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Understanding the Corridors: A Practical Narrative Review of Percutaneous Pelvic and Acetabular Fixation

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ABSTRACT: Percutaneous fixation has become an increasingly important part of modern pelvic and acetabular trauma surgery. The technique offers the potential for stable fixation with less soft-tissue disruption, lower blood loss, and reduced surgical morbidity compared with extensive open approaches. However, percutaneous fixation around the pelvis remains technically demanding. The challenge is not simply to identify safe osseous corridors on CT scan and three-dimensional reconstruction view but translating it into a reliable intraoperative fluoroscopic image.

This narrative review describes the major percutaneous corridors used for pelvic ring and acetabular fixation and focuses on the practical skills required to use them safely. Particular attention is given to preoperative CT planning, reduction, patient positioning, fluoroscopic views, C-arm manipulation, and the often-underappreciated role of the radiographer.

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The learning curve for these procedures is partly a learning curve in radiographic anatomy. Surgeons must learn not only about the correct placement of the screws, but also how to recognize the trajectory on fluoroscopy. Equally, radiographers need familiarity with pelvic imaging and the specific views required by the surgeon. This review proposes a practical framework in which pelvic percutaneous fixation is understood as a combination of anatomy, reduction, imaging, and team-based technical execution.

Keywords: *pelvic fracture; acetabular fracture; percutaneous fixation; pelvic ring; iliosacral screw; acetabular screw; fluoroscopy; C-arm; radiographer; minimally invasive surgery*

Introduction

The treatment of pelvic and acetabular fractures has changed considerably over the last several decades with a shift towards percutaneous methods of fixation. Open reduction and internal fixation still remain an important treatment for displaced acetabular and pelvic injuries, but improvement in imaging, implants, reduction techniques, and understanding of the osseous anatomy of pelvis has expanded the role of percutaneous fixation [1–4].

The attraction of these newer techniques is straightforward. When an appropriate reduction can be achieved, screws can provide stability while minimizing disruption of the soft tissues. This can be particularly valuable in patients with significant physiological injury, poor soft-tissue conditions, obesity, osteoporosis, or advanced age [1,2].

The procedure itself, however, is anything but straightforward. The pelvis is a complex three-dimensional structure containing several narrow osseous pathways that can accommodate screws. These corridors are surrounded by important neural, vascular, visceral, and articular structures. A guidewire may be only a few millimetres away from a dangerous structure while appearing satisfactory on a single fluoroscopic image.

This creates a fundamental challenge: the surgeon sees a three-dimensional corridor on CT scan but operates using two-dimensional fluoroscopy. Successful percutaneous fixation therefore requires more than knowledge of pelvic anatomy. It requires the ability to convert three-dimensional anatomy into reproducible fluoroscopic views and then use those views to guide a screw safely through the intended corridor.

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The surgeon does not simply need to know where the screw should be but also to understand how to see where the screw is. This narrative review therefore focuses not only on the established pelvic and acetabular screw corridors but also on the practical imaging skills and team factors that allow these corridors to be used safely.

The primary advantage of percutaneous fixation is reduced surgical exposure. Extensive open approaches to the pelvis and acetabulum can involve considerable soft-tissue dissection and may be associated with severe blood loss, chance of infection, wound complications, neurovascular injury and prolonged recovery [1,2]. Percutaneous fixation essentially avoids much of these complications [2,3]. However, these advantages should not lead to the misconception that percutaneous fixation is a simpler form of pelvic surgery. It is better understood as a different technical skill set.

Open surgery provides direct visualization of the fracture and the relevant anatomy. Percutaneous surgery removes that direct visualization and replaces it with imaging. The surgeon therefore becomes dependent on the quality and interpretation of the images.

The technique is particularly useful for minimally displaced fractures, fractures that can be reduced indirectly, and selected patients in whom a large surgical exposure carries increased morbidity [1,2].

The fundamental principle remains that fixation should follow reduction. A technically perfect screw cannot compensate for an unacceptable fracture reduction. In acetabular fractures, restoration of joint congruity remains particularly important because residual articular incongruity is associated with poorer long-term outcomes [1]. Reduction may be achieved through traction, positioning, closed manipulation, percutaneous reduction tools, Schanz pins, joysticks, or limited accessory windows depending on the fracture pattern [1].

The surgeon should therefore make an early decision, and if the fracture is irreducible through closed maneuvers, then forcing a percutaneous approach simply because it is less invasive may create a more difficult and less predictable operation.

And hence, the significance of preoperative planning cannot be underestimated. The most important fluoroscopic image may be the CT scan obtained before surgery. Thin-slice CT with multiplanar reconstruction should be reviewed carefully before the patient enters the

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operating room. Three-dimensional reconstructions can provide additional orientation, but the surgeon should also become comfortable with axial, sagittal, and coronal images because these allow the actual dimensions of the bony corridor to be appreciated.

The purpose of CT planning is not simply to identify the screw corridor but to help the surgeon determine his entry point for screw placement, the trajectory, narrowest portion of the corridor, screw length, relationship to the sacral foramina and whether the fracture itself changes the expected anatomy. The corridor should be considered in the fractured and reduced pelvis, not simply in a normal pelvic model.

Preoperative CT can also help predict the fluoroscopic angles required during surgery. One study demonstrated that sagittal CT reconstructions could be used to anticipate intraoperative inlet and outlet angles for iliosacral screw placement [5]. This is an important practical concept: CT planning and fluoroscopic planning should be performed together.

The concept of a safe corridor outlines that it is a three-dimensional region of bone through which a screw can safely pass.

The commonly used pelvic corridors include:

Iliosacral corridors.

Transsacral corridors.

Supra-acetabular corridors.

Anterior column corridors.

Posterior column corridors.

Iliac wing corridors.

The dimensions and orientation of these corridors vary considerably between patients.

Sacral dysmorphism is a well-known example. Variations in sacral anatomy can significantly alter the available space for iliosacral screws and increase the risk of neural injury or cortical violation [6,7].

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Percutaneous iliosacral screw fixation is one of the most established application of minimally invasive pelvic fixation. The screw passes from the ilium across the sacroiliac joint into the sacrum. Depending on the fracture and the anatomy, screws may be placed into the S1 or S2 corridors, and transsacral fixation may be considered in selected patterns [3,6]. Additional oblique or modified views may be required depending on the patient's anatomy and the intended trajectory [6,8].

The inlet projection is primarily useful for evaluating the anterior-posterior position of the screw and its relationship to the anterior sacral cortex. A screw that appears acceptable on an AP or outlet view can be dangerously anterior or posterior when examined on the inlet projection.

The outlet projection allows assessment of the cranial-caudal position of the guidewire and its relationship to the sacral foramina. The surgeon should identify the foramina and understand where the guidewire sits relative to them before advancing the wire.

Sacral dysmorphism deserves particular attention because the usual fluoroscopic assumptions may not apply. The corridor can be smaller, more oblique, or differently shaped than expected. Preoperative CT is therefore particularly valuable in these cases. The practical lesson is simple: Do not let the textbook angle override the patient's anatomy.

Transsacral screws extend across the sacrum from one ilium to the other. They can provide substantial fixation because of their long working length and purchase in both iliac wings. However, they require accurate identification of the safe osseous corridor. The narrowness of the safe zone means that apparently small errors in trajectory can have major consequences.

The anterior pelvis contains several useful pathways for percutaneous fixation, particularly through the superior pubic ramus and anterior column. The anterior column extends from the acetabular region toward the superior pubic ramus. Depending on the fracture pattern, screws can be inserted in antegrade or retrograde directions. The corridor is bounded by the acetabulum, pelvic cavity, and surrounding cortical structures. Its dimensions change along its length. The obturator oblique projection is particularly useful for visualizing the anterior column, while inlet-type projections help define the relationship of the wire to the pelvic brim and joint [1,9].

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Percutaneous posterior column fixation presents another significant technical challenge. The posterior column extends between the acetabular region and the ischial tuberosity. The corridor is surrounded by the sciatic notch, hip joint, and pelvic structures. Iliac oblique and obturator oblique views can help define the trajectory and confirm that the wire remains within the intended bony pathway [1,9]. Because the posterior column is curved and irregular, the surgeon must resist the temptation to advance a guidewire based on one apparently satisfactory image. The guidewire should be advanced gradually, with repeated assessment in complementary projections.

The C-arm is often treated as an accessory to the operation. For percutaneous pelvic fixation, this is a mistake. The C-arm is effectively the surgeon's operative exposure. In an open acetabular operation, the surgeon uses direct visualization and palpation to understand the anatomy. In a percutaneous operation, the same information must be reconstructed from fluoroscopy. This makes C-arm positioning a surgical skill. The goal is not simply to obtain an AP, inlet, or outlet image. The goal is to obtain a projection that accurately represents the relevant anatomical plane. This distinction becomes important when dealing with patients who are obese, patients with altered pelvic anatomy, patients with pelvic rotation, or patients with complex fracture patterns. Textbooks often describe inlet and outlet views using approximate angles. These angles are useful starting points but should never be treated as universal numbers.

One of the most important practical considerations in percutaneous pelvic fixation is also one of the least discussed: the radiographer. A technically capable radiographer who understands pelvic fluoroscopy can substantially improve the efficiency and safety of the procedure. The radiographer needs to understand how the C-arm movement changes the image and how to reproduce a previously established projection. The radiographer should also understand the surgeon's objective when a particular view is requested. A surgeon who has extensive pelvic experience but works with a team unfamiliar with pelvic fluoroscopy may still struggle while an experienced radiographer can make the learning curve considerably easier for a surgeon who is developing pelvic fluoroscopic skills. The literature recognizes this relationship. The review by Banaszek and colleagues specifically emphasized that percutaneous pelvic and acetabular fixation requires substantial expertise from both the surgeon and the radiographer [10].

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The quality of the radiograph depends partly on the quality of communication. Rather than simply requesting, the surgeon can communicate the purpose: Similarly, instead of repeatedly asking for a specific view, the surgeon may explain which cortical boundary needs to be visualized. This creates a shared mental model and over time, the radiographer begins to anticipate the required movements, and the surgeon understands what the resulting image should demonstrate. This is particularly valuable in centers where pelvic surgery is not performed every day.

The learning curve of percutaneous pelvic fixation is partly a learning curve in radiographic anatomy. Early in training, the pelvis on fluoroscopy can look like a collection of overlapping lines. With experience, those lines become recognizable structures. This is why watching experienced pelvic surgeons can be so useful. The most educational part of an operation may not be watching where the surgeon inserts the screw but instead understanding which image the surgeon requests before doing it.

Conventional fluoroscopy remains widely used because it is available in most trauma operating rooms and does not require specialized navigation infrastructure. However, image-based navigation and CT-based navigation have been developed to improve the accuracy of percutaneous screw placement. A systematic review and meta-analysis found lower malposition rates with CT navigation compared with conventional fluoroscopy, although navigation cannot be applied equally to every fracture pattern and may introduce additional logistical and technical requirements [11,13]. More recent work has explored intraoperative three-dimensional fluoroscopy and computer-assisted planning [12,14]. These technologies are valuable, particularly for anatomically difficult cases. However, they do not make conventional fluoroscopic knowledge obsolete. In many parts of the world, surgeons will continue to perform pelvic trauma surgery with a standard C-arm. This is particularly relevant in lower-resource environments, were access to navigation, intraoperative CT, or robotics may be limited. A surgeon who understands anatomy and fluoroscopy can therefore remain effective even without advanced technology.

The role of three-dimensional imaging is likely to continue expanding. Intraoperative 3D fluoroscopy can provide additional information about screw position and fracture reduction and may identify problems that are difficult to appreciate on conventional fluoroscopy [12]. Computer-assisted planning can also identify safe corridors before surgery and

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potentially reduce the cognitive burden of translating CT anatomy into intraoperative trajectories [14].

Percutaneous pelvic fixation can require considerable fluoroscopy, especially during the learning curve. Repeatedly searching for the correct image, repositioning the C-arm, and redirecting guidewires can increase radiation exposure to both the patient and operating-room personnel. The best approach is not simply to minimize the number of images but to make every image purposeful. Preoperative CT can help predict the appropriate fluoroscopic views [5]. Establishing the desired projections before inserting the guidewire can reduce unnecessary fluoroscopy. Once a satisfactory projection is obtained, the surgeon and radiographer should be able to reproduce it. The principle is therefore to plan the corridor before surgery, establish the image before drilling, and confirm the trajectory before advancing the implant.

Percutaneous pelvic fixation is difficult to learn from written descriptions alone. A structured training pathway may be useful. Trainees should first learn normal pelvic radiographic anatomy and then progress to recognizing pelvic landmarks on AP fluoroscopy. Additionally, cadaveric training and simulation can provide further opportunities to understand screw trajectories without the pressure of a clinical case. Most importantly, trainees should learn that pelvic screw fixation and pelvic fluoroscopy are not two separate skills. They are the same skill viewed from two directions.

There is a tendency in surgical education to describe technical skills as if they are acquired by memorizing anatomy and operative steps. Pelvic percutaneous fixation demonstrates why this is not always true. It is possible to know the terminology without truly understanding the radiographic images. One may know that an inlet view shows one relationship and an outlet view another, while still struggling to understand why the C-arm needs to move in a particular direction.

The future of pelvic and acetabular fixation will likely involve increasing use of preoperative 3D planning, intraoperative 3D imaging, navigation, robotics, and patient-specific instrumentation [12,14]. These developments are likely to reduce some of the uncertainty associated with conventional fluoroscopy. However, there will remain a need for surgeons who understand conventional pelvic imaging.

