Original Article

Hip Bone Fracture Diagnosis and Management

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Abstract

Background: Hip bone has an important structural role in the human body and is considered a central anatomical structure that is surrounded by large muscles, pelvic organs, and neurovascular bundles. It acts as a hanger where girdle and lower limb muscles originate or attach. Its function is essential in body weight-bearing and movement allowance. Hip fractures must be dealt with appropriately to restore anatomical stability and functionality. **Objectives:** We aimed to evaluate various aspects of hip fracture in the published literature. **Method:** PubMed database was used for article selection, and the following keywords were used in the mesh; "Hip Bone Fracture Evaluation"[Mesh] and "Management of Hip bone Facture"[Mesh]. Articles related to this subject were included. **Results:** Understanding of the mechanism of injury is crucial for suitable management. An anamnesis may report groin or buttocks pain and inability to bear weight on the fractured extremity; which is increased with walking. Examination findings usually report one or a combination of deformities, previous trauma, and leg shortening. Lateral and anteroposterior X-ray is the primary golden view of hip fractures, while other modalities are used for further identification of fractures and possible complications. 2D and 3D CT reconstructions show the anatomical hip models based on anatomical landmarks, which make it a possible modality for evaluating asymmetry of the postoperative hip. **Conclusion:** Careful clinical suspicion of hip fractures and possible neurovascular compromises are possible complications of falls, especially in the elderly. The advantageous radiological modalities represent possible adjuvants for evaluation and monitoring management of hip fractures.

Keywords: Hip fractures, Surgical Management

Introduction

Fragility fractures most commonly occur in elderly patients because of variant causes that are out of this article's objective. Although nutrition is only one of the multiple factors influencing bone mass and fragility fractures, this is very significant for bone health [1]. Hip fracture is considered a major type of fragility fractures due to its significant effect on the quality of life, health outcomes, and medical costs. Hip fractures have a direct impact on public health in terms of their high disability, morbidity, and mortality [2].

Worldwide, the incidence of hip fractures is escalating as a result of the increase in people's lifespan as well as lifestyle-related changes. The recent literature estimated that by 2030, the prevalence of hip fracture will rise up to 289,000, which makes hip fractures a major public health concern due to its impact on the life of people and the community [2].

Surgical management is the standard management approach in elderly patients. Non-surgical management is associated with various complications such as [3]:

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- Increase in the percentage of fractures displacement up to 62%
- Urinary Tract Infection
- Pneumonia
- Deep Venous Thrombosis
- Poor Functional Outcomes

Non-surgical management is recommended for patients who are unfit for surgery. The goals of treatment in fit patients are anatomic reduction and stable fixation, but in elderly patients, the aim is to restore the function and to decrease the risk of secondary complications. In this study, we aimed to review the published literature in order to evaluate hip fractures risk factors, diagnostic and surgical management approaches.

Methodology

PubMed database was used for article selection, and the following keywords were used in the mesh; "Hip Bone Fracture Evaluation"[Mesh] and “Management of Hip bone Facture"[Mesh]. A total of 40 papers were reviewed and included in the research. The articles were selected based on the relevance to the project including hip bone fractures’ management approach. Exclusion criteria included all other articles that did not have a related aspect to hip bone fracture as their primary endpoint or repeated studies.

Discussion

Fracture of the hipbone is most often reported as a result of falls from standing height. It is one of the most serious injuries to the orthopedics and emergency departments, worldwide. The high rates of health costs, mortality, and morbidity of hip fractures and its complications have led to the establishment of many global databases, intensive guidelines, and care audits such as the National Hip Fracture Database in Britain [2]. Awareness campaigns, risk modification, proper diet, and activity programs are targeted toward those at risk and those with predisposing factors, such as aging or menopausal. Surgical treatment is almost always required to stabilize the broken hip, depending on the type, location, affected tissues, and the shearing forces that caused the fracture in the first place. In general, the hip bone fractures can be resulted from falling, weaken bones or direct blow to the side, where three different types can occur (see table 1) [3].

Table 1: Types of Hip Bone Fractures

Intracapsular	At the level of the neck and the head of the femur; may have a loss of blood supply to the bone.
Intertrochanteric	Between the neck of the femur and a lower bony prominence called the lesser trochanter, an attachment point for major muscles of the hip.
Subtrochanteric	Below the lesser trochanter, along the bone shaft; may be broken into several pieces.

The hip joint is a central and important anatomical structure as large muscles of the girdle and lower limb encapsulate it. The neurovascular bundle lies anterior and posterior to the hip [4]. An estimation of the bodyweight on the hip could be around double and half times the body weight putting force on the acetabular-femoral pivot, which is an extraordinary feat not strange to the capabilities of human anatomy. However, this delicate structure might be disrupted due to external or internal forces. When the hip dysfunctions, the surgeon should pay attention and approach the situation from its all angles, including the anatomical one.

Risk Factors

There are non-modifiable and modifiable risk factors of hip fractures, as with other traumatic fractures. The non-modifiable factors include previous hip fracture, age of 65 or more, female gender, family history of hip fractures, and low socioeconomic status [5-9]. On the other hand, certain factors can be prevented and are known as modifiable risks, including chronic use of certain medications (such as levothyroxine, loop diuretics, proton pump inhibitors, and selective serotonin reuptake inhibitors), osteoporosis, falls (especially in elderly), sedative lifestyle (also in older age), and vitamin D deficiency [10-15].

Clinical Features and Diagnosis

Patients with hip fractures usually report the presence of pain and the inability to bear weight on the fractured extremity. The pain location is usually on the groin or buttock and may refer to the upper knee or the distal side of the femur. The pain worsens when the patient walks or bears any weight on the affected site. It is extremely important to ask about the mechanism of the injury, or about the history of any recent falls or event that may cause trauma. Asking for the before-mentioned risk factors is of critical importance along with other co-morbidities in these patients.

Clinical examination is very relevant in such patients and may reveal very helpful findings in diagnosing the fracture. Upon inspection, a deformity might be seen as a shortened leg, which is on the affected side. However, some fractures like stress and/or the non-displaced ones may not present with such deformities. Another finding is ecchymosis which is noted more in trauma patients, and rarely present initially in non-traumatic patients. In these patients, the pain gets higher when the leg is rotated or adducted, especially when performing the log roll maneuver, with internal and external rotation while the leg and thigh in supination. Applying any axial pressure or load may elicit pain as well. Fracture displacement can be noted as well, with patients preferring to keep their legs in abduction and external rotation when they lay supine in the examination table. The leg may appear shortened in this position and the patient is unable to perform an active straight leg raise.

Assessment of the vascular, with distal pulses, and neural (sensation) components are vital for any associated injury along with documentation of their status. Some patients (usually traumatic) may present in unstable status. The most important point in these cases is to stabilize them as quickly as possible and prepare them for a possible emergency operation. Every elderly patient presenting with hip pain and a history of fall should be treated as a fracture until proven otherwise. Radiological modalities are of utmost importance here as in any fracture, in order to establish the diagnosis, to identify the fracture type and even for the final decision of the next step in management [9].

The initial radiological test is plain radiography (x-ray) which is usually carried out in a cross-table lateral (hip) and anteroposterior views (pelvis). In these patients, painful positioning of the limb should be avoided and thus some views like frog-leg view should be also avoided. Sometimes, positioning the limb in such a way will even cause some complications, such as worsening of a displaced fracture or even displacement of a nondisplaced fracture. If the plain radiography is negative, with high clinical suspicion of hip fracture, further testing is needed. Usually, the next step in such patients is magnetic resonance imaging (MRI) or a bone scan in order to identify the possible pathology. These tests are done in order to reveal some other fractures, which may not be seen on plain radiography such as stress fracture, pelvic fracture, and/or pathologic fractures. Computed tomography can be used, but it has some disadvantages in some cases; for example, it may not show the bone marrow edema surrounding the fracture line, and it is unable to detect trabecular bone injuries in osteoporotic fractures sometimes [16].

