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An Overview on Diagnosis and Management of Fracture Neck Femur

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Abstract:

Fracture of the neck of femur is a common orthopedic injury, particularly in the elderly population, and represents a major cause of morbidity and healthcare burden worldwide. Timely diagnosis through clinical evaluation and imaging, primarily X-rays and CT scans, is essential for optimal management. Two commonly employed surgical options for internal fixation are the Dynamic Hip Screw (DHS) and Cannulated Cancellous Screws (CCS). DHS offers a fixed-angle device with controlled collapse and sliding mechanism, ideal for displaced or unstable fractures. Cannulated screws, on the other hand, are less invasive and preserve more bone stock, typically used in minimally displaced or stable fractures.

Keywords: Femoral neck fracture, Dynamic hip screw, Cannulated screws, Internal fixation, Orthopedic trauma, Hip surgery, Fracture management, Adult femoral fractures, DHS vs CCS, Surgical treatment options.

Introduction:

Fracture neck femur can be described as the current “Orthopedic Epidemic” . It is one of the most common fractures in adult which represent an enormous socio-economic and medical burden to find out the most effective method to treat it. It constitutes almost 20% of the surgical fractures. Its incidence had raised due to the increased life expectancy and increased high velocity accidents. The average age of the population increased markedly while the incidence of hip fractures grew many times, particularly in industrialized countries. Although the age-specific incidence varies from country to country, a continued increase worldwide is expected that by 2025, it may reach around 4 million annually.

The majority of these fractures occur due to direct trauma especially in young age from high energy road traffic accidents while in older patients from simple falling. It is often called a fracture of fragility due to osteoporosis. Osteoporosis incidence is increasing recently with expression of its senile form in the proximal femoral fracture that contributes considerably to the mortality in old people.

It is more common in women than in men probably as a result of several factors which is further enhanced by post-menopausal changes.

There are numerous surgical methods for the treatment of femoral neck fractures, with considering the wide range of osteosynthestic therapies, it is crucial to assess the quality of different care options to ensure the optimal treatment. The treatment should encourage union without deformity and allows early mobilization.

However, the optimal implant for fixation method remains controversial, internal fixation remains the treatment of choice for these fractures in all age groups, where preservation of the femoral head is a top priority. It is important to have early anatomic reduction along with rigid internal fixation and lesser complications.

The benefits of ideal internal fixation include; preservation of the patients’ own hip joint, less invasive surgery, and better range of activity than in those treated by Total Hip Replacement.

Today's most popular head-preserving implants include the dynamic hip screw (DHS) and the multiple cannulated screws (MCS)

. Although they lessen the risk of displacement, allow early weight bearing and early rehabilitation, there is no consensus regarding the optimal approach for management of femoral neck fractures. However, there are complications of these surgical methods including revision surgery, avascular necrosis of the femoral head, fracture non-union, infection, and implant failure.

The most important factors causing controversy in these fractures are the evolving methods of treatment being available and a lack of high level evidence studies proving one treatment modality to be better than another. Both DHS and MCS have the capacity of compression in the fracture site but their strength for maintaining reduction is not the same.

I. Diagnosis

Incidence and Risk Factors

In the US alone, 250,000 hip fractures occur annually, and this figure is expected to double by 2040.

Risk doubles every decade after fifty. These include the following

- Female sex, and increased age
- Physical inactivity
- Arthritis
- Osteoporosis
- Dementia
- Defective vision
- Smoking
- Excessive coffee or alcohol consumption
- Low BMI

➢ Clinical presentation

Signs and Symptoms;

- Severe pain in hip or groin
- Inability to walk or move
- Inability to bear weight on the leg on the side of injury
- Stiffness, bruising and swelling in and around the hip
- Limb shorter on the side of injury
- The fractured limb is in an external rotation position

➢ Radiological Evaluation;

Diagnostic imaging is central to the diagnosis of femoral neck fractures. These include;

1. Plain radiographs

Plain radiographs have traditionally been ordered as the initial step in the workup of hip fractures. The main purpose of x-ray films is to determine the site and extent of the fracture and rule out any other associated fractures. However, it may appear normal in a patient with an undisplaced fracture. That is why Plain radiographs have poor sensitivity **(1).**

The standard radiographic examination of the hip includes an anteroposterior view of the hip & pelvis and a cross-table lateral view.

Fig (1): Xray Pelvis Anteroposterior and Lateral views showing a Dynamic Hip Screw Implant in the right proximal femur.

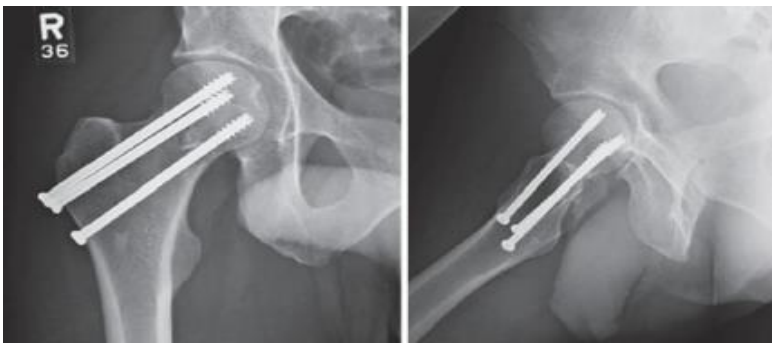

Figure (2): AP (left) and lateral (right) radiographs showing parallel screws were inserted into the femoral head to hold a femoral neck fracture. (Reproduced from Management of femoral neck fractures in young adults. Indian journal of orthopaedics. 42. 3-12. 10.4103/0019-5413.38574.)

2. **MRI**

If a hip fracture is suggested but not clear on standard x-ray films and the pain is still persistent, then a magnetic resonance imaging (MRI) study should be performed to rule out a nondisplaced or impacted fracture.

