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CASE REPORT

Avascular Necrosis of the Femur Head after Internal Fixation of the Posterior Wall of the Acetabulum: A Case Report

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ABSTRACT

Background: Posterior wall fracture in acetabulum is the most common type of acetabular fracture. Although relatively rare, one of the complications associated with this type of injury is avascular necrosis (AVN) of femoral head. **Objective:** To provide a case that such procedures must be performed with great care. The significance of the case lies in its potential to guide clinicians to consider surgical complications. **Case:** A 63-year-old male patient visited the Soebandi Hospital, Jember, with complaints of pain and stiffness in the right groin for 1 month after internal fixation due to fracture of the acetabular rim for the last 3 months. There was no history of taking long-term steroids, and the patient did not consume alcohol and other drugs. We performed a total hip arthroplasty and reconstruction to the patient. One year after surgery, the patient has been able to walk, and having an increased Harris Hip Score from 1.6 % to 70%. **Discussion:** AVN is known to be a complication of high-energy trauma, such as posterior wall acetabular fracture. In these cases, surgical delays and potential postoperative complications may contribute to the development of AVN. Total Hip Arthroplasty (THA) remains a viable treatment option for patients with advanced AVN, as it offers significant improvements in pain and function**. Conclusion:** Total Hip Arthroplasty is the operative treatment of choice for head femur AVN patients if femoral head and acetabulum are no longer viable. Patients with AVN who underwent total hip replacement had better quality of life.

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Highlights

1. Acetabular fracture most commonly occurs in the posterior wall, frequently resulting from high-energy trauma in young individuals and low-energy trauma with osteoporosis in older adults, with a 10% risk of developing AVN.
2. Avascular Necrosis (AVN) of the femoral head is one complication of posterior wall acetabular fracture that treated with open reduction and internal fixation.
3. Total Hip Arthroplasty (THA) is a definitive and effective treatment for patients with AVN.
4. Total Hip Arthroplasty can restore hip joint function, reduce pain, and provides good outcomes even in complex cases.

BACKGROUND

Posterior wall fractures are the most common type of acetabular fracture (Mortazavi et al., 2021), with the prevalence of 30% (Do et al., 2024). The incidence of acetabular posterior wall fractures in the United States and Western Europe counts for 37 hip fractures per 100,000 annually (Mauffrey et al., 2014), and only 10% of them develop into avascular necrosis (AVN). Posterior wall acetabular fractures occur in age groups, whether old and young. In young population, it occurs as the result of high energy mechanism (Do et al., 2024), such as traffic accidents or falls from heights (Elshoura et al., 2017). The older age group experiences posterior wall acetabular fractures due to low force trauma which can be followed by osteoporotic bones. Older ages are associated with the increment of orthopedic injury, thus the risk of having acetabular fractures is 2.4-fold (Simske et al., 2023).

The medical management of posterior wall acetabular fractures encompasses non-operative approaches, internal fixation, and arthroplasty. The utilization of reinforcement rings, primary cups, or a combination of arthroplasty and internal fixation may be employed depending on the specific classification of the fracture (Krappinger et al., 2024) that should be done immediately. Operative treatment such as open anatomical reduction, is required for posterior wall acetabular fractures that cause instability in the hip joint, as well as fractures that cause entrapment of bone fragments or soft tissue within the hip joint, regardless of the type of classification (Elshoura et al., 2017) to restore the continuity of hip joint, preserve hip function and coxarthrosis (Christiaans et al., 2024). Fractures of this kind that are also associated with hip dislocations, nerve damage, and bone and cartilage injuries require immediate and careful treatment. In acetabulum fractures, especially posterior wall fractures, classical literature shows that involvement of fragments ≥40–50% is almost always associated with joint instability and is therefore an indication for fixation, while fragments <20% are generally stable and can be managed non-operatively. The best option for these complex cases is an open reduction and internal fixation procedure (Kim et al. 2011; Schweitzer et al., 2013).

Posterior wall acetabular fractures are commonly associated with complications such as avascular necrosis of the femoral head (AVN), traumatic sciatic nerve injuries, and post-traumatic osteoarthritis (OA) (Milenkovic et al., 2022). Approximately 30% of these fractures are linked to posterior hip dislocation, with AVN of the femoral head observed in 33.3% of cases (Milenković et al., 2013). Avascular Necrosis (AVN) of the femoral head is influenced by various factors, including the type of trauma sustained, how quickly treatment is received, and the specific surgical method used. In addition, being over 65 years old is a significant risk factor for developing this condition (Schweitzer et al., 2013). In this case, we reported a patient with Posterior Wall Acetabulum Fracture who experienced AVN after three months of internal fixation.