Management

Certain surgical anatomical aspects of the hip are important for the surgeon. Dissection, for instance, should be in line with muscle planes. Detached muscles should be re-inserted into their tendinous insertions or subperiosteal origins. When retracting these muscles, it is recommended to pull them toward their neurovascular structures as a precaution [14]. Important nerves include the sciatic nerve (the largest nerve in humans) posteriorly and the femoral bundle anteriorly. The sciatic is dangerously close to the acetabulum at only 1.5 cm; this is of surgical importance for example, in the total hip prosthesis, and osteosynthesis of dorsal acetabulum fractures [17]. A simple way to protect the sciatic would be flexing the knee and extending the hip; while relaxing the knee and flexing the hip would relieve the femoral bundle of any tension [4].

When approaching the hip joint posteriorly, the sciatic nerve is the largest nerve passing through the fatty area between the Gluteus Maximus and external hip rotators. Retracting it posteriorly and medially away from the acetabulum is recommended, as it can be accessed through the G. Maximus. The neurologic injury does occur in traumatic hip fracture-dislocation (around 10% in adults and 5% in children), with the most common nerve injury being that of the sciatic [18]. It is therefore important to examine neurological function in patients at risk. Fortunately, partial recovery occurs at ~70% regardless of therapeutic intervention [18]. External rotators are also found posterior to the hip joint and should be retracted posteriorly and medially [4]. Another important surgical caution in posterior approaches is a possible injury to the medial femoral circumflex artery, which is the major blood supply to the femoral head. Its deep branch is protected by the Obturator Externus during hip dislocations and complete circumferential capsulotomy [19]. Avascular necrosis of the femoral head is another headache for surgeons approaching hip dislocations with femoral head fractures. Approaching this through digastric trochanteric flip osteotomy can reduce overt displacement under the direct view of the surgeon; this technique was recommended for treating high volume acetabular fractures [20].

Anteriorly, muscles surrounding the hip include the Sartorius, from the anterior superior iliac spine inserting into the medial upper tibia; the Rectus Femoris, lying on top of the hip joint capsule originating from both the anterior inferior iliac spine and anterior superior aspect of the acetabulum, the straight and reflected heads respectively; and finally the Iliopsoas (the most powerful hip flexor) diving at the medial aspect and inserting at the lesser femoral trochanter. Laterally, the Tensor muscles and its fascia fuse with Gluteus Maximus posteriorly (inserts at gluteal groove); the Gluteus Medius and Minimus (major abductors) slide at the iliac wings and insert at the greater trochanter. The problem lies in the neurovascular supply and the surgeon should know that these attach posteriorly and superiorly, and as mentioned above, retract the muscle towards the neurovascular bundle [4].

Studies have reported that native anatomical structure could not be fully restored, as compared with the non-affected side [21]. Two-dimensional techniques were inferior to three-dimensional rendering according to several studies. They are liable to underestimation and might show difficulty in reproducing the original landmarks [22, 23]. The 2D CT interpretation is affected by rotation and the tilt of the hip girdle [23]. Tsai et al. [21] utilized 3D CT and reconstructed anatomical hip models based on anatomical landmarks and compared implanted and other normal hips with regards to orientation and position of structures in the same patients. The advantage of 3D rendering was evident as models had accurate hip rotation and pelvic tilt in the images. This has demonstrated 3D CT as a possible standard for evaluating the asymmetry of the postoperative hip [21].

Conclusion

Hip Fracture remains one of the most fatal fractures, with a major impact on the economy, morbidity, and lifestyle as well. Even though it is commonly experienced in older patients, road traffic accidents and trauma have increased in prevalence lately and these patients usually present with other fractures and sometimes in unstable conditions. Thus, the rule of the physician is to understand the mechanism of such

fracture, with an early diagnosis which will help in choosing the optimum management option since some operations need to be done within a tight window. However, the role of clinicians to help in reducing the risk factors seen in the populations and educate the society is of major importance in this disease. New recent updates in management and the control of risk factors have introduced a new light into the conventional understanding and protocols of hip fracture. Furthermore, with further studies with larger samples and longer follow up periods, a better understanding of the total impact of such breakthroughs can be developed, making the management of such patients more and more optimum.

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