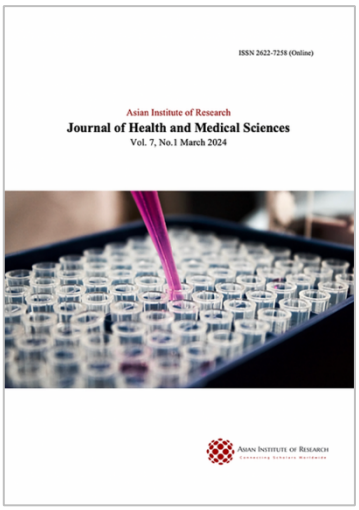

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Old Fracture of Acetabulum Combined with Osteoarthritis Total Hip Arthroplasty (THA)

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Abstract
This review examined the use of total hip arthroplasty as therapeutic option for management of chronic fracture of acetabulum accompanied by osteoarthritis. The article discussed the epidemiology, risk factors, and potential complications associated with this complex condition, as well as its increasing prevalence among the elderly population. The rationale for combining total hip arthroplasty with fracture fixation was discussed, along with the potential benefits of pain relief, increased stability, enhanced long-term outcomes, and decreased healthcare costs. The article also examined the potential risks and complications associated with this approach, as well as the significance of a multidisciplinary treatment approach that takes each patient's unique requirements and goals into account. Overall, it provided a comprehensive overview of the challenges and considerations involved in managing an old fracture of the acetabulum in conjunction with osteoarthritis and emphasized the potential role of total hip arthroplasty as a treatment option for this complex condition.

Keywords: Acetabulum, Fracture Fixation, Hip Replacement, Post-Traumatic Arthritis, Osteoarthritis, Rehabilitation of Fracture

1. Introduction

The annual incidence of Acetabular fractures (AFs) is 3 per 10,000 individuals (Approximately) worldwide. More than 60% of these are caused by high-energy traumas, specifically car accidents. AFs occur when the hip cavity, also known as the acetabulum, breaks. These injuries were the result of factors, such as mishaps, automobile accidents, and sports injuries. While they can occur at any age, the prevalence of osteoporotic bone in the elderly makes them more common. Osteoarthritis is a degenerative joint disease, characterized by the disintegration and loss of cartilage in joints, which causes pain, rigidity, and constrained range of motion (ROM). Osteoarthritis affects any joint, including the hip, and is also more prevalent among the geriatric. Old acetabulum fractures combined with hip osteoarthritis (OAFHAs) can present orthopedic surgeons with a formidable challenge. These fractures are frequently consequence of high-energy trauma, coupled with substantial morbidity and disability. The onset of osteoarthritis in the afflicted hip joint further complicates the management of these cases (Wang et al., 2020). THA is surgical procedure that can alleviate pain and enhance function in patients with acetabular

fractures and osteoarthritis. However, THA in this context is challenging procedure that necessitates meticulous planning and execution to attain optimal results (Sharma et al., 2019). Young patients typically sustain AFs as a consequence of severe trauma, whereas elderly patients are more susceptible to these traumas for low-energy mechanisms. Open Reduction and Internal Fixation (ORIF) is presently regarded as standard treatment for these fractures, but surgery can be challenging for anatomic location and 3-Dimensional complexity of acetabulum. Even with anatomical reduction, posttraumatic arthritis could still develop (Gautam et al., 2020). Different injury mechanisms and the common occurrence of osteoporotic bone can result in distinct fracture patterns in elderly. Typically, these patterns include anterior column, posterior hemi-transverse, and both column injuries. It is complicated to successfully reduce a fracture, and failure to do so may result in joint degradation in vital areas. Prime treatment objectives for geriatric patients with fractures are to alleviate pain, timely weight bearing, and the return to independent daily activities. Treatment options for AFs in this population may include non-surgical and surgical management, but there is currently no consensus regarding the optimal approach (Panteli et al., 2023). AFs treated with surgical fixation can result in complications such as posttraumatic arthritis (PTA), osteonecrosis of femoral head, chondrolysis, and nerve palsies resulting from the procedure. According to a meta-analysis of AFs treated with ORIF, 13- 44 % of patients exhibited PTA, requiring THA to diminish symptoms. Yet, owing to local tissue changes and infections, conversion to THA can be challenging. In addition, patients with a history of AF who undergo THA run the risk of complications including heterotopic ossification, surgical site infection, and implant loosening, which may necessitate revision surgery. Although it was suggested that THA in AF patients is less effective than THA for non-traumatic primary osteoarthritis (Stibolt et al., 2018).

1.1. Rationale of combining total hip arthroplasty with old fracture of acetabulum and osteoarthritis:

Combining THA with OAFHAs has multiple benefits, including pain relief, increased stability, improved long-term outcomes, and decreased healthcare costs. Although there are potential risks associated with this approach, the benefits may outweigh the risks for patients who are carefully selected (Gautam et al., 2020). The surgical procedure known as total hip arthroplasty (THA) involves replacing the hip joint with a prosthetic device. This procedure has become more prevalent over the past few decades as a treatment for various hip conditions, like osteoarthritis and hip fractures. In cases where patients present with OAFHAs, there are multiple reasons to combine THA with fracture fixation (Tiftikçi et al., 2015).

First, THA can provide significant pain alleviation to patients with both osteoarthritis and old fractures of the acetabulum. This is particularly essential for patients experiencing chronic pain for extended time periods, as it can have a significant impact on their life activities. THA can also restore ROM and mobility, allowing patients to return to activities they were formerly unable to engage in. Second, combining THA with fracture fixation can increase the hip joint's stability, thereby decreasing the likelihood of future fractures and other complications. The prosthetic device used in THA can provide additional support and strength to an acetabulum that has been compromised, thereby preventing future fractures. This is especially essential for elderly patients, who may be more susceptible to falls and other accidents. Thirdly, combining THA and fracture fixation can improve patients' long-term outcomes. According to studies, patients undergoing THA for osteoarthritis or other hip conditions report high levels of satisfaction and an enhanced quality of life. Similarly, patients those undergo fracture fixation for elderly acetabulum fractures have favorable outcomes, with high rates of fracture healing and functional recovery. The comprehensive treatment of osteoarthritis and the old fracture can be enhanced through the combination of these two procedures (Shao et al., 2023).

Lastly, the combination of THA and fracture fixation can result in reduced long-term healthcare costs. By treating both conditions concurrently, patients may require fewer follow-up appointments and be able to avoid future operations or treatments. Infection, dislocation, and implant failure are potential hazards associated with the combination of THA and fracture fixation. However, these risks can be mitigated through cautious patient selection, the use of an appropriate surgical technique, and post-operative care and monitoring (De Franco et al., 2023).

1.2. Epidemiology of old fracture of acetabulum combined with osteoarthritis:

The incidence and prevalence of OAFHAs increase with age and are more prevalent in the elderly population. In some instances, non-surgical treatment options may be appropriate, but surgical intervention may be necessary for successful outcomes. Improving outcomes for patients with this complex condition will necessitate a multidisciplinary approach that considers each patient's unique requirements and goals (Cui et al., 2020).

A study was conducted at Liaquat National Hospital, Pakistan, comprising 50 patients with acetabular fractures from 2012-2014. Their average age was 44.20±11.65 years. Using reconstruction plates, ORIF of fractures were performed. At 24 months, mean HHS was 82.368.55. In 35 (70.0%) cases, clinical prognosis was excellent to good, while in 15 (30%) cases, it was fair or poor. In 39 (78%) cases, radiological upshot was anatomical, while in 5 (10%) cases, it was congruent and in 6 (12%) cases, it was incongruent. Thus, functional and radiological outcomes were significantly affected by the mechanism of injury, duration between injury and surgery, initial degree of displacement, and quality of reduction, according to the study's findings.

Five years of prospective data collection at a Level-I trauma centers were followed by a retrospective analysis. Among the identified 1123 cases of acetabular fractures, 156 involved patients older than 65, with an average age of 78. Falls and automobile collisions were the leading causes of injury. 82% of patients had substantial medical comorbidities, 33% of them died within a year, and 75% of those deaths occurred within 90 days of the fracture. 84% of the deceased patients had received non-operative treatment. The one-year mortality rate for patients treated with traction alone was 79%, and the mortality rate within 90 days was 50%. 70% of the total cohort had an ABC or AC/PHT fracture pattern. 36.5% of the surgically treated patients underwent ORIF with standard reduction techniques and surgical implants through the ilioinguinal (69%) and Kocher-Langenbeck (28%). It was discovered that elderly patients with acetabular fractures were uncommon, accounting for only 14% of all cases. Patients those underwent surgical treatment had reduced rates of mortality. ABC and AC/PHT fracture patterns were most prevalent, and standard fixation constructs and implants were efficacious at treating these challenging fractures. During their recuperation, mostly patients were unable to go back home and required skilled nursing care (Deng et al., 2018).

1.3. Total Hip Arthroplasty

THA is a surgical procedure comprising the replacement of hip joint with prosthetic joint. Patients with severe hip pain or dysfunction due to osteoarthritis, rheumatoid arthritis, avascular necrosis, or a previous hip injury frequently undergo this procedure. During this procedure, spoiled portions of hip joint are replaced with metal, plastic, or ceramic components. The new components are designed to replicate the shape and function of a healthy hip joint, allowing for a greater ROM and reduction in pain (Günther et al., 2021). THA is an extremely effective procedure with a high patient satisfaction rate. According to the American Academy of Orthopaedic Surgeons, over 300,000 THAs are performed yearly, with an approximate 90% success rate in the first 10 to 15 years following surgery (Okafor et al., 2019).

THA provides pain relief, enhanced mobility and quality of life, and a reduced risk of falls and fractures. Patients who undergo THA typically experience a substantial reduction in pain, allowing them to resume to activities they were previously unable to engage in. Additionally, THA can enhance general physical function, which can result in enhanced mental health and social interactions (Tayler et al., 2022).

However, THA is not risk-free. Infection, blood clots, dislocation of the prosthetic joint, and implant failure are the most frequent complications associated with THA. Careful patient selection, an appropriate surgical technique, and post-operative monitoring and care can mitigate these risks. There have been numerous advancements in THA techniques and materials in recent years, which have further improved patient outcomes. These include minimally invasive techniques that reduce the size of the surgical incision, post-operative pain, and recovery time, as well as newer prosthetic designs that seek to improve stability and durability (Fontalis et al., 2021).

1.4. Intent of this review article

This article seeks to provide an overview of management of OAFHAs using THA, including patient selection, preoperative planning, surgical techniques, and postoperative care. Also discussed will be the current evidence on the outcomes and complications of THA for this condition.

2. Anatomy

A comprehensive understanding of acetabular anatomy is indispensable for hip arthroscopy procedures. The intricate morphology of the acetabulum and pelvis is crucial for any procedure involving the hip joint. The articular surface of acetabulum is supported between legs of an inverted "Y," with anterior and posterior columns of acetabulum serving as "Y" legs. The iliopectineal line represents the anterior column on radiographic images, while ilioischial line represents the posterior column. Anterior or posterior column fracture is diagnosed if any of these lines are interrupted. The external and internal iliac arteries are closely related to these vessels and, if necessary, must be properly identified and ligated. Anomalous connections between these two arteries, known as corona mortis, are recognized and treated with caution, as their injury can result in severe complications. The lesser and greater sciatic valleys traverse the lumbar plexus and its numerous nerve roots, which are susceptible to injury during portal placement and other hip procedures.

2.1. Bone landmarks

Acetabulum carries three bones: ilium, ischium, and pubis. Understanding the acetabular bone landmarks is essential for diagnosing and treating the hip injuries, as well as the placement of implants during hip replacement surgery. Acetabulum is the socket-like pelvic structure that creates hip joint with the femoral head. On the surface of the acetabulum are two key bony landmarks: acetabular fossa and acetabular rim. Acetabular fossa is the depression in middle of acetabulum where tip of the femur rests. Acetabular margin surrounds the acetabular fossa and stabilizes the hip joint.

2.2. Ligamentous attachments

Networks of robust ligaments that attach to acetabulum maintain stability of hip joint. During movement, these ligaments are essential for sustaining the position and alignment of femur in acetabulum. There are three major categories of acetabular ligaments: iliofemoral, pubofemoral and ischiofemoral ligament. In addition to these ligaments, the hip joint has a fibrous capsule that connects to the acetabulum and surrounds the joint. The ligaments reinforce the base of the acetabulum, where the capsule is thickest. It serves a crucial role in maintaining the integrity of the hip joint and providing movement stability.

2.3. Vascular supply

The acetabulum's blood supply is essential for maintaining bone health and function. Injuries to the blood vessels that nourish the acetabulum can cause avascular necrosis, a condition in which bone tissue dies from lack of blood supply. This can result in arthritis and joint deterioration, so surgeons must be mindful of the vascular supply when operating on the hip joint.