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OBJECTIVE

This case report aimed to highlight the complication after installation of internal fixation, especially on posterior wall acetabulum. This provides valuable insights that surgical procedures must be carried out carefully. The significance of this report lies in its potential to guide clinicians to consider surgical complications so that morbidity rates of AVN can be reduced.

CASE(S)

A 63-year-old male patient visited Soebandi Hospital, Jember with complaint of pain in right hip after surgery on the right acetabulum due to fracture of the acetabular rim. Three months before, the patient had a motorcycle accident and had posterior wall acetabulum fracture showed in Figure 1A-C. Then, the patient had ORIF surgery with plate and screw as shown in Figure 2A. The patient had complaints of pain and stiffness in the right groin for 1 month and also there was decreasing range of motion of hip external rotation of 20°, internal rotation of 10°, adduction of 15°, abduction of 20°, and flexion of 80°. The patient smoked 1-2 packs a day, there was no history of taking long-term steroids, and the patient did not consume alcohol and other drug or herbal medicine.

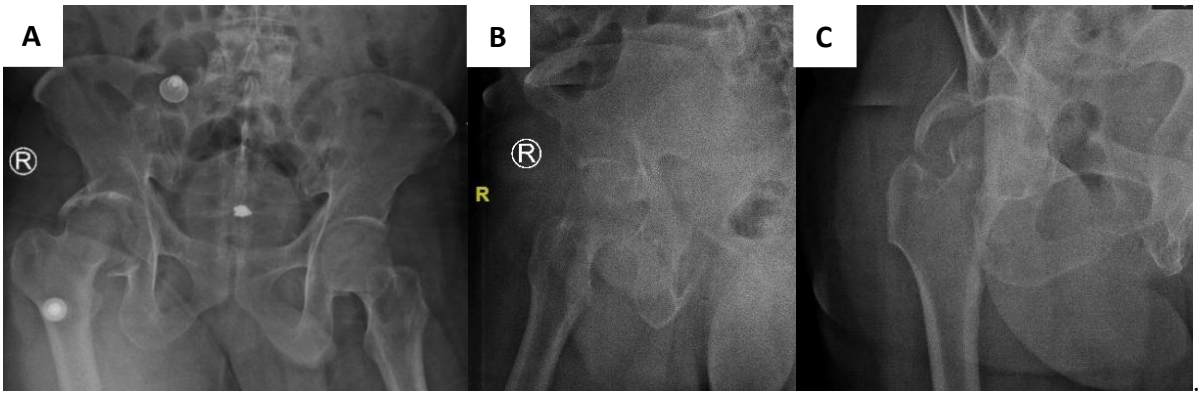

Figure 1. A. Pelvis Ap X-ray before ORIF, **B.** Alar X-ray before ORIF, **C.** Obturator X-ray before ORIF

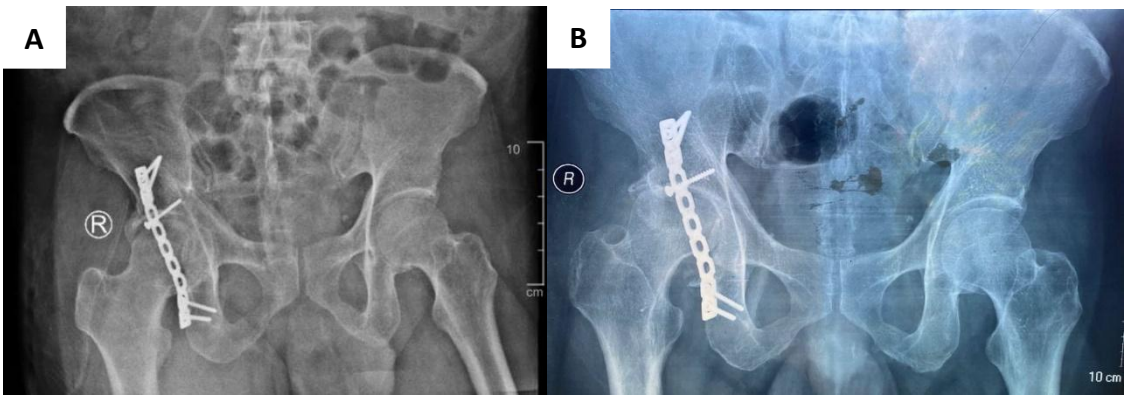

Figure 2. A. Pelvis AP X-ray post-ORIF, **B.** AVN right hip in pelvis AP X-ray after internal fixation within three months