3. **CT**

CT is helpful in determining displacement and degree of comminution in some patients **(2).**

4. **Duplex Scanning**

Duplex Scanning is indicated to rule out DVT if delayed presentation to hospital after hip fracture **(3).**

- **Laboratory Evaluation;**

Laboratory studies generally are not necessary for the diagnosis of femoral neck fractures. However, preoperative assessment of the patient is essential. CBC, bleeding profile, cross-matching, blood calcium level, liver function tests, renal function tests, virology must be done and evaluated prior to any intervention.

II. Principles of management

Acute Phase

Treatment of hip fracture generally involves a combination of surgery, rehabilitation and drugs. Several factors need to be considered before a treatment plan is recommended. The aim of treatment is to decrease the pain, promote healing, prevent complications, and help patient to return to his previous normal function as pre-injury state. Initial management includes; assessment of general condition, pain killers, intravenous fluid replacement, blood tests.

Chronic Phase

Non-operative management for these fractures is rarely the treatment of choice. It is only considered in high-risk patients whose surgical risks negate any benefit of fixation. Thus early surgical intervention will be so vital to prevent further complications.

III. Surgical Treatment of femoral neck fractures

The results of osteosynthesis in young patients are debatable by presenting a considerable complication rates. However, little doubt is present that the most problematic complication is the occurrence of osteonecrosis. Many variables have been associated with this complication after femoral neck fractures.

Most literature does not support the differences in gender but higher rates of nonunion and AVN are more common in younger patients. Some explanations are given on the basis of high energy trauma and its correlation with dislocated fractures in young adults.

Many of the patients coming with femoral neck fracture have significant comorbidities, which lead to delays in surgery and functional recovery. These patients should be mobilized as soon as possible to prevent complications associated with immobilization. Therefore, a surgical technique allowing anatomic alignment and a stable fixation with early mobilization is accepted as the standard approach for intertrochanteric fractures. Surgeon can control fracture reduction, implant selection and implant placement, all of which must be optimized to ensure the success of the surgical intervention. Non-displaced fractures are treated typically with percutaneous cannulated screws or dynamic hip screw. While displaced fractures of the femoral neck in elderly patients, the treatment depends on the patient's baseline activity level and age.

Goals of the surgical management of femoral neck fractures in adult patients ;

(1) Return to pre-injury level of function
(2) Early mobilization
(3) Achieve an anatomic reduction of the fracture to preserve the blood supply and effectively prevent AVN
(4) Provide a stable fixation while preserving bone stock to achieve union **(4).**

Complications:

Fixation of femoral neck fractures is associated with a higher incidence of complications than any other fracture. The rate of nonunion and avascular necrosis with open reduction and internal fixation continue to be unacceptably high. Avascular necrosis continues to be a significant complication with as many as 24% of patients being affected. With these complications, it may be argued that the most cost-effective solution to femoral neck fractures in the majority of patients is open reduction and internal fixation.

Complications include the following :

- **Osteonecrosis**
  - Incidence of 10-45%.
  - Severe symptoms not always present when AVN develops.
  - Many studies tried to demonstrate association between time to fracture reduction and subsequent AVN but still inconclusive.
  - **Increased risk with:**
    - Increase initial displacement but can still also develop in nondisplaced injuries.
    - Non-anatomical reduction
  - **Treatment:**
    - ✓ Prosthetic replacement in the form of hemiarthroplasty or THA **(5).**

- **Nonunion**
  - Incidence of 5-30%.
  - Increased incidence in displaced fractures.
  - No correlation between age, gender.
  - **Treatment:**
    - **Free vascularized fibula graft (FVFG)**

✓ Indicated in young patients with a viable femoral head **(6).**

- **Arthroplasty**

✓ Indicated in older patients or when the femoral head is not viable.

- **Loss of independence**
  - Requiring walking aids and assisted living following fracture surgery.
  - Associated factors:
    - age >80 years
    - prior walking aid use
    - current tobacco smoking

Dynamic Hip Screw

Dynamic hip screw or sliding screw fixation consists of a lag screw, a side plate and cortical screws which fix the side plate to the proximal femoral shaft. The idea behind the dynamic compression is that the femoral head component is allowed to move along one place and since bone responds to dynamic stress, the femur may undergo primary healing resulting in joint requiring no remodeling **(Figure 3)**.

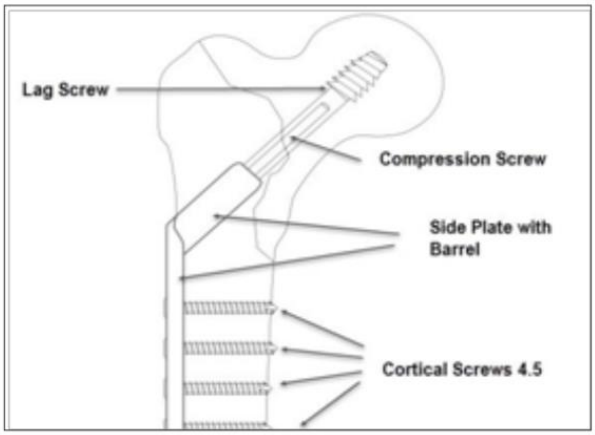

Figure (3): An illustration of Dynamic Hip Screw implant in the proximal femur.

Rarely, the hip screw might protrude into the hip joint articular surface. This can present as increased pain on mobilisation and may result in surgical intervention, such as revision to a hemi to total hip replacement.

Cannulated Screws for Femoral Neck Fracture

Cannulated screws (CS) are the most commonly performed type of fixation for these fractures **(Figure 4)**. They provide good torsional stability, are minimally invasive and preserve blood supply. Parallel partially threaded screