Brief Insight about Complications of Acetabular fractures

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Abstract

Acetabular fractures, complex injuries involving the hip socket, present a significant surgical challenge with a high potential for complications. Their proximity to major neurovascular structures and the intricate anatomy of the acetabulum contribute to a diverse range of potential early and late sequelae impacting patient outcomes. This abstract summarizes the key complications associated with acetabular fractures, highlighting their pathogenesis and clinical implications. Early complications often arise from the initial trauma and subsequent surgical intervention. Hemarthrosis, the accumulation of blood within the hip joint, is common and necessitates prompt drainage to prevent infection and impede healing. Infection, a devastating complication, can lead to implant failure, nonunion, and the need for extensive revision surgery. Avascular necrosis (AVN) of the femoral head, resulting from disruption of the blood supply, poses a significant threat to long-term joint function and can necessitate joint replacement. Heterotopic ossification (HO), the formation of ectopic bone around the joint, can restrict range of motion and requires aggressive management. These early complications are often influenced by the severity of the initial injury and the effectiveness of surgical reduction and fixation. Late complications represent a major concern in the long-term management of these fractures. Post-traumatic osteoarthritis (OA) is a nearly inevitable consequence of acetabular fracture, its severity dependent on the extent of articular cartilage damage and the accuracy of fracture reduction. The progressive degeneration of the hip joint often necessitates surgical intervention, such as total hip arthroplasty, years after the initial injury. Malunion, the healing of the fracture in a malaligned position, leads to altered joint mechanics, pain, and accelerated OA. Nonunion, the failure of the fracture fragments to heal, presents a further challenge requiring revision surgery. Finally, persistent pain and functional limitations, even with successful fracture healing, significantly impact quality of life and can be linked to a variety of factors including residual articular cartilage damage, malalignment, nerve injury, and psychological factors. Effective management of acetabular fractures requires a multidisciplinary approach involving orthopedic surgeons, radiologists, and rehabilitation specialists. Minimizing complications necessitates meticulous surgical technique, appropriate implant selection, and comprehensive post-operative rehabilitation. Pre-operative planning, including meticulous fracture classification and accurate assessment of associated injuries, is crucial for optimizing outcomes. Long-term follow-up is essential to monitor for the

development of late complications and to provide timely interventions aimed at preserving joint function and improving patient quality of life.

Keywords: Complications, Acetabular fractures

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Introduction

Acetabular fractures, due to their complex anatomy and proximity to vital structures, carry a significant risk of various complications. These complications can be broadly categorized into early complications, occurring in the immediate post-operative period, and late complications, arising months or even years after the initial injury. Early complications often stem from the severity of the fracture itself and the surgical intervention required. These include infection, hemarthrosis (bleeding into the hip joint), avascular necrosis (AVN) of the femoral head due to disrupted blood supply, and heterotopic ossification (HO), the formation of abnormal bone growth around the joint, potentially limiting mobility. Careful surgical technique and meticulous post-operative care are crucial to minimizing these risks. [(1)]

Late complications represent a significant challenge in the long-term management of acetabular fractures. Avascular necrosis (AVN) remains a major concern, potentially leading to joint collapse and the need for hip replacement. The risk of AVN is higher with certain fracture patterns and in cases where significant displacement or comminution (fragmentation) occurred. Malunion, where the fracture heals in a poor position, is another prevalent late complication, resulting in pain, altered joint mechanics, and reduced range of motion. These malunions can lead to osteoarthritis and accelerated joint degeneration, necessitating further surgical intervention down the line. [(2)]

Post-traumatic osteoarthritis (OA) is a highly probable late complication of acetabular fractures, even with successful fracture healing. The initial trauma and subsequent surgical repair inevitably disrupt the articular cartilage, leading to progressive joint degeneration and pain. The severity of post-traumatic OA varies greatly depending on fracture type, surgical technique, and patient factors. The progression of OA can be influenced by patient age, activity level, and the presence of pre-existing conditions. Managing post-traumatic OA may require a combination of conservative measures like physical therapy and pain management, or eventually, surgical intervention such as a hip arthroplasty. [(1)]

Finally, the potential for persistent pain and functional limitations should not be underestimated. Even with anatomically accurate fracture reduction and fixation, some patients experience chronic pain and limited mobility impacting their quality of life. The causes of persistent pain can be multifactorial, encompassing residual articular cartilage damage, malalignment of the joint, nerve

irritation, or psychological factors. A comprehensive rehabilitation program, addressing both physical and psychological aspects, is critical for optimizing functional outcomes and minimizing long-term disability. Careful follow-up and tailored interventions are crucial for addressing these individual challenges and improving long-term patient well-being. [2]