3. Pathophysiology

The pathophysiology refers to abnormal functioning of hip joint as a result of various diseases or traumas:
The most prevalent acetabular pathophysiology is acetabular fracture. A fracture of the bone that forms up the acetabulum is referred to as an acetabular fracture. This type of injury is typically result of trauma, like road accident or a fall from a considerable height. Simple, non-displaced acetabular fractures can range to more complex, displaced fractures involving multiple bone fragments.

Osteoarthritis is a degenerative joint disease accruing when the cartilage covering the extremities of bones in joints begins to deteriorate. This can result in hip joint pain, rigidity, and function less. Osteoarthritis of acetabulum is most prevalent in older individuals or those with a history of hip injuries or surgical procedures. Avascular necrosis occurs when the bone's blood supply is interrupted, resulting in the death of bone tissue. This can be caused by trauma, protracted steroid use, and excessive alcohol consumption, among others. Avascular necrosis of the acetabulum can cause hip joint discomfort, stiffness, and loss of function. Hip dysplasia is a congenital anomaly caused by improper hip development. This can result in joint instability and abnormal wear and strain, causing pain and functional limitations. Hip dysplasia of acetabulum can augment the probability of developing osteoarthritis of hip joint (Gambling et al., 2019).

3.1. Causes and risk factors of old fracture of acetabulum

The most frequent cause of old acetabulum fractures is a high-energy trauma, such as an automobile accident or a fall from a great height. These types of injuries may result in a fracture of the acetabulum bone. If the fracture is not treated properly or heals improperly, it can result in chronic pain and functional limitations. Certain risk factors can increase the probability of developing an acetabular fracture. Among these risk factors are: age, osteoporosis, injuries and trauma, previous hip surgeries, old fractures, low sun exposure, use of corticosteroids, low milk intake, using tobacco and alcoholic abuse (Al-Algawy et al., 2019).

Individuals with osteoporosis are at a greater risk for developing acetabulum fractures. Old fractures of the acetabulum are more likely to occur in individuals who have previously sustained hip injuries or undergone hip surgery. This is due to the fact that these traumas can weaken the bone, making it more susceptible to fractures. Use of corticosteroid medications, such as prednisone, for an extended period of time can weaken the bones and increase the risk of fractures, including ancient fractures of the acetabulum. Abuse of alcohol: Excessive alcohol consumption can weaken bones and increase the risk of fractures, including ancient acetabulum fractures. Tobacco use can weaken bones and reduce blood flow to bone tissue, thereby increasing risk of fractures.

3.2. Mechanisms leading to osteoarthritis

Osteoarthritis is a common joint disease characterized by cartilage degeneration and underlying bone alterations. A hip fracture caused by an acetabular fracture, a type of pelvic fracture, can result in the development of osteoarthritis. Loss of joint congruity is one of the mechanisms that contribute to development of osteoarthritis in acetabular fracture. Normal contact between femoral head and acetabulum is disrupted when joint surface is displaced as a result of a fracture. This can result in abnormal joint loading, resulting to articular cartilage and underlying bone changes. This can contribute to the development of osteoarthritis over time.

Damage to the articular cartilage is another mechanism that contributes to the development of osteoarthritis in acetabular fractures. A joint's articular cartilage is a smooth, lubricated surface that covers the bone extremities. When a fracture disrupts the joint surface, the articular cartilage can become damaged. This can result in the release of inflammatory molecules, which can further harm the cartilage and bone beneath it. This can contribute to the development of osteoarthritis over time. The mechanisms that contribute to the development of osteoarthritis in acetabular fracture are intricate and multifactorial. Loss of joint congruity, articular cartilage damage, and disruption of the surrounding soft tissues can all contribute to the onset of this prevalent joint disease.

3.3. Interplay between old fracture and osteoarthritis

If AF is not properly treated or is severe, it can result in joint instability, increased joint pressure, and increased risk of developing osteoarthritis. When an old acetabular fracture is present, increased joint pressure and aberrant joint biomechanics can hasten the progression of osteoarthritis. The interaction between ancient acetabular fractures and osteoarthritis can also be influenced by joint instability. When the soft tissues encircling hip joint become damaged, joint may become unstable, resulting in abnormal loading and bone changes. This can eventually contribute to the development of osteoarthritis (Lai et al., 2022).

