Controversies In Treatment Of Acetabular Fracture

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ABSTRACT

Introduction

Acetabular fractures treatment represents a great controversy, challenge and dilemma for an orthopedic surgeon. The aim of the paper is to present the results of different management of acetabular fractures according the age, occupation, health status and etc of patients. At the occurrence of acetabular fracture, it is necessary to start the treatment immediately, with an obligatory application of thromboembolic and antibiotic prophylaxis. Conservative
treatment is acceptable if the dislocation of fracture is less than 2.5 mm. Indications for surgical treatment are incongruent or unstable fractures with verified dislocation greater than 2.5 mm, as well as when the radiography measured by JM Matta shows incongruence of acetabular roof less than 40° in all planes.

**Keywords:** acetabulum, fracture, therapy, controversy elderly,

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**The young and adult problem**

Fractures of the acetabulum occur primarily in young adults as a result of high-velocity trauma. These fractures are often associated with other life-threatening injuries. The exact incidence of acetabular fractures in various parts of the world is not known. Studies at level I trauma centers have shown an admission rate for pelvic and acetabular fractures of 0.5-7.5% (Tab.1). Displacement of the fracture fragments leads to articular incongruity of the hip joint that results in abnormal pressure distribution on the articular cartilage surface. This can lead to rapid breakdown of the cartilage surface, resulting in disabling arthritis of the hip joint[1]. Anatomic reduction and stable fixation of the fracture, such that the femoral head is concentrically reduced under an adequate portion of the weight bearing dome of the acetabulum, is the treatment goal in these difficult fractures.
<table>
<thead>
<tr>
<th>Fracture type</th>
<th>Letournel, % (n = 567)</th>
<th>Matta, % (n = 255)</th>
<th>Dakin et al, % (n = 85)</th>
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<tr>
<td>Anterior wall</td>
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<td>1.2</td>
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Tab.1: Relative Frequency Of Acetabular Fracture Types In Large Casistic Various Studies

**Indications**

Indications for open reduction and internal fixation include the following [1-9]:

- All displaced fractures (>2 mm articular step)
- Intact roof-arc angle less than 30°
- Failure to achieve or maintain concentric reduction by closed means
- Fractures that have a medial roof-arc angle of 45° or less, an anterior roof-arc angle of 25° or less, or a posterior roof-arc angle of 70° or less across the weightbearing portion of the acetabulum, according to Vrahas et al, on the basis of a cadaveric study; persistent instability after closed reduction
- Incarcerated intra-articular fragments or impaction of the articular surface
- Emergency open reduction and internal fixation (ORIF) if associated vascular injury or sciatic palsy develops after a closed reduction

Nonoperative treatment should be considered in the following circumstances[1-9]:

- Undisplaced fractures
- Displaced fractures if the following conditions are met: (1) A large portion of the acetabulum remains intact and the femoral head remains congruous with this portion of the acetabulum; (2) a secondary congruence is present after only moderate displacement of a both-column fracture and the patient presents late (>3 weeks after injury)
- Small posterosuperior wall fractures that are associated with a stable hip joint and a congruent reduction; careful follow-up is needed to monitor for signs and symptoms of late instability in the initial months after injury
- A posterior wall injury that is minimally displaced or nondisplaced and is part of a more complex pattern requiring an ilioinguinal approach
- If surgery is contraindicated (see Contraindications)

The Elderly Problem

The U.S. population is aging. By 2030, it is estimated that 17% of the population (55 million Americans) will be over 65 years [10,11]. Elderly individuals consequently represent the most rapidly growing subgroup of patients currently sustaining acetabular fractures [12]. The incidence of such fractures is expected to approximately double over the next 20 years [13]. The goal of treatment is to reconstitute the hip joint to provide a stable, painless construct capable of rapidly recovering its preinjury level of function. Successful open reduction and internal fixation (ORIF) and total hip arthroplasty (THA) are both treatment options compatible with achieving these goals in properly selected patients. However, treatment decisions must be highly individualized. Early referral to an appropriate center experienced in acetabular reconstruction is to be encouraged.

