P

atients who sustain an acetabular fracture are a challenge to the orthopedic surgeon because of the inherent difficulty of the fracture and its treatment. Acetabular fractures in elderly patients add another level of complexity with additional co-morbidities associated with age such as osteoporotic bone, the fracture type and comminution, medical conditions, and insufficient bone stock to support fixation.

Natural History
The elderly represent the fastest growing subset of the American population. Geriatric patients will represent a large subset of acetabular fractures by the year 2010. In the future, the goals of treatment for the elderly must be the same for any other trauma patient with an acetabular fracture – rapid mobilization and restoration of the pre-injury level of function.

Today, treatment alternatives include, open reduction and internal fixation (ORIF) and immediate total hip arthroplasty (THA) or conservative treatment with traction or bed rest followed by subsequent THA as needed.

There are few studies that specifically address treatment of the acetabular fracture in the older population. Most of the studies available on the treatment of the acetabular fracture are as part of generalized one surgeon series, with an elderly subset.

Clinical Presentation
In elderly patients, acetabular fractures, like hip fractures, often result from simple falls. While this may not cause a fracture in a young patient, in the elderly with osteoporotic bone, comminuted fractures, especially those involving the anterior column and quadrilateral plate, are common. Poor bone quality may also cause impaction of the articular surfaces of the acetabulum and the femoral head. In addition, concomitant intertrochanteric or femoral neck fractures can occur and need to be ruled out. In patients presenting with groin or hip pain a thorough diagnostic work-up is required since occult hip or acetabular fractures may be missed.

Diagnostic Work-Up
The diagnostic work-up includes standard x-rays with anteroposterior pelvis as well as obturator and iliac Judet views. Inlet and outlet pelvic views are recommended if sacroiliac joint injuries or sacral fractures are suspected. In addition, a computed tomography (CT) scan of the pelvis with 2 mm cuts is recommended to assess the fracture patterns in detail and thus facilitate decision making for operative versus conservative treatment and to carefully plan an operative procedure. Radiological imaging also provides critical information on the bone quality. Severe osteoporosis may influence decision making for operative versus non-operative treatment.

History and Physical Examination
The diagnostic work-up is not limited to radiological imaging. A thorough medical work-up is required to perform critical risk analysis. The operative risk assessment must include: laboratory tests, a thorough physical exam including peripheral neurovascular status, cardiac evaluation using EKG, echocardiography and additional tests if required, pulmonary evaluation using chest x-ray (AP and lateral views) and pulmonary function tests with spirometry, renal and hepatic evaluation if necessary, and possibly Doppler ultrasound of carotid arteries. Preopera-
The work-up may also include the patient’s social status and assessment of daily activities and physical fitness as well as possible postoperative home support. Currently, magnetic resonance venography (MRV) is an option used in order to rule out pelvic thrombi. MR has the benefit of being able to evaluate for pelvic thrombi non-invasively and is added to the standard MR evaluation of the pelvis to define occult bony or soft tissue injury.17-18
**Decision Making**

Non-operative treatment of acetabular fractures in the elderly can result in an unacceptable functional result if the fracture is displaced; this underscores the need for surgical treatment in all but the cases with minimal displacement out of traction.\(^4\)

In patients with non-displaced or minimally displaced fractures (less than 2 mm) and no subluxation of the hip joint, non-operative management may be considered. Conservative treatment includes adequate pain management and functional physical therapy with bed-to-chair transfers and pivoting on the non-fractured side. Deep vein thrombosis prophylaxis is mandatory. In addition, toe-touch weight bearing on the injured side can be allowed if compliance and motor coordination of the patient are sufficient enough to be able to follow these restrictions. Conservative treatment requires weekly radiographic controls until healing and to exclude fracture displacement.

**Surgical Indications**

The treatment of displaced acetabular fractures in elderly patients should be based on the same surgical principles and indications that are applied to younger patients. Significant fracture displacement (greater than 2 mm) and joint subluxation require open reduction and internal fixation in order to realign the joint surface and the weightbearing dome (Fig. 1). In elderly patients with medical risk factors or limited functional activity some intra-articular gap malalignment secondary to comminution and displacement is acceptable. Conservative treatment consisting of prolonged bed rest or skeletal traction in an attempt to achieve a concentric reduction cannot be considered a good treatment option for these fractures due to the morbidity of prolonged recumbency and the inadequate reductions achieved with traction.\(^5\) It is controversial whether the surgery for these elderly patients should be open reduction and internal fixation, primary total hip arthroplasty, both as delayed total hip arthroplasty.

Some elderly patients with an associated both column acetabular fracture with secondary congruence of the articular surface may be treated conservatively if the articular congruity can be maintained without traction and if the patient can be mobilized.

Non-operative (conservative) treatment was once the standard of care for these elderly patients with acetabular...
fractures due to their low physical demand and the morbidity associated with the surgical procedure; the patients were held in traction, for extended periods of time, in order to obtain bone healing. Spencer and colleagues reviewed data with this kind of treatment and demonstrated that 30% of the patients had unacceptable functional results and that rather internal fixation should be considered in the older population when there is little possibility that a satisfactory result can be obtained by other means.4

Open reduction and internal fixation of geriatric acetabular fractures is recommended in the majority of cases with displacement and hip subluxation.5,6 Indications are based on a fracture with a pattern amenable to fixation through a single non-extensile exposure without performing a trochanteric osteotomy or disrupting the abductor musculature, adequate bone quality for fixation, no femoral head injury, and whether the reconstruction may be performed in a reasonable surgical time (i.e., 3 to 4 hours), (Fig. 2).

The current data supports that, in the presence of a displaced acetabular fracture in an elderly pre-injury ambulator, ORIF is an excellent treatment option when using a single anterior or posterior approach; it provides adequate fixation for early weight bearing and restoration of the bone stock.

A study performed by the senior author (DLH)7 reviewed 45 patients 55 years or older with an acetabular fracture and whom subsequently underwent surgical management and ORIF; acute ORIF has shown to be feasible, with a low complication rate (4% to 7%) and a satisfactory outcome. This study also identified predictors for a poor outcome: femoral head injury (impaction, fracture, AVN) or a die punch acetabular impaction/fracture type lesion.

Percutaneous methods for the stabilization of acetabular fractures are being developed and may be applicable in certain cases (i.e., a frail patient that requires rapid mobilization with a minimally displaced fracture). These percutaneous techniques provide adequate construct rigidity, however, the load to failure is less than that of traditional plate and screw fixation and reduction may be an issue.7,9 Transfer to an appropriate referral center for definitive treatment has to be encouraged for patients with more displaced and complicated fractures.

For acute total hip arthroplasty in cases of acetabular fracture it is necessary to reduce the gross pelvic deformities sufficiently enough to provide a bed for the prosthetic acetabular shell and to achieve acetabular fixation and bone stock in order to allow ingrowth into the cup, or a stable well fixed cement mantle.

Acute THA is necessary in the presence of an irreparable femoral head injury, preexisting arthritis, significant impaction injuries, marked comminution, or the need for an extensile approach when managing these elderly acetabular fracture patients.10-12

Acetabular fixation with THA can be performed using standard plate and lag screw techniques. Alternatively, cables have been proposed (i.e., via passing braided cables around the ischium and across the quadrilateral surface, exiting the pelvis in the region on the anterior inferior iliac spine and across the supra-acetabular region on to the outer table of the pelvis). This construct gives a stable both-column configuration and supports the quadrilateral lamina in order to support acetabular reaming and uphold the acetabular shell.13 Using this technique, all fractures healed but the cup often migrated between 2 and 3 mm, with acetabular loosening in up to 53% at seven years compared to 11% in a cohort of routine THA patients at the same institution. Clearly, stabilization of the bony anatomy must be reached in order to achieve a successful prosthetic acetabular reconstruction.13

Investigators at the Mayo clinic reported the results of a series of 66 patients having a THA after an acetabular fracture with a mean follow up of 9.6 years.13 Twenty-seven percent of these patients underwent a revision of the THA at the time of the review. Failure of the acetabular component was noted to be four to five times higher than in cases performed for routine osteoarthritis. They concluded that premature failure or deficiencies of acetabular bone stock was the major difference and that acute restoration of the bone stock may improve the outcome.

The additional option of limited acute ORIF combined with THA has not been explored. However if acute acetabular ORIF is possible and the patient can tolerate and is a candidate for the procedure, the indications for an additional THA are limited (particularly by the type of femoral head injury present).

Bellabarba and coworkers, in a study of 30 patients with cementless acetabular reconstruction after acetabular fracture, showed a good to excellent result in 90% of the patients with a Harris hip score of 88. The study concluded that intermediate-term results of THA with cementless acetabular reconstruction for posttraumatic arthritis after acetabular fracture were similar to those after the same procedure for non-traumatic arthritis regardless of whether the acetabular fracture had been internally fixed initially.16

What has not been compared is acute ORIF followed by delayed THA. The latter may be better than acute THA. This cannot easily be determined because there is morbidity associated with both procedures. In the most recent study done by the senior author (DLH) the complication rate was high for ORIF and acute THA in the face of an acetabular fracture. From the same data of patients that underwent acute THA, two-thirds of the patients presented with complications. The complications rate reported in Mears’ series of ORIF with acute THA was 5%. Acetabular fracture surgery is known to have a high complication rate. Matta’s complication rate was 16%.7 Limited ORIF and THA would not have a significantly higher morbidity than formal ORIF, and that one operation would carry less overall morbidity than two operations.14,16

Based on the current knowledge it does appear that an injury to the femoral head may predict poor hip joint endurance and strong consideration should be given to acute
total hip arthroplasty. It is possible that future advances in arthroplasty techniques possibly combined with newer techniques in limited or percutaneous fixation may allow for less morbid, more durable acute hip reconstructions in these patients.

The recommendations to treat an acetabular fracture in elderly patients from the current literature are:

1. Acute ORIF with acceptable reduction if no femoral head injury and the patient is a candidate for surgery.
2. Acute ORIF with total hip arthroplasty if femoral head injury or reduction is not possible.
3. Delayed total hip arthroplasty if not a surgical candidate acutely, and if subsequent failure of acute ORIF.

Overview
The question that remains controversial is whether or not geriatric patients with acetabulum fractures should be treated by open reduction and internal fixation or total hip arthroplasty, either acute or delayed. Anatomic reconstruction of the acetabulum has been shown conclusively to provide excellent long-term outcomes; this is clearly preferable to prosthetic reconstruction as it obviates many of the well-known complications of arthroplasty in this setting. This holds true even in the geriatric population, though anatomic reconstruction may be more difficult. In the event that post-traumatic arthritis develops, prior reconstruction of the bony anatomy will provide far better bone-stock for the arthroplasty. Initial non-operative treatment may be justified if there is no gross pelvic deformity or subluxation of the hip joint without resorting to traction. Minimally invasive stabilization techniques may have a role at some point, but they do not obviate the need to obtain an acceptable reduction.

References