Complications of acetabular fractures

1) Early complications of acetabular fractures:

1) **Mortality**: The reported prevalence of mortality associated with acetabular fracture surgery ranges from 0–3.6%. The most common cause of death was massive pulmonary embolism. [1]

2) **Thromboembolism**: Pulmonary emboli remain one of the most significant complications associated with acetabular fractures. The prevalence in acetabular fractures ranges from 1% to 5%. The incidence of clinically apparent DVT ranges from 2.3–5% in the acetabular fracture literature. Heparin or low-molecular-weight heparin are given for the first 8-12 days, and then the patient switched to warfarin for a total 75 days. The DVT prophylaxis stopped if the patient become ambulatory sooner. Patients with a postoperative pulmonary embolism or DVT are treated with full chemical anticoagulation (eg, heparin and warfarin or low-molecular-weight heparin and warfarin). If additional injuries are such that anticoagulation is contraindicated, a vena cava filter is warranted. [2]

3) **Infection**: Deep infection following acetabular fracture surgery occurs in 0–10% of patients. The addition of perioperative antibiotics reduced the infection rate to 1%. Recognition of the Morel-Lavallée skin injury is essential. **Hak et al**. [3] reviewed 24 cases and presented a treatment protocol. Nearly 50% of the patients had positive cultures obtained from the lesion. They recommended debridement before or during acetabular fracture surgery. Even so, there was still a 13% incidence of infection with Morel-Lavallée skin injury. [3]

4) **Nerve injury**: The sciatic (tibial and/or peroneal), femoral, pudendal, obturator, superior gluteal, and lateral femoral cutaneous nerves may be involved, individually or in combination either iatrogenic (detected post operative) or by trauma (detected pre operative). The most common, and most significant, is the injury to the sciatic nerve or one of its divisions. Two patterns of injury are most common: involvement of either the tibial and peroneal (sciatic) or isolated involvement of the peroneal division. [4]

a- **Sciatic nerve injury**: The reported prevalence of postoperative sciatic nerve injury is 2–16%. Intraoperative measures should be directed toward decreasing the prevalence of postoperative sciatic. Recommended measures include transcondylar femoral traction, holding the knee flexed and hip extended during posterior approaches, and careful use of specially designed sciatic nerve retractors. More recently, spontaneous motor potentials (SMPs) have been used to assess intraoperative sciatic nerve function, and subsequently identify impending nerve injury. Once injured, the sciatic nerve or the peroneal division has the capacity to recover as long as 3 years after injury. [4]

b- **Femoral nerve injury**: Femoral nerve injury is rare sequelae of acetabular fractures or their surgery. A complete laceration of the femoral nerve from a pubic ramus fracture may occur where the nerve will not recover and required a tendon transfer. The ilioinguinal approach puts the nerve at risk from traction during fracture manipulation. Care must be taken with lateral traction of the iliopsoas compartment because the femoral nerve lies on its medial side. [5]

c- **Obturator nerve injury**: The obturator nerve is vulnerable to injury with forceps placement along the quadrilateral surface with either the ilioinguinal or modified Stoppa approach. It is particularly at risk with aggressive exposure below the pelvic brim into the true pelvis. [5]

d- **Superior gluteal nerve injury**: The superior gluteal nerve and superior gluteal vascular bundle exits the pelvis high in the sciatic notch. The neurovascular bundle is at risk in fractures that exit high in thegreater sciatic notch and during posterior surgical exposures. Injury to the superior gluteal nerve would result in a permanent limp secondary to paralysis of the hip abductors. [5]

5) **Mal reduction:** The aim of surgery must be both anatomical reduction of the weight-bearing surface of the acetabulum and a congruent reduction of the femoral head under the acetabular dome. When these goals are accomplished, more than 80% of patients have excellent or good results. Similarly, non-anatomical reduction or subluxation of the femoral head results in less favorable outcomes Fig. (1). [6]

Fig. (1): Mal reduction and fixation failure. [2]

6) **Vascular injury**: The superior gluteal vessels being trapped in the fracture at the angle of the greater sciatic notch. Care should be taken when bleeding is encountered in this area. Initial attempts at hemostasis should rely on direct pressure and local thrombotic agents. Only if this is unsuccessful should ligatures or vascular clips be used because of the danger of also compromising the superior gluteal nerve. Injury of superior gluteal artery may occur in complex acetabular fractures with significant fracture displacement into the sciatic notch so, preoperative angiography is recommended. [6]

Letournel and Judet [7] described an inconsistent connection between the external iliac artery and the deep inferior epigastric artery that they labeled the "corona mortis" or circle of death (Fig 2). They stated that the connection was present in 10–15% of exposures. [7]