Multiple subsets exist within the elderly population. These can be generally categorized as patient factors, injury factors, or treatment factors[10]. Patient factors in the elderly include physiologic age, degree of underlying osteoporosis, comorbid medical conditions, preexisting degenerative joint disease (DJD), premorbid activity level, and baseline mental function. Injury factors include injury mechanism, fracture characteristics, and presence of associated injuries. Treatment factors include the chosen management pathway, the quality and timing of treatment rendered, and the deleterious effects of any perioperative complications. Of these, only treatment factors are under the control of the operative team. Optimal management of the elderly patient with an acetabular fracture requires that each of these factors be considered when formulating the treatment plan[10].
Where we can do the good management?

Adult and Elderly patients with acute acetabular fractures presenting to the Orthopedic Trauma Service at Hospital for Special Surgery (HSS) are treated according to the following recommendations [10-15] (Fig.1).

Acute ORIF with an acceptable reduction of the acetabulum and restoration of joint congruency through a single anterior or posterior approach if no femoral head injury and the patient is a candidate for surgery.

We must prefer in the elderly: Acute ORIF with THA if femoral head injury or reduction not attainable. The acetabular columns are reduced and stabilized with rigid internal fixation prior to insertion of the acetabular component. (Other acute THA techniques have been used at our institution with good early results [7].)

Instead in young and adult, we must always try with ORIF.

Delayed THA if not a surgical candidate acutely, or salvage THA if ORIF failure.

**Acetabular Fracture in an Elderly Patient**

**Treatment Determinants:**

Patent and Injury Variables

I. Resides in a nursing home setting.
II. Not a medical candidate for any surgical procedures.
III. Has severe osteoporosis.
IV. Associated both-columns fracture with "secondary congruence".
V. Low Transverse fracture.
VI. Posterior Wall fracture involving <25% with stable hip joint.
VII. Minimally or non-displaced fracture.

I. Functional ambulatory.
II. Able to tolerate surgery.

A. Expectation of an acceptable reduction with ≤3-4 hours operative time through a single non-extensive approach.

A. Irreducible through single, non-extensive exposure.
B. Anticipated protracted surgical time (>3-4 hours).
C. Severe acetabular impaction/communion.
D. Displaced femoral neck fracture.
E. Significant femoral head fracture/impaction.
F. Significant pre-existing arthrosis.

a. Non-operative treatment
   - Skin traction for comfort
   - Rapid mobilization, toe-touch weight bearing
b. Secondary total hip Arthroplasty, as indicated

a. Open Reduction and Internal Fixation

a. Open Reduction and Internal Fixation with primary total hip arthroplasty

**Fig. 1:** Treatment algorithm for acetabular fractures in the elderly[15.]
Should the patient meet the criteria predictive of successful ORIF, they are enrolled in a standard treatment protocol, applied to all adult acetabular fractures.

Initially, the patient young or adult or elderly is evaluated in accordance with advanced trauma life support (ATLS) principles, to include complete primary and secondary surveys. Emergent surgical indications are ruled out during this stage. A–P pelvis radiographs obtained during this stage initially identify the acetabular injury. Complete medical, surgical, and social histories are obtained with emphasis regarding those factors, which could affect the hospital course, surgical intervention, or ability to fully participate in rehabilitation. These include premorbid ambulatory status, occupation, living conditions, use of tobacco, alcohol or illicit drugs, history of DVT, bleeding disorders, allergies, underlying DJD, chronic medications that may have deleterious effects on bone healing, and history of previous irradiation to the pelvis.

Further radiographic imaging is directed by the orthopedic physical exam in an effort to identify any associated injuries. The pelvis is further evaluated with Judet views and CT of the pelvis with 2 mm cuts. These studies allow complete elucidation of the fracture pattern, and are critical for initial management decisions (operative vs. nonoperative; ORIF vs. THA). Fracture classification as described by Letournel [15] is useful for selecting the appropriate operative approach and for planning fracture reductions. Any evidence of continued cartilage impaction or instability requires application of skeletal traction to avoid abrasive erosion or vascular compromise to the femoral head.

A comprehensive medical evaluation is mandatory. This ensures medical optimization prior to operative intervention, and provides operative risk assessment. This includes, as indicated, a standard laboratory battery (complete blood count, chemistry panel, coag's, urinalysis, urine culture), cardiac evaluation (12-lead EKG, cardiac enzymes, echocardiogram), pulmonary evaluation (chest x-ray, pulmonary function testing with spirometry), renal function tests, hepatic evaluation and carotid Doppler ultrasound. Neurologic deficits are confirmed and followed through the postoperative period by the neurology service. Early social work intervention is initiated for postoperative planning, placement, and prepositioning of home health care services.

