

Pelvis/acetabulum: management of geriatric injuries

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Abstract Geriatric pelvic and acetabular fractures pose significant challenges due to patient frailty, comorbidities, and the complexity of fracture patterns. This review examines current evidence and evolving strategies for managing these injuries. Treatment approaches range from nonoperative management to surgical interventions, including percutaneous fixation, open reduction and internal fixation (ORIF), and total hip arthroplasty, either as a standalone procedure or combined with ORIF. Decision making is guided by fracture morphology, patient functionality, and physiological reserve to optimize clinical outcomes. Minimally invasive techniques, particularly for fragility fractures of the pelvis, have gained traction because of their ability to provide stable fixation while minimizing surgical morbidity. The importance of early mobilization and a multidisciplinary perioperative approach is highlighted as essential in reducing complications and improving recovery. Despite advancements, controversy remains regarding the optimal treatment of complex acetabular fractures in elderly patients. This review synthesizes the latest evidence and expert perspectives to aid clinicians in selecting the most appropriate management strategies, with the goal of restoring mobility, minimizing complications, and enhancing the quality of life in this vulnerable population.

Keywords: osteoporotic fractures, acetabulum, pelvis bone, aged

1. Acetabular Fractures in the Elderly: Which Ones Need to Be Fixed?

When evaluating an elderly patient with an acetabular fracture, treatment decisions are complex and must be based on a comprehensive understanding of the patient so that appropriate goals for care can be established. The principles of stable fracture management, pain relief, and early rehabilitation should be met in any type of acetabular fracture in the elderly.^{1–3} However, decision making should involve not only the fracture pattern but also the patient's comorbidities and previous functionality.⁴ There are no high-level evidence guidelines or literature-based recommendations regarding the ideal management of these fractures; however, there are 5 possible alternatives including nonsurgical management, percutaneous management, open reduction and internal fixation (ORIF), ORIF plus total hip arthroplasty (THA), or THA alone, which may be immediate or delayed.^{4,5}

In well-selected patients, any of these treatments have the potential to yield good outcomes with similar mortality rates when adjusted for comorbidities.^{5,6} However, since we are seeing increasing life expectancy and higher functionality in patients

older than 65 years, surgical management is increasingly indicated to restore preinjury status or independence in activities of daily living and for pain management.³ This shift in approach highlights a philosophical change from “Which fractures should be fixed” to “Which patients should NOT be fixed?”

With these considerations in mind, the current role of conservative management is being reconsidered. A nonoperative approach was the treatment of choice until a few decades ago, and despite advances in understanding fracture patterns and internal fixation options, it still has a role in the management of these patients.⁷ These procedures pose a high surgical risk, and in general, patients selected for conservative management are older and sicker.^{4,5,8,9} Current indications for nonsurgical management include patients with high surgical risk; those with low previous functional demand, such as nonambulatory patients or those previously confined to bed; and those with some fracture patterns with minimal displacement or secondary joint congruence who are able to mobilize safely; all others should be considered for surgical management.^{5,8,10,11} It is important to note that conservative management does not mean confining the patient to bed rest; protocols should be established that include pain

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management, early rehabilitation, thromboembolic prophylaxis, and radiological follow-up.^{12–15}

2. Surgical Indications: Who Should Be Operated On?

The choice of appropriate surgical management also requires consideration of several factors. Krappinger et al² described that fracture-related factors, surgeon-related factors, and patient-related factors must be considered when deciding on the best individualized treatment for each patient.

Surgical treatment is recommended for patients with significantly displaced fractures or joint incongruity or for those expected to regain previous functional independence.^{14,16} ORIF has been the treatment of choice for displaced fractures, particularly in patients with good general health and good bone quality.^{4,15} This approach allows for near-anatomical restoration of the joint, reducing the risk of long-term complications such as post-traumatic osteoarthritis.¹²

Percutaneous fixation has emerged as a less invasive surgical option for treating acetabular fractures in the elderly, especially for those at higher surgical risk.⁵ This technique, which involves inserting screws through small incisions, is used in patients with nondisplaced or minimally displaced fractures.¹⁵ Studies have shown that percutaneous fixation offers good outcomes regarding pain reduction and stability, allowing for early mobilization and minimizing postoperative complications related to extensive surgical exposures.^{4,6,14} However, its use is limited to fractures with specific characteristics, such as those that do not significantly compromise joint congruence or stability.

On the contrary, in patients with severe osteoporosis or more complex fractures involving the femoral head, THA, whether alone or combined with ORIF, has shown good results.¹⁷ Several studies suggest that THA in the initial treatment of acetabular fractures may be superior in patients with negative predictors such as acetabular dome impaction, posterior wall injuries, or comminution.^{11,13,18} THA allows for early mobilization and reduces the risk of complications associated with prolonged immobilization.^{2,8}

Delayed THA, in which joint replacement is performed weeks or months after initial internal fixation, is reserved for patients in whom initial ORIF fails to maintain stable reduction or in those who develop post-traumatic osteoarthritis.^{12,13} This option has proven effective in patients with progressive acetabular collapse or in those with joint compromise that could not be resolved with ORIF alone. Although delayed THA carries a higher complication rate than early intervention, it remains an effective solution for those requiring definitive treatment to restore function and alleviate long-term pain, although it is associated with a high rate of arthroplasty revision.^{4,19}

If the fracture also involves the pelvic ring, we can use the fragility fractures of the pelvis (FFP) classification, as described by Rommens et al,²⁰ to complement treatment. FFP Type I and II fractures, which are less unstable, are usually treated conservatively with rest, pain management, and early mobilization, although treatment of FFP Type II may be more complicated because of posterior pelvic ring involvement. If conservative treatment fails, such as when the patient cannot tolerate weight bearing or walking, or if fracture progression is observed, surgical stabilization should be considered.²¹ FFP Type III and IV fractures, being more unstable and painful, generally require surgical treatment with minimally invasive techniques and stable fixation, allowing for early mobilization.¹⁶

In general, surgical indications can now be considered the standard of care, but it is necessary to balance the benefits of

surgery with the inherent risks in elderly patients, such as pulmonary or thromboembolic complications, and to identify those with indications for conservative management.

3. Comminuted Intraarticular Acetabular Fractures: ORIF Versus Arthroplasty

With the increase in life expectancy in the general population, there has been a rise in the relative and absolute number of cases of acetabular fractures in patients older than 65 years. Not surprisingly, these elderly patients have morbidity and mortality rates similar to those of hip fractures.^{3,22} In young patients with acetabular fractures, the main objective of the treatment is to restore articular anatomy to prevent post-traumatic osteoarthritis.²³ It is crucial to understand that in patients with low-energy acetabular fractures due to bone fragility, the main objective of treatment is to return the patient to their previous level of activity as soon as possible.^{3,24} Because these patients often have concurrent pathologies and have a physiological lability inherent to their age, it is essential to treat them with a multidisciplinary approach.^{3,11}

The following treatment options can be considered:

1. Conservative treatment
2. Percutaneous fixation
3. ORIF
4. Early ORIF plus THA
5. Late THA for failed treatment

Conservative treatment is indicated for nondisplaced fractures or minimally displaced fractures that do not affect the acetabular roof. The treatment consists of early mobilization with weight bearing according to tolerance.^{25,26}

Percutaneous fixation treatment is an attractive option for older patients, but reduction techniques are challenging, making this technique most suitable for fractures with acceptable reduction for which the main goal of surgery is fracture stabilization. Percutaneous fixation is contraindicated when there is a large posterior wall fracture due to the risk of neurological damage. Case series reporting the results of percutaneous fixation in the elderly demonstrate reduced complication rates and lower mortality compared with standard ORIF.^{27,28} One of the early proponents of percutaneous pelvic fixation, Dr. Starr, has shown that functional outcome and the conversion rate to THA when comparing ORIF with percutaneous fixation were quite similar (30% at 3 years).²⁸

The best indication for percutaneous fixation is a nondisplaced fracture where the goal is to mobilize the patient rapidly. Percutaneous methods can be considered in displaced fractures where an acceptable reduction can be obtained using closed methods, especially in patients with decreased physiological reserves where traditional open surgery is too risky or too difficult.^{3,27,28}