Teague et al. [87] described the retropubic vascular anatomy related to the ilioinguinal exposure. All vessels larger than 2 mm in diameter connecting the obturator system with the external iliac or inferior epigastric system were identified and ligated. [8]

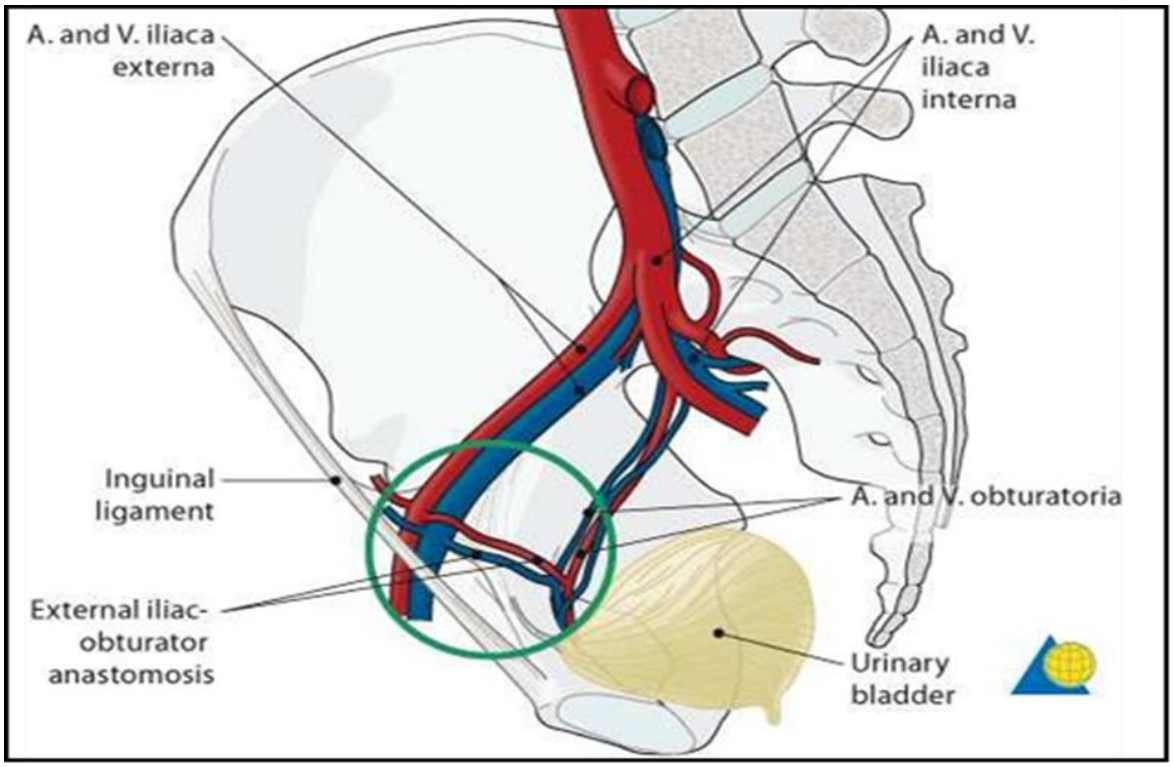

Fig. (2): The corona mortis is an aberrant anastomosis between the obturator and the external iliac vessels that can easily be injured during the Stoppa or ilioinguinal approach. [5]

2) **Late complications of acetabular fractures:**

1) Avascular necrosis:

• **Femoral head necrosis:** The reported incidence of femoral head avascular necrosis is 2–10%. The incidence of F-AVN after a fracture associated with a posterior dislocation is the highest as regard to other types of fractures. **Letournel and Judet** [7] found no correlation with the time to reduction of the femoral head or the quality of the reduction of the acetabulum. They stated, "In fact, the fate of the femoral head appears to be decided from the outset (soft tissue dissection and blood supply to femoral head)" However, this may not be true for a pure dislocation, which requires an immediate reduction to avoid avascular necrosis (AVN). [7]