Preoperatively, adequate pain management and DVT prophylaxis (pneumatic compression boots and pharmacologic intervention if not contraindicated) are provided. Foley catheters are commonly placed for patient comfort, but are removed at least 24 h prior to surgery in an effort to minimize infection. Magnetic resonance venography (MRV) is conducted one day before surgery to rule out DVT. MRV is advantageous over duplex ultrasound as a screening tool because of its ability to accurately image pelvic thrombi [10]. Inferior vena cava (IVC) filters are placed preoperatively in patients with demonstrated DVT or those considered at high risk (past history of DVT). Two to
four units of PRBC are typed and crossed for use in the main operating room. Fresh frozen plasma (FFP) should be available in cases with underlying coagulopathy or hepatic dysfunction.

In the main operating room, positioning is dependent upon the operative approach. Foley catheters are placed in all patients. Care is taken to pad all bony prominences and to properly place axillary rolls in case of lateral decubitus positioning. In most cases, epidural anesthesia is provided by the anesthesia team. Antibiotics (a cephalosporin, unless contraindicated) are provided approximately 30 min before initial skin incision. EMG and SSEP monitoring is conducted throughout the procedure. Hypotensive anesthesia and careful hemostasis minimize blood loss. A cell saver is utilized in all cases, and blood is returned to the patient whenever sufficient quantities are obtained. PRBC are provided as indicated.

Surgical approaches, as well as reduction and fixation techniques are dependent upon the fracture type, and are well described elsewhere [10]. In all cases, however, effort is taken to ensure anatomic reduction of the articular surface. When accessible, the joint is debrided and femoral head inspected for evidence of articular damage. Intraoperative radiographic verification of reduction quality and hardware positioning is conducted prior to closure. Atraumatic handling of soft tissues and wound closure over hemovac drains minimizes postoperative wound complications.

Postoperatively, elderly patients are commonly maintained in the PACU or ICU overnight to ensure an adequate level of care. Initial PCA (patient-controlled analgesia) pain control is managed by the Pain Service; DVT prophylaxis (typically a Coumadin pathway and pneumatic compression boots) is initiated; antibiotics are continued for 48 h, or until drains are discontinued; and heterotopic ossification prophylaxis initiated in case of an extensile approach and absence of contraindications. Posterior hip precautions are maintained for 6 weeks in case of a Kocher-Langenbeck approach. Drains are continued until output is minimal and the patient has mobilized. Physical therapy is initiated early with emphasis on transfers, walker-assisted ambulation with toe-touch weight bearing and pivoting on the effected extremity, range of motion at the hip, and quadriceps strengthening. Medical management remains critical throughout this period. Postoperative CT of the acetabulum is obtained before discharge to quantify the quality of reduction.

During the subacute recovery phase, patients are most commonly transferred to rehabilitation facilities with continued supervised physical therapy. Initial clinic follow-ups occur at 2 weeks for wound check, and at 6 weeks for functional and radiographic evaluation. Metabolic workup and treatment for future fracture prevention are indicated for patients with low-energy mechanisms or other evidence of significant osteoporosis[10].
What approach to the fractures in the young or adult patients?

The choice of approach usually is dictated by the fracture anatomy, but it also depends on the personal preference and experience of the operating surgeon. Guidelines for the choice of approach are as follows[1-11]:

- Anterior fracture, cephalad to iliopetricaneal eminence - Iliofemoral
- Anterior fracture, patients with complex injuries requiring exposure of the symphysis or quadrilateral plate - Ilioinguinal
- Posterior wall/column - Kocher-Langenbeck
- Transverse with posterior lip - Kocher-Langenbeck or transtrochanteric
- Transverse without posterior lip - Depending on the rotation of the fracture
- T-shaped - Depending on the fracture pattern, ilioinguinal/Kocher-Langenbeck/combined/extensile
- Both columns - Ilioinguinal, modified ilioinguinal/combined/extensile

Of these exposures, the ones commonly performed are the ilioinguinal exposure for anterior column or T-shaped or bicolumnar fractures with mild comminution in the posterior column, and the Kocher-Langenbeck exposure for posterior column injuries.

Isaacson et al investigated the use of the modified Stoppa approach for the treatment of acetabulum fractures with regard to three outcomes: hip function, complications, and quality of fracture reduction and percentage of fractures that united. They concluded that for a variety of acetabular fractures, this approach yields good functional outcomes with minimal complications.

Controversies in young or adult patients

From 1980 to 2007, Ferguson presented radiological and epidemiological studies on acetabular fractures in patients aged over 60 years. The series included 1309 patients. The study showed that the fracture was characterized by a shift of the anterior column, more frequently in the elderly when compared to younger patients. Impacted fracture of the acetabular roof was present in 40% of cases, and impacted anterior wall / column was represented in 38% (16,17). In the study from 1990 to 2006, Saveski J. (16,17) treated 236 patients with acetabular fractures (16,17), according to the Letournel’s classification, in 86 patients (36, 4%), simple acetabular fractures were represented, and 150 patients (63.6%) had a complex fracture (17).

When compared to younger patients, the percentage of elderly patients with acetabular fractures increased during the 27-year-old researches with different distributions of fractures (16,17). In a study by 1152 patients, during the treatment of traumatic arthritis with arthroplasty and anterior approach, the authors came to the following conclusion: the low percentage of dislocation, earlier return of functions and reduced intra- and postoperative complications (16,17).

In treatment of acetabular fracture, the following controversy is raised: whether to primarily perform the hip arthrodesis due to fractures? In my series, I have always strive to do a restitution of the acetabulum. Acetabulum repaired, even incongruent one, provides good support and stability to hip arthroplasty. It is still a great controversy.
in orthopedic surgery to do a hip replacement after arthrodesis is done. In a series by 151 patients who had hemodynamic instability, an unstable pelvic fracture was accompanied by acetabular fractures. The pelvis was primarily treated with external fixation (16,17). Dynamic stability was clinically achieved by placing an external fixator. Radiographically, despite the improvement of arcus pubis (symphysis pubis), 64% of patients had an aggravation of posterior diastase (sacroiliac joint) (16,17). Finding of “external fixator deformity” in 73% of cases, which is diagnosed with an emergence of increasing flexion or internal rotation of the hemipelvis (16,17), is characteristic. During his 10-year-old experience, JM Matta has stated that surgical treatment of acetabulum fracture through ilioinguinal approach provides excellent results obtained with surgical treatment in 119 (33%) out of the 373 acetabular fractures. The following fractures were managed with the ilioinguinal approach: anterior wall or column, the anterior column associated with transverse fractures as well as columns with transverse fractures (16,17). Matta also indicates some complications: wound infection 3%, iatrogenic nerve injury 2%, death from pulmonary embolism 1%. After one year, clinical postoperative results were as follows: excellent in 37% of patients, good in 47%, satisfactory in 14% and poor in 2% of patients. Two patients underwent arthroplasty due to post-traumatic arthritis (16,17). From March, 1991 to December, 1992, Cole JD and Bolhofner BR surgically treated 55 acetabular fractures using the ilioinguinal approach (16,17). The approach provides an excellent visualization of the pelvic ring. Patients were followed for 17.7 months on average (16,17). The fracture was repaired 6-12 weeks after surgery. Radiographic marks were as follows: excellent in 64% of patients, good in 25%, satisfactory in 7% and poor in 4% of patients. The following complications were stated: transient failure of n. femoral vein in 2 patients, one infection, and one inguinal hernia (16-17). The established reposition was lost in one patient. In the first year of life, six patients reported post-traumatic arthritis. Heterotopic ossification was not statistically significant (16-17). Clinical results for this sample were as follows: excellent in 47% of patients, good in 42%, satisfactory in 9%, and poor in 2% of patients. In acetabular fractures controversy is raised by a dilemma whether to primary solve the fracture with endoprosthesis. In the study, the authors stated that he primarily used osteosynthesis when treating acetabular fractures in patients aged over 70 years, and simultaneously, he embedded total cement prosthesis. They had 8% of revisions. Averagely one year later, 21 % of the patients who were primarily treated only with acetabular osteosynthesis needed endoprosthesis as well (16-17).

Letournel et al. presented their experiences in the treatment of 195 acetabular fractures using the ilioinguinal approach in 178 cases (90%), and in 17 cases (10%), using a combination of Kocher- Langenbeck approach, as a double cut. 39 simple and 156 complex cases of acetabular fractures were surgically treated. In 39 cases of complex fractures, the fracture of anterior column and transversum occurred, while in 98 patients, the fracture of anterior and posterior wall occurred (16,17). Incongruence of acetabular fractures through the ilioinguinal approach was perfect in 85% of cases. The complication rate was extremely low, with no evidence of external iliac heterotrophic ossification (16,17).
The surgery in the elderly.

Acute ORIF is indicated for the majority of elderly patients sustaining displaced acetabular fractures [10]. Regardless of age, ORIF of acetabular fractures will consistently provide satisfactory results when:

1. An anatomic acetabular reduction with a congruent hip joint is achieved and maintained through healing.
2. The femoral head is preserved as a bearing surface.
3. Complications are avoided.

It is critical to select those patients at high risk for early failure and joint destruction. Should any of the above requirements be deemed unattainable due to underlying patient, injury, or treatment factors, an alternative to ORIF should be sought.

Acute THA

Select acetabular fractures in the elderly have a predictably poor prognosis when treated either conservatively or with ORIF. Frequently, staged or acute THA is ultimately required. Although the role for acute THA remains somewhat controversial, this solution does provide the shortest overall recovery period for these injuries [10]. The rationale for acute THA in this setting is similar to that applied to femoral neck fractures, namely, early mobilization and avoidance of a subsequent surgical procedure [10]. To date, most literature regarding THA following acetabular fracture evaluates delayed THA versus acute THA. Conduct of acute THA, therefore, requires further evaluation and definition.

Mears and Velyvis [21] followed up 57 patients who underwent acute THA with minimal internal fixation for a mean of 8.1 years (range, 2–12 years). Mean age was 69 years (range, 26–89; 18 patients were younger than 60 years). Transverse and comminuted anterior column fractures with displacement of the quadrilateral surface were stabilized with two 2.0-mm braided cables [20]; both-column fractures received an additional percutaneous lag screw. Good to excellent outcomes were achieved in 79% (45/57). When the elderly were considered in isolation, functional outcomes were noted to decrease with increasing age, although results still appeared favorable. The adequacy of fixation, however, has been questioned [3]. The main concern when utilizing THA for an acute acetabular fracture is acetabular component fixation. At 6 weeks postoperatively, an average of 2 mm vertical and 3 mm medial displacement of the cups was noted with this technique, although long-term follow-up showed no clinical or radiographic evidence of loosening. However, with radiolucencies noted in 19%, osteolysis noted in 21%, and a mean of greater than 0.2 mm/year acetabular wear noted in 16%, the risk for revision surgery is not negligible [3]. Moushine et al. [24] followed up 18 patients, mean age of 76 years (range, 65–93), who were also treated with the cable fixation and acute THA for acetabular fracture, for a mean period of 36 months (range, 12–46). Good results were achieved in 17 of 18 patients. All had evidence of fracture healing, although similar early migration
occurred in 87% during the first 3 months. No radiographic evidence of loosening was encountered during this short-term follow-up.

**Delayed THA**

Delayed THA following acetabular fracture is conducted as either a staged procedure following initial treatment, or as a salvage procedure in response to failed ORIF or progressive posttraumatic degenerative arthritis. Delayed THA following conservative management can be complicated by malunion or nonunion at the fracture site. Salvage THA following ORIF can be complicated by heterotopic ossification, proliferative scar formation, obstructive hardware, or occult infection [20].

**Conclusion**

Acetabulum fractures carry a high degree of risk for the occurrence of: venous thromboembolism and fat embolism, and therefore it are necessary to begin treatment immediately, as well as to include thromboembolic prophylaxis. Patient’s age and possible existing chronic diseases hold a great significance in the choice of treatment[17]. Conservative treatment is acceptable when the clinical conditions of the patient are very bad and dangerous for the life. The long experience and overall skills of the surgical team is a crucial factor in the treatment of acetabular injuries.

**References**