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In this case, we found AVN in the femoral head and acetabulum after three months, as seen in Figure 2B where flattening of humeral head can be seen. Then, joint replacement surgery/arthroplasty was performed to increase range of motion of this patient. The Harris Hip Score before surgery was 1.6%. When the operation was carried out, osteonecrosis was obtained on the femoral head in Figure 3. Total hip arthroplasty and acetabuloplasty surgery was performed, then the X-ray after surgery showed in figure 4. Two days after surgery, the patient said he could move his right groin. The motor strength of the patient's right extremity also improved, and the Harris Hip Score was 47.50%. The patient used a cane and was able to walk 2-3 blocks with difficulty wearing socks and shoes. The patient was able to climb with his hands by holding the railing on the stairs. The patient felt there was improvement in his hip while walking, resting, and increasing of his range of motion.

Figure 3. Osteonecrosis of the femoral head

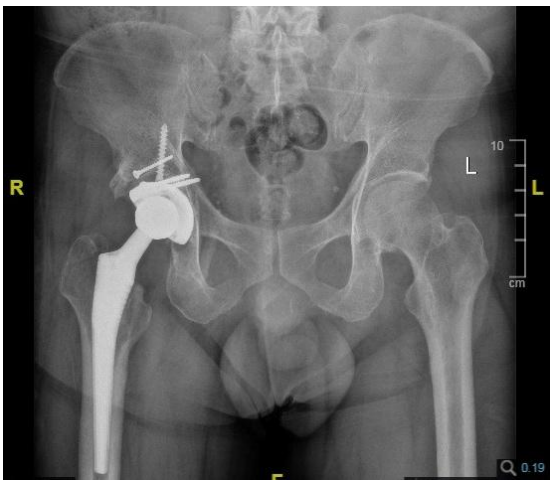

Figure 4. AP pelvic plain photo after total hip replacement

Clinical evaluation of patients six months after surgery included differences in the length of the right and left lower limbs, Harris Hip Score, and range of motion of the hip joint. Evaluation of the difference in the length of the two lower legs did not reveal any difference, as seen in Figure 5. In assessing the range of motion of the hip joint, the results showed external rotation of 38°, internal rotation of 35°, adduction of 25°, abduction of 45°, and flexion of 110°, that increase before surgery. Harris Hip Score evaluation was carried out and a result of 70% was obtained, that increase from the previous percentage.
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Figure 5. Clinical photo post-arthroplasty surgery

DISCUSSION

Avascular necrosis of the femoral head is an important cause of hip pain to recognize. It is often discovered incidentally on pelvic X-rays taken for other reasons. In some cases, the pain is a symptom of the disease (Tu et al., 2021; Xin et al., 2023). Typically, the pain quickly becomes mechanical, with limitations in various joint movements, especially internal rotation (Yoon et al., 2022). Avascular necrosis of the femoral head, a condition caused by a lack of blood supply should always be considered a potential diagnosis for any hip disease, especially arthritis or osteoarthritis (Cehelyk et al., 2023; Christiaans et al., 2024). Arterial obstruction or disruption leads to organ necrosis, in this case osteonecrosis (Tu et al., 2021). Hip pain in avascular necrosis is usually felt in the groin and anterior thigh, and is exacerbated in changing position. Initially, the pain may be severe at night, resembling inflammatory pain (Gupta et al., 2009; Ju et al., 2016; Jebson et al., 1994; Letournel, 1994)