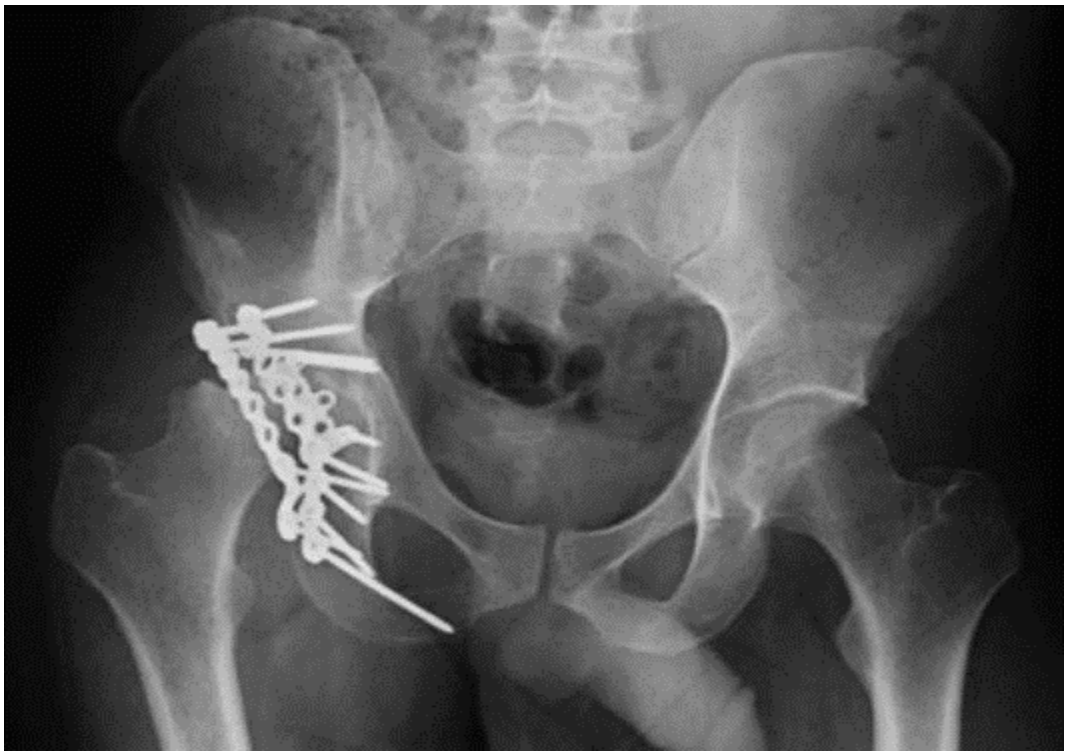

Fig. (3): This Xray pelvic view showing avascular necrosis and osteoarthritis of hip joint. [7]

• **Necrosis of the acetabulum:** The only report in the literature of acetabular avascular necrosis (A-AVN) is by **Letournel and Judet** [2], who documented three cases of anterior column A-AVN. After critical reevaluation later, two of these cases were found to be the result of intraarticular hardware. The cause of the third case is still in question, but Letournel has labeled this case cartilage necrosis. [7]

2) Late infection: Late infection following acetabular fracture surgery also is a rare complication. **Letournel and Judet** [7], documented five cases, three of which were diagnosed within a few months of surgery and the other two several years after surgery. [7]

3) Heterotopic ossification: Heterotopic ossification (HO) is a well- recognized complication of acetabular fracture surgery. The reported incidence varies from 3–69%. Heterotopic ossification after an acetabular fracture has been shown to be related to extensile surgical exposures, male gender, associated head injury, significant delays to open reduction and internal fixation, the fracture type, the

severity of the injury, and preexisting skeletal conditions. Heterotopic ossification has also been reported to be a frequent complication of combined anterior and posterior approaches but is most common with the extensile exposures, especially those that require greater trochanter osteotomy. [8]

• **Heterotopic ossification prophylaxis**: Using either indomethacin, radiation therapy, or a combination of the two always help to prevent HO following acetabular fracture surgery. Using 25 mg indomethacin orally three times a day for 6–12 weeks beginning on postoperative day 1 or using 1,000 rad of radiation therapy (200 rad each day for 5 days beginning postoperative day 3). [9]

• **Heterotopic ossification treatment**: Heterotopic ossification requires surgical resection only if it has functional significance (ie, significant limitation of hip motion or hip ankylosis). Traditionally, surgical resection should be delayed until the heterotopic bone has reached full maturity. This has been assessed clinically, radiographically, by monitoring serum alkaline phosphatase levels, and by technetium bone scintigraphy. Newer information suggests that early resection may be considered. Radiation therapy should be used in conjunction with early resection. [9]

Fig. (4): 3D CT scan showing left side heterotopic ossification. [9]

4) Posttraumatic osteoarthrosis: The overall incidence was 17% and increases with imperfect reduction, infection or AVN. Some cases of arthritis had no identifiable cause and it may occur as late as 10 years. The consensus among acetabular fracture surgeons is that restoration of the femoral head under the weight-bearing dome of the acetabulum and restoration of joint congruency is the best prophylaxis against posttraumatic arthritis. Anatomical reduction offers the best chance for a good long-term outcome. [10]

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