily identifiable medial to the ASIS. Identify the femoral nerve at the medial-deep aspect of the iliopsoas muscle. Just medial to it, identify the iliopectineal fascia (IPF). This is the investing fascia of the medial aspect of the iliopsoas muscle. This fascia lies between the femoral nerve and the external iliac artery. It has a firm attachment to the underlying iliopectineal eminence and the pelvic brim (Video 4).

Video 3 Lateral window development.

Video 4 External iliac oblique and inguinal ligament dissection.

- Access to the true pelvis via the ilioinguinal exposure is only possible after incision of the IPF. Using blunt dissecting instruments, separate the IPF from the femoral nerve laterally and the external iliac artery medially. Incise the fascia from its superficial point to the iliopectineal eminence. The following details need to be considered when dissecting through the IPF: (1) The IPF might be tethered and oriented more horizontally because of its attachment to a displaced fracture fragment. (2) In elderly patients, the IPF is not always well defined. (3) Vascular conduits from the iliac system to the iliopsoas muscle penetrate the IPF. (4) The IPF is attached to the pelvic brim and, consequently, full dissection to the level of the sacroiliac joint is required. (5) The periosteum of the iliopectineal eminence that is attached to the fascia is thick and must be carefully removed (Video 5).
- Safe external iliac vein and artery mobilization necessitates the development of the medial window. Make a small incision lateral to the rectus abdominis muscle and carry out subperiosteal dissection over the posterior aspect of the superior pubic ramus. Place a sponge at the space of Retzius to protect the bladder. Identify and ligate the corona mortis vascular anastomosis (retropubic anastomosis) connecting the external iliac to the obturator vascular system that is usually found approximately 5 cm lateral to the pubic symphysis. This is best done through the medial window with the surgeon standing on the contralateral side. The dissection medial to the external iliac vein should be kept to a minimum to avoid damage to the lymphatics. A Penrose drain is placed around the vessels, which can then be mobilized medially and laterally, offering access to the medial and the middle window, respectively.
- Utilizing the second window, elevate the obturator internus muscle from the quadrilateral surface. Identify and protect the obturator neurovascular bundle at the superolateral aspect of the obturator foramen.
- Place a Penrose drain around the femoral nerve and iliopsoas muscle.
- After the development of the 3 working windows, the ilioinguinal approach is complete (Video 6).

Video 5 Dissection of the iliopectineal fascia.

Video 6 Medial window development and demonstration of the complete ilioinguinal approach.

Step 4: Fracture Reduction and Fixation

For reduction of a both-column acetabular fracture, connect the mobile parts of the acetabulum to the iliac segment that is attached to the sacrum, noting that, in most cases, the usual sequence involves the reduction of the anterior column to the intact ilium followed by the reduction of the posterior column (Video 7).

- Correct the external rotation of the anterior column by manipulation with a Schanz pin or a Farabeuf clamp that is placed at the iliac crest. A combination of maneuvers is usually needed, and a pusher is used to caudally displace the medial edge of the anterior column fragment.
- At this stage, it is important to identify and stabilize any fracture fragments close to the sacroiliac joint and possible sacroiliac joint disruptions.
- Stabilize the periphery of the anterior column to the intact ilium either with a plate over the inner aspect of the iliac fossa or with a lag screw from the anterior column to the iliac crest.
- A buttress plate over the pelvic brim or a lag screw is the usual way to stabilize the most central part of the anterior column to the intact ilium.

Video 7 Working through the 3 windows of the ilioinguinal approach.

- Reapproximate the posterior column, utilizing the middle or lateral window. Typically, this is accomplished with a reduction clamp with concomitant lateralization of the femoral head via a Schanz pin placed through the proximal lateral aspect of the femur to the femoral neck. Place 2 posterior column screws either through or outside the pelvic brim buttress plate, in order to stabilize the posterior column fragment.
- A concomitant posterior wall fracture, which often occurs with a both-column fracture, is often minimally displaced. This is because it is created by a “pull” rather than a “push” mechanism. Create a small fascial elevation and a tunnel over the outer aspect of the iliac bone, which will facilitate the application of long arm forceps to provisionally stabilize the posterior column fragment. Perform fixation with a lag screw from the inner iliac fossa to the posterior wall.

Step 5: Wound Closure and Postoperative Aftercare

Perform meticulous hemostasis, apply drains, and ensure watertight closure, which are the final steps of the operation (Video 8).