The incidence of AVN of the femoral head is quite common, especially following high-energy trauma, such as in the case above (Giustra et al., 2024). AVN results from disrupted blood supply to the proximal femur, causing death of osteocytes (Einhorn et al., 2023). Causes of AVN can be categorized into two groups: trauma and non-trauma (Zhang et al., 2019). Traumatic causes include fractures of the femoral head and neck, and hip dislocation. Notably, a femoral neck fracture can disrupt blood supply, particularly if there is displacement or shift (Mardanpour et al., 2016; Oransky and Sanguinetti, 1993; Porter et al., 2008). The risk of Avascular Necrosis (AVN) is greater in displaced femoral neck fractures than in undisplaced ones. Dislocations can also cause AVN by damaging nearby blood vessels, leading to a lack of blood flow. Additionally, non-traumatic factors like steroid use and excessive alcohol consumption are known to increase the risk of developing AVN (Moya-Angeler et al., 2015; Cash and Nolan, 2007). Other risk factors encompass chronic diseases such as Gaucher disease, Caisson disease, blood clotting disorders, chemotherapy, autoimmune diseases, and HIV/AIDS. AVN most often affects physically active individuals aged 20-40 years (Gautier et al., 2000; Judet et al., 1955; Howse and Bendall, 2023). In the US, approximately 10,000-20,000 new cases of femoral head AVN are diagnosed annually (Miyahara et al., 2022; Desforges and Mankin, 1992; Gautier et al., 2000). MRI have become the gold standard for diagnosing and evaluating AVN (Konarski et al., 2022; Petek et al., 2019). Using MRI can aid early detection and identify patients at risk of femoral head fracture. Key findings include bone marrow edema in the proximal femur and the presence or absence of joint effusion (Milenkovic et al., 2022; Zlotorowicz and Czubak, 2024). (Kandhari et al., 2015; Eckardt et al., 2015). However, MRI cannot be used in this case because the patient had undergone internal fixation with implant stainless (Howse and Bendall, 2023; Murphey et al., 2014).

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Most of the blood supply to the femoral head originates from the medial and lateral branches of the circumflex artery and the deep femoral artery (Gautier et al., 2000; Judet et al., 1955). Obstruction of microcirculation in the subchondral region leads to a lack of blood flow to the femoral head, causing osteocyte necrosis. This vascular damage, as previously described, can result from trauma or non-traumatic causes (Desforges and Mankin, 1992; Gautier et al., 2000). A posterior wall acetabulum fracture is the main potential cause of AVN in this patient. Factors such as the fracture's comminution, impaction, dislocation, and femoral head injury can influence treatment outcomes and raise the risk of AVN. Factors like surgical delay, approach of the surgeon, postoperative infection, and migration of ORIF components may increase the risk (Kandhari et al., 2015; Zlotorowicz et al., 2011).

Total Hip Arthroplasty is a surgical procedure for patients experiencing severe pain, loss of hip function, and a collapsed femoral head. The operation include replacing the femoral head with an artificial one. While THA is generally effective at improving hip function and reducing pain, it is typically not advised for younger patients. This is because it can lead to limitations in physical activity and may require future surgeries to replace the implant (Milenkovic et al., 2022b). Studies suggest that high acetabular component placement is the preferred technique in arthroplasty in AVN (Jebson et al., 1994; Letournel, 1994). In the case above where AVN occurs in the femoral head, this is an indication for THA, where the damage to the femoral head that has occurred has manifested and affected the function of the patient's hip joint. This procedure is often performed on patients with AVN of the femoral head and has a good therapeutic success rate (Kandhari et al., 2015).

Limitations

The limitation of this study is the relatively short follow-up period, A longer follow-up is needed to determine whether the patient will develop any complications. In addition, the study would be stronger if it included more cases and was presented as a case series.

CONCLUSION

Acetabulum posterior wall fracture is a serious injury, and can result in many complications, one of which is AVN. Total hip arthroplasty is the operative treatment of choice for AVN patients if the femoral head and acetabulum are no longer viable. Patients with AVN who underwent THA had good outcomes in this and previous studies.

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Conflict of Interest

All authors have no conflict of interest.

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Patient Consent for Publication

Written informed consent was voluntarily obtained from the patient for the dissemination of their case information, in accordance with ethical standards protecting patient autonomy, privacy, and confidentiality.

Author Contribution

All authors have contributed to all process in this research, including preparation, data gathering and analysis, drafting and approval for publication of this manuscript. AHB preparation research process, data gathering; RR preparation research process, data gathering; AH drafting the manuscript; BW drafting and data analysis; and NH data analysis, manuscript publication approval.

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