4. Clinical Manifestations

Fractures of acetabulum have many clinical manifestations. Clinical manifestations of this injury may become more complicated when combined with osteoarthritis. It can cause significant hip discomfort and swelling. The pain can be severe and can intensify with movement, weight-bearing, or any form of pressure to the afflicted area. There may be visible edema around the hip joint, as well as possible bruising or redness. When AFs are accompanied by osteoarthritis, pain and edema can become persistent and chronic. Patients may experience pain at repose, and hip joint ROM may be restricted. Walking, standing, and all other weight-bearing activities may be difficult and lead to increased pain and distress. Joint stiffness is one of the most prevalent clinical manifestations of OAFHAs. Loss of articular cartilage and alterations in the underlying bone can lead to stiffness. Patients may experience a diminution in ROM, particularly in flexion and internal rotation. Development of bone spurs or osteophytes is an additional clinical sign. These are bony growths that can form in the joint space and further restrict the hip's ROM. Inflammation and irritation can also be caused by bone spurs, resulting in increased pain and edema.

In addition to muscle weakness or atrophy, patients with OAFHAs may also experience muscle weakness. Consequence to injury, soft tissues surrounding hip joints, including muscles and tendons, may become weakened or damaged. This reduces muscle mass and power, making walking and other physical activities problematic. Early diagnosis and treatment can reduce likelihood of developing chronic symptoms and complications (Shorter et al., 2019).

4.1. Signs of old fracture of acetabulum

Signs and symptoms of an old fracture of the acetabulum may include: Hip discomfort (a dull or sharp pain in the hip joint that may worsen with activity), reduced ROM in hip joint, making it challenging to move the leg, Walking may be difficult or agonizing as a result of the hip joint injury, a clicking or popping sensation may develop in hip joint as a result of alterations that occur in the joint after a fracture and leg length discrepancy may exist if the fracture caused hip joint mal-alignment (Hidaka et al., 2021).

4.2. Signs of osteoarthritis

Osteoarthritis is widespread and degenerative joint diseases that primarily deteriorate cartilage in the joints. Consequently, individuals with osteoarthritis frequently experience joint pain, rigidity, and limited ROM (Horecka et al., 2022). The joint may be difficult to move due to rigidity, and it may feel "locked" or "stuck" in one position. The stiffness typically improves as the joint is moved and loosened, but it may recur after periods of rest or inactivity. Limited ROM is an additional indicator of osteoarthritis. As cartilage in a joint deteriorates, the joint may become less malleable, making it difficult to utilize the joint's full range of motion (Primorac et al., 2020).

5. Diagnosis

The symptoms of OAFHAs can overlap with those of other conditions, making diagnosis difficult. However, comprehensive patient history and physical exam is the first step in diagnosing OAFHAs.

5.1. Clinical presentation and history

OAFHAs can result in a variety of clinical presentations like hip discomfort, joint stiffness, limited ROM, edema, tenderness and cracking of hip and muscular atrophy. The patient may experience dull or sharp pain in the hip joint that worsens with activity or weight-bearing, hip joint stiffness, particularly in the morning or after extended periods of inactivity, difficulty moving the afflicted leg through its complete ROM, edema and tenderness in the vicinity of hip joint, clicking or cracking in the hip joint during movement, and muscle weakness in the affected limbs (Katz et al., 2021).

In addition to the clinical presentations, a comprehensive patient history is essential for diagnosing AFs in conjunction with osteoarthritis. Patients are inquired for their symptoms including location, duration, and intensity of any pain or discomfort, previous hip joint injuries or interventions, medical history, certain occupations or activities may pose risk of hips injury.

5.2. Imaging modalities for diagnosis

Typically, imaging studies are used to corroborate the diagnosis of OAFHAs, carrying X-rays, CT-scans, MRI and arthroscopy. X-rays are typically first imaging study ordered, as they can reveal any hip joint deformities. X-rays can also reveal osteoarthritis symptoms, such as bone spurs and joint space constriction. CT scans provide more detailed images of hip joint than x-rays and can assist in determining the extent of bone or joint injury. MRI scans generate meticulous images of soft tissues, such as cartilage and ligaments, in hip joint. This imaging technique can help identify any cartilage or ligament injuries. In some instances, arthroscopy may be used to diagnose AFs. Through a small incision, a small camera is inserted into hip joint during arthroscopy, a minimally invasive procedure. This enables the visualization of joint, soft tissues and cartilage (Hayashi et al., 2018).

5.3. Differential diagnosis

Diagnosing the underlying cause of patient's symptoms requires differential diagnosis. A comprehensive patient history, physical examination, and imaging studies can assist in distinguishing between these conditions and determining the most appropriate treatment. These are:
Hip osteoarthritis is a degenerative joint disease that can cause joint discomfort, stiffness, and restricted ROM. Its symptoms resemble those of OAFHAs. However, osteoarthritis symptoms typically develop gradually, whereas acetabular fracture symptoms can occur abruptly. Labral tears are injuries to the labrum, which is a cartilage ring surrounding the hip joint. Labral tears can cause hip pain, joint stiffness, and cracking or clicking sounds in the hip joint. Trochanteric bursitis is an inflammation of the bursa, a pouch filled with fluid that cushions the hip joint. Trochanteric bursitis can cause hip discomfort, tenderness, and swelling in the outer hip region. Femoral neck stress fractures can induce hip pain, particularly during weight-bearing activities. Avascular necrosis is a condition characterized by the death of bone tissue and may manifest as hip discomfort, stiffness, and restricted ROM (Pianka et al., 2021).

6. Therapeutic Approach

Typically, a combination of non-surgical and surgical treatment options is used to treat OAFHAs:

6.1. Conservative management strategies

In cases where the fracture is stable and the osteoarthritis is mild, conservative management strategies may be used in treating OAFHAs, including pain management, physical therapy, assistive devices, modifications to lifestyle, corticosteroid etc (Lim et al., 2022).

Pain management is an integral part of conservative treatment to help manage the pain associated with this condition using over-the-counter or prescription pain medications. Physical therapy may be recommended to help strengthen the hip joint's ROM, strength, and function. Modifications of patient’s lifestyle may be advised to modify their daily activities to reduce tension on affected hip joint, involving avoiding high-impact activities like running and leaping and losing weight to reduce the load on the hip joint. In some instances, corticosteroid injections may be utilized to reduce inflammation and alleviate discomfort in the affected hip joint. Injections of hyaluronic acid may also be used to enhance joint lubrication and alleviate pain (Kemp et al., 2020).

7. Surgical Interventions

Surgical interventions for conditions affecting the hip can range from minimally invasive procedures to significant operations:

7.1. Total hip arthroplasty

Total hip arthroplasty (THA), is a surgical procedure, performed under general anesthesia, in which a damaged or arthritic hip joint is replaced with a metal, ceramic, or plastic artificial joint. During surgery, the damaged portions of the hip joint is removed and replaced with a prosthetic joint composed of a metal stem implanted in femur, a metal or ceramic ball attached to the tip of the stem, and a plastic or metal socket implanted in the hip bone. The new joint would restore stability, mobility, and function by mimicking the natural movement of the hip joint (Merola et al., 2019).

With a reported success rate of up to 95% in alleviating hip pain and restoring function, THA is a highly successful procedure. Infection, blood clots, dislocation, nerve injury, and implant failure are potential risks and complications associated with THA, as with any surgery (Table 1). To optimize outcomes, it is essential to thoroughly weigh the potential benefits and risks of THA and to adhere to all pre- and post-operative instructions.

Table 1: Characteristics of Patients Undergoing THA Who Have an Old Acetabular Fracture and Osteoarthritis

S. No	Sample size	Age (Years)	Fracture	Time since fractured (Years)	Follow up period (Years)	Reference
1	96	40.5	Posterior/anterior wall and columns, transverse fractures	1-10	1.5-2	Grubor et al., 2015
2	42	55-84	Posterior wall and posterior column	3-30	2-10	Brown et al., 2019
3	62	71.5	Anterior column and posterior hemi-transverse	5-7	4-5	Panteli et al., 2022
4	446	38	Posterior wall and posterior column	1-5	10	Cantrell et al., 2022
5	33	66	Posterior (2) and anterior fracture (16)	1-5	1-14	Lin et al., 2015
6	22	75.3	Transverse (9), anterior column (7), both column (6)	1-7	2.5	Herscovici et al., 2010

7.1.1. Indications and contraindications

THA is typically recommended for patients with significant hip pain and functional loss due to conditions such as osteoarthritis, arthritis rheumatoid, avascular necrosis, hip fractures and hip dysplasia. While, the contraindications involve Active infection in patients with severe osteoporosis, Patients with advanced age or substantial medical conditions, Allergy to implant materials of metals or plastics used in THA and Mental health conditions which can impede recovery phases (Günther et al., 2021).

7.1.2. Preoperative planning and evaluation (including patient selection and preoperative imaging)

THA efficacy is contingent on preoperative planning and postoperative evaluation. Typical preoperative planning stages include patient selection, preoperative imaging, and evaluation of the patient's medical history and comorbidities (Carmel-Neiderman et al., 2021).

Patient selection for THA is based on several factors, including age, degree of disability, pain intensity, and overall health. Patients who are younger and more physically active may be better candidates for THA, as they may experience greater surgical benefits.

Imaging is crucial for assessing the extent of hip joint injury and planning the surgical approach prior to surgery. X-rays, magnetic resonance imaging (MRI), and computed tomography (CT) scans are common imaging techniques utilized in preoperative planning for THA. These imaging studies can help pinpoint the location and

severity of joint injury, evaluate bone quality, and determine implant size and placement. The evaluation of a patient's medical history and comorbidities is essential for determining the most appropriate surgical approach and assessing the risks associated with THA. Certain medical conditions, including cardiovascular disease, diabetes, and pulmonary disease, may necessitate additional monitoring and care during and after surgery.

Additionally, patient's lifestyle, occupation, and expectations may also be considered during preoperative planning for THA. Patients who engage in high-impact activities, for instance, may require specialized implants or postoperative rehabilitation, whereas sedentary patients may benefit from simpler, less invasive surgical procedures.

7.1.3. Surgical technique and approach

THA is performed using a variety of surgical techniques and methodologies, including posterior, anterior and lateral approach (Table 2).

Posterior approach: In this technique, an incision is made on the back of the hip, enabling the surgeon to access the hip joint by slicing through the muscles and tissues on the side of the hip. This is the most common technique for THA and provides excellent exposure of the hip joint.

Anterior approach: This approach entails making an incision on the front of the hip, allowing the surgeon to access the hip joint by going between the muscles and tissues rather than cutting through them. Compared to the posterior approach, this technique may result in less muscle damage and a quicker recovery period.

Lateral approach: This approach entails making an incision on the side of the hip, allowing the surgeon to access the hip joint by cutting through the side of the hip's muscles and tissues. This method is utilized less frequently than the posterior or anterior approaches (Moretti et al., 2017).

Table 2: THA surgical techniques for patients with an old acetabular fracture and osteoarthritis

S. No	Surgical technique	Merits	Demerits	Reference
1	Antero-lateral approach	Provides excellent exposure of the acetabulum and femoral head, and if necessary, can be extended to a posterior approach.	Possibility of lateral femoral cutaneous nerve injury and hip instability due to disruption of anterior soft tissue structures.	Austin et al., 2009; Hasija et al., 2018
2	Posterior approach	Reduces the risk of injury to the lateral femoral cutaneous nerve and improves visibility of the posterior column and wall.	If not conducted carefully, can result in limited exposure of the acetabulum and femoral head, with the possibility of nerve damage.	Hu et al., 2017; Onyemaechi et al., 2014
3	Lateral approach	Avoids injury to the lateral femoral cutaneous nerve while providing adequate exposure of the acetabulum and femoral head.	Possibility of hip instability due to disruption of lateral soft tissue structures, resulting in limited exposure of the posterior column and wall	Goulding et al., 2010; Suzuki et al., 2013

7.1.4. Postoperative care and rehabilitation

Postoperative care and rehabilitation following THA are essential for a positive outcome and rapid recovery. Following are some general recommendations for postoperative care and rehabilitation following THA:

Pain is a common side effect of THA, and is managed through analgesics. Physical therapy is an essential component of THA rehabilitation along with the domestic exercises. Weight-bearing restrictions are imposed and patients are required to use a walker or crutches for several weeks or months, while progressively increasing the

amount of weight placed on hip joint. The incision site is kept sterile and dry to prevent infection and to prevent blood clots wearing compression stockings or taking blood thinners are recommended (Chen et al., 2021).

7.1.5. Outcomes and complications

THA is a highly effective surgical procedure that can alleviate pain and increase functions of hip joint. However, as with any surgical procedure, there are potential complications and outcomes of this technique:
One of the primary objectives of THA is to alleviate pain in the hip joint, thereby improving the patient's mobility, walking ability, and ability to conduct daily activities. It can restore mobility to hip joint, enabling the patient to engage in physical activities they were unable to perform prior to surgery. THA implants can last for many years, providing patients with hip joint disease with long-term relief (Ninomiya et al., 2018).

The notable complications included infection at surgical site, formation of blood clots in the extremities that can be fatal if they travel to lungs. Implant failure can loosen, deteriorate, or shatter, necessitating revision surgery, dislocation of the replacement hip joint, which is more likely to occur in first few months following surgery, nerve or blood vessel damage during surgery. Although uncommon, some patients may experience an allergic reaction to the materials used in the implant (Aqil et al., 2020).

7.2. Other surgical techniques

Osteotomy and arthrodesis are other surgical procedures used to treat conditions of the hip joint. Osteotomy is typically performed on younger patients with hip dysplasia or other conditions affecting hip joint alignment. Typically, it is not used to treat acute acetabular fractures (Millis et al., 2018). Arthrodesis is another surgical procedure that immobilizes the hip joint by fusing it together. Typically, it is reserved for cases of severe hip joint injury or chronic hip pain that cannot be managed by other surgical techniques.

In ORIF, an incision is made near the hip joint and metal plates are employed with screws or wires to hold the fractured bones in position. In percutaneous screw fixation, the fractured bones are held in position by inserting screws through small incisions or percutaneous punctures in the skin. Using bone grafts or metal mesh, the surgeon reconstructs the hip joint cavity during acetabular reconstruction.

8. Prognosis and Outcome of Old Fracture of Acetabulum Combined with Osteoarthritis

The prognosis and outcome of OAFHAs depend on a number of factors, including the severity and location of the fracture, the extent of the osteoarthritis, the patient's age and overall health, and the chosen treatment approach. It can result in chronic pain, stiffness, limited mobility and ROM. It can result in further joint injury and a worsening of symptoms if left untreated.

THA is a common surgical treatment option for acetabular fractures and osteoarthritis. It entails replacing the damaged hip joint with an artificial joint, which can provide significant pain alleviation, enhanced function, and improved life quality. THA efficacy depends on a number of factors, including the patient's age, overall health, and the durability of the implanted joint (Gautam et al., 2020). Depending on the specific circumstance, other surgical procedures, such as acetabular reconstruction, may also be considered. The prognosis and outcome of treatment for OAFHAs will depend on the severity and location of the fracture, the severity of the osteoarthritis, and the efficacy of the chosen treatment approach. Discussion given below in table which is conducted previously with different sample sizes follow up to different OAFHAs patients post-operatively in different part globally (Table 3) as we can see the result clearly shown that very few complications and revisions were recorded with passage of time and with higher HHS (Harris Hip Score) score which is a measure of dysfunction so the higher the score, the better the outcome for the individual. Results can be interpreted with the following :< 70 = poor, 70-80 = fair, 80-90 = good, and 90-100 = excellent.

Table 3: THA Outcomes in Patients with an Old Acetabulum Fracture and Osteoarthritis

S. No	Research	Sample size	Follow up (Years) Mean	Complications	Revisions	Harris Hip Score (Mean)
1	Grubor et al., 2015	96	1.5-2	Deep infection (n=4), respiratory (n=2), Dislocation (n=1)	5.3	87
2	Brown et al., 2019	42	5	Deep infection (n=1), Periprosthetic fracture (n=3), and Dislocation (n=3).	9.5	84
3	Panteli et al., 2022	62	4.5-5	Heteroscopic ossification (n=9)	16	85
4	Cantrell et al., 2022	446	10	Deep infection and dislocation	72	83
5	Lin et al., 2015	33	66	Pneumonia, urosepsis, hematoma, loss of fixation and line infection	6	77
6	Herscovici et al., 2010	22	75.3	Orthopedic surgery complications (10), UTI (2), ischemic attack (1)	18.2	74

9. Conclusion

An old acetabular fracture combined with osteoarthritis can result in chronic pain, stiffness, and limited mobility and surgical intervention may be required to better its functioning and alleviate the pain. THA is a common surgical treatment option for this condition, and it can provide significant pain relief and enhanced function. The significance of early diagnosis and intervention, the dependence of THA success on a number of factors, and the potential advantages of other surgical techniques, such as acetabular reconstruction, are among the most important considerations. Future research directions may include the development of patient-specific implants and the improvement of implant survival rates. Clinical implications and recommendations for the treatment of old acetabulum fractures accompanied by osteoarthritis include close collaboration with the healthcare team and selection of the optimal surgical technique based on patient-specific factors.

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