- Apply 1 drain at the space of Retzius and 1 at the internal iliac fossa. Remove the drains on the second postoperative day or when drainage has stopped.
- Perform closure of the inguinal canal and the external abdominal fascia with a nonabsorbable suture.
- Perform closure in layers with emphasis on the reconstitution of the inguinal ligament.
- Prescribe chemical thromboprophylaxis for 6 to 8 weeks.
- We use heterotopic ossification prophylaxis only in patients managed with a double approach (anterior and posterior approaches) or when reconstruction has been delayed (>2 weeks).
- Have the patient begin physical therapy with isometric quadriceps and abductor strengthening exercises on the first postoperative day.
- Instruct the patient to use toe-touch weight-bearing for 8 to 12 weeks.
- Consider follow-up evaluations at 2 and 6 weeks and then at 3, 6, 12, and 24 months postoperatively.

Video 8 Closure of the ilioinguinal approach.

Results

The ilioinguinal approach remains 1 of the standard approaches for the management of acetabular fractures¹⁰. Other approaches such as the anterior intrapelvic approach^{11,12} have recently gained popularity, but the ilioinguinal approach can reliably provide sufficient access to the vast majority of anterior based acetabular fractures and allow for safe and effective fixation of these fractures¹³.

Pitfalls & Challenges

- The sequence of the development of the three windows might vary, depending on the fracture type and the planned reconstruction.
- Avoid undue traction.
- Hip flexion relaxes the structures anterior to the hip joint.
- Substantial bleeding might be encountered through the bone fragments. This usually stops after the reduction of fractures.

- Use bone wax to stop the bleeding from the nutrient vessels of the iliac bone.
- The identification and dissection of the iliopectineal fascia is the key step of the procedure.
- Avoid excessive dissection medial to the external iliac vein to avoid injury to the lymphatics.
- Reconstruction of the inguinal canal is of paramount importance in order to avoid the development of posttraumatic hernia.

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References

1. Letournel E. Fractures of the acetabulum. A study of a series of 75 cases. 1961. Clin Orthop Relat Res. 1994 Aug;305:5-9.
2. Letournel E. The treatment of acetabular fractures through the ilioinguinal approach. Clin Orthop Relat Res. 1993 Jul;292:62-76.
3. Letournel E. Acetabulum fractures: classification and management. Clin Orthop Relat Res. 1980 Sep;151:81-106.
4. Matta JM, Merritt PO. Displaced acetabular fractures. Clin Orthop Relat Res. 1988 May;230:83-97.
5. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. J Bone Joint Surg Am. 1996 Nov;78(11):1632-45.
6. Ochs BG, Marintschev I, Hoyer H, Rolauffs B, Culemann U, Pohlemann T, Stuby FM. Changes in the treatment of acetabular fractures over 15 years: analysis of 1,266 cases treated by the German Pelvic Multicentre Study Group (DAO/DGU). Injury. 2010 Aug;41(8):839-51. Epub 2010 May 6.
7. Kloen P, Siebenrock KA, Ganz R. Modification of the ilioinguinal approach. J Orthop Trauma. 2002 Sep;16(8):586-93.
8. Scolaro JA, Routt ML Jr. Reduction of osteoarticular acetabular dome impaction through an independent iliac cortical window. Injury. 2013 Dec;44(12):1959-64. Epub 2013 Aug 2.
9. Cutrera NJ, Pinkas D, Toro JB. Surgical approaches to the acetabulum and modifications in technique. J Am Acad Orthop Surg. 2015 Oct;23(10):592-603. Epub 2015 Aug 28.
10. Tosounidis TH, Gudipati S, Panteli M, Kanakaris NK, Giannoudis PV. The use of buttress plates in the management of acetabular fractures with quadrilateral plate involvement: is it still a valid option? Int Orthop. 2015 Nov;39(11):2219-26. Epub 2015 Jul 24.
11. Guy P. Evolution of the anterior intrapelvic (Stoppa) approach for acetabular fracture surgery. J Orthop Trauma. 2015 Feb;29 Suppl 2:S1-5.
12. Archdeacon MT, Kazemi N, Guy P, Sagi HC. The modified Stoppa approach for acetabular fracture. J Am Acad Orthop Surg. 2011 Mar;19(3):170-5.
13. Gänsslen A, Grechenig ST, Nerlich M, Müller M, Grechenig W. Standard approaches to the acetabulum part 2: ilioinguinal approach. Acta Chir Orthop Traumatol Cech. 2016;83(4):217-22.