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Conclusion

Percutaneous fixation of pelvic and acetabular fractures is technically demanding because the surgeon must navigate complex three-dimensional anatomy using primarily two-dimensional imaging. The safe use of pelvic screw corridors therefore requires more than anatomical knowledge. It requires preoperative CT planning, satisfactory fracture reduction, careful patient positioning, reliable fluoroscopic views, controlled guidewire placement, and appropriate confirmation of the final implant.

Perhaps most importantly, it requires a good C-arm and a radiographer who understands pelvic fluoroscopy. This part of the operation is often underemphasized. Yet when conventional fluoroscopy is being used, the quality of the image effectively determines the quality of the surgeon's intraoperative visualization.

The central lesson is therefore simple: The surgeon must not only know the corridor; the surgeon must learn to see the corridor. For trainees, this may be the most important transition in learning pelvic percutaneous fixation. The goal is not to memorize radiological angles but to understand what each image is showing, why it is being requested, and how it relates to the three-dimensional anatomy seen on CT.

Declarations

Ethics approval

Not applicable. This article is a narrative review and does not involve new research involving human participants.

Consent for publication

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Conflict of interest

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Author contributions

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References

1. Caviglia H, Mejail A, Landro ME, Vatani N. Percutaneous fixation of acetabular fractures. *EFORT Open Rev.* 2018;3(5):326–334. doi:10.1302/2058-5241.3.170054.
2. Routt MLC Jr, Kregor PJ, Simonian PT, Mayo KA. Early results of percutaneous iliosacral screws placed with the patient in the supine position. *J Orthop Trauma.* 1995;9(3):207–214.
3. Routt MLC Jr, Simonian PT, Mills WJ. Iliosacral screw fixation: early complications of the percutaneous technique. *J Orthop Trauma.* 1997;11(8):584–589.
4. Cole PA, Bohl DD, Zlowodzki M. Innovations in the management of pelvic and acetabular fractures. *J Orthop Trauma.* 2015;29 Suppl 2:S2–S5.
5. Sagi HC, Coniglione F, Park SC. Correlating preoperative imaging with intraoperative fluoroscopy in iliosacral screw placement. *J Orthop Trauma.* 2015;29(9):e381–e385.
6. Routt MLC Jr, Simonian PT, Agnew SG, Mann FA. Radiographic recognition of the sacral alar slope for safe placement of iliosacral screws. *J Orthop Trauma.* 1996;10(3):171–175.
7. Miller AN, Routt MLC Jr. Variations in sacral anatomy and implications for iliosacral screw fixation. *J Orthop Trauma.* 2012;26(4):208–213.
8. Shaw J, Gary J, Ambrose C, Routt MLC. Multidimensional pelvic fluoroscopy: a new and novel technique for assessing safety and accuracy of percutaneous iliosacral screw fixation. *J Orthop Trauma.* 2020;34(11):572–577. doi:10.1097/BOT.0000000000001796.
9. Starr AJ, Walter J, Harris A, Reinert CM, Jones AL. Percutaneous screw fixation of the columns of the acetabulum: a new technique. *J Orthop Trauma.* 2002;16(4):245–253.

 DOI: ***10.5281/zenodo.22106664***

10. Banaszek D, Starr AJ, Lefaivre KA. Technical considerations and fluoroscopy in percutaneous fixation of the pelvis and acetabulum. *J Am Acad Orthop Surg.* 2019;27(24):899–908. doi:10.5435/JAAOS-D-18-00102.
11. Verbeek DO, Hermans E, van Vugt A, Frölke JPM. Correct position of percutaneous iliosacral screws with computer-navigated versus fluoroscopically guided surgery in traumatic pelvic ring fractures. *J Orthop Trauma.* 2016;30(6):331–335. doi:10.1097/BOT.0000000000000502.
12. Warner SJ, Haase DR, Routt MLC, Eastman GJ, Achor TS. Use of 3D fluoroscopy to assist in the reduction and fixation of pelvic and acetabular fractures: a safety and quality case series. *J Orthop Trauma.* 2023;37(11S):S1–S6. doi:10.1097/BOT.0000000000002686.
13. Zwingmann J, Konrad G, Kotter E, Südkamp NP, Oberst M. Computer-navigated iliosacral screw insertion reduces malposition rate and radiation exposure. *Clin Orthop Relat Res.* 2009;467:1833–1838.
14. Computer-assisted surgery and planning in percutaneous pelvic screw fixation. *Orthop Traumatol Surg Res.* 2026;112(1 Suppl):104392. doi:10.1016/j.otsr.2025.104392.

 DOI: ***10.5281/zenodo.22106664***