Traditional ORIF techniques are associated with longer surgical time and greater bleeding but have more predictable outcomes facilitated by improved quality of reduction and fixation.²⁹ In elderly patients, traditional fixation is often augmented with additional screws and longer screws. ORIF is best indicated in patients with “poor prognosis radiological signs” (PPRS). Anglen et al¹⁸ were the first to describe this kind of radiographic finding when they reported on the “gullwing” sign indicating impaction of the dome of the acetabulum. Over time, many other PPRS have been described, including osteoporosis, concomitant hip osteoarthritis, subluxation of the femoral head, posterior wall involvement, marginal impaction of the articular surface, and osteochondral damage of the femoral head.^{18,30,31} For ORIF to be effective and achieve a low rate of conversion to THA, an exact anatomical reduction must be achieved and there must be no residual PPRS.^{3,23,28,32–34}

Finally, combined ORIF plus THA is technically demanding because the surgical team must have experience in both, and these procedures are associated with more blood loss and operating room time than ORIF alone. On the contrary, it can be a single surgery that may allow immediate postoperative weight bearing, which is so important in these patients. Therefore, we choose combined ORIF and THA in patients with many PPRS and in those who can tolerate longer surgery.^{35,36}

Many orthopaedists choose to wait for the patient to achieve malunion of the fracture and then perform a delayed THA. This approach does not seem to us to be the most appropriate, since it would put the patient at risk of complications from prolonged bed rest. In addition, worse final functional results of late THA are reported compared with acute THA.³⁷

Wide variability in the choice of treatment has been reported across trauma centers worldwide, and controversy continues.³⁸ Taking into account the different treatments available, the authors follow a logical stepwise approach to determine treatment of patients with fragility acetabular fractures (Fig. 1). The first item we consider is whether the fracture is nondisplaced (or at least the femoral head is congruent with the acetabulum) or whether the patient has absolute contraindications for surgery. When either or both of these are true, nonsurgical treatment is considered.

If there is displacement of the fracture, then one needs to determine whether the patient can tolerate traditional open surgery. If not, we perform a percutaneous reduction and fixation to reduce the risks to the patient. If the patient has good physiological condition, it is appropriate to look for the existence of PPRS. If none exist, we choose ORIF. However, if the imaging studies show many of them, we recommend ORIF plus THA.

In conclusion, the main goal of treatment is to return the elderly patient with a fragility acetabular fracture to weight bearing rapidly. The optimum treatment for a given patient depends on many variables, and a multidisciplinary approach is key for best results.

4. Minimally Invasive Fixation of Fragility Fractures of the Pelvis

The incidence of fragility fractures of the pelvis (FFP) during the past decade in patients older than 65 years has risen dramatically.

In 1 study from the United States, data from the Nationwide Inpatient Sample of more than 600 million Medicare discharges from 1993 to 2010 demonstrated that the incidence of geriatric pelvic fractures increased by 24% during that period.³⁹ Similarly, data from the German Pelvic Trauma Registry show that during 1991–1993, the highest incidence of pelvic fractures was in men aged 21–25 years, whereas in 2004–2010, these injuries were most common in women aged 81–85 years.

FFP differ from pelvic fractures in younger patients in many significant ways. They result from low-energy trauma that occurs in bone that is osteopenic and weak. Fractures follow the areas of lowest bone mineral density. As a result, fractures are often bilateral, and H-type sacral fractures are much more common in the elderly. Typically, the bone fails between intact ligaments. We observe an implosion of the pelvic ring instead of an explosion, which occurs in high-energy trauma. The injuries can become more unstable with time. Owing to the unique characteristics of these fractures, a comprehensive classification of fragility fractures of the pelvic ring with recommendations for treatment has been proposed.^{20,40} The injuries are classified by the degree of instability and the specific fracture pattern and can be divided into 4 categories.

The treatment principle for FFP in the elderly is first and foremost to provide adequate pain management. This then enables successful conservative management, when possible, as well as reduces morbidity in patients that require surgery. When needed, surgery should be as less invasive as possible because of the frailty of these patients. Achieving stability of the pelvic ring is more important than perfect restoration of the bony anatomy, and patients must be mobilized as early as possible.

Minimally invasive fixation of the FFP in the elderly can often be performed using percutaneous screw fixation. Rommens et al⁴¹ published their experience with the operative treatment of FFP and found lower mortality compared with nonoperative management. Over a 10-year period, approximately 22% of FFP II fractures and 69% of FFP III–IV fractures were treated operatively, and in both groups, survivorship was greater in the operative group compared with patients managed conservatively, at all periods. In another study of 30 patients with osteoporotic posterior pelvic ring injuries, iliosacral screw fixation reduced pain significantly and was associated with screw loosening in 3.3% of patients.⁴² However, a larger study of 50 patients with

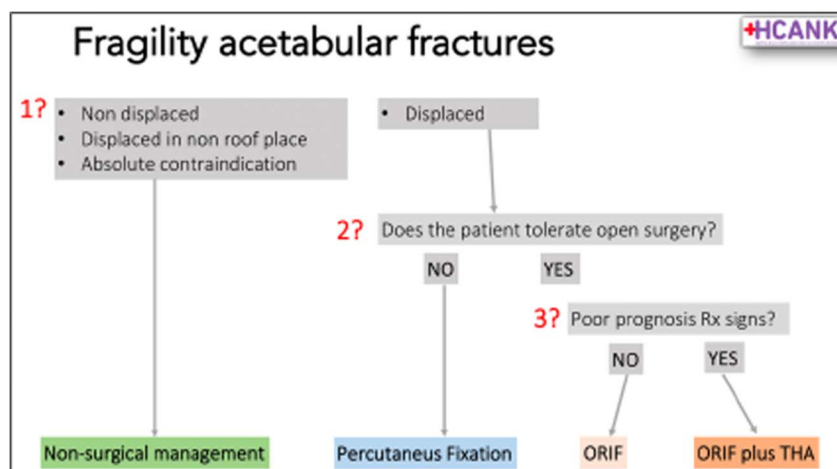


Figure 1. Treatment algorithm for fragility fractures of the acetabulum. ORIF, open reduction and internal fixation; THA, total hip arthroplasty.

FFP similarly showed good function outcomes, although 18% of patients required revision surgery due symptomatic screw loosening.⁴³

Achieving biomechanically sound fixation in patients with FFP is clearly important, and investigators have looked at different methods of improving traditional screw fixation in the elderly pelvis. One method is to augment host bone density by inserting bone cement at the tip of the screw. Biomechanical data show that pullout strength of the augmented screw was significantly greater, but that with cyclic loading, the overall construct failed at a similar rate with the failure occurring at the iliac wing instead.⁴⁴ Currently, the clinical benefits of adding bone cement to augment iliosacral screw fixation remain unproven.⁴⁵ Another method to improve fixation is to use longer screws that are fixed in the dense bone of the opposite iliac crease, the so-called trans-sacral fixation. Biomechanical evaluation of posterior pelvic fixation shows greater strength of trans-sacral, transiliac fixation compared with standard iliosacral screw fixation.⁴⁶ The benefits of trans-sacral screw fixation have been clinically verified in a small clinical study of 16 patients, all of whom were able to walk within 3.6 days of surgery. 75% of patients were discharged home, and there were no complications.⁴⁷ Other techniques such as posterior trans-sacral bars and posterior pelvic plating have been reported.

Finally, the need for fixation of the anterior pelvic ring when such injuries occur in patients with FFP has been unclear. A biomechanical study of simulated FFP III injuries in osteopenic bone showed that anterior ramus fixation with an intramedullary screw significantly improved stability of the entire pelvic ring and also prevented fracture progression with cyclic loading.⁴⁸ Anatomical pelvic models have been studied and show that safe, straight bony corridors allowing for trans-sacral fixation are only found in the posterior pelvis in approximately half of the patients and, in up to 20%, there is no straight sacral corridor.⁴⁹ Similar findings have been found in the pubic rami,⁵⁰ suggesting that curved implants may be of benefit when performing percutaneous fixation of the pelvic ring.

In summary, FFP in the frail elderly are challenging to treat. Percutaneous methods of pelvic fixation continue to advance and can now be performed with minimal morbidity. Data suggest that such methods of surgery, when performed minimally invasively, can provide sufficient mechanical stability for immediate patient mobilization, with a low complication rate, and may reduce mortality compared with nonoperative management in patients with FFP involving the posterior pelvic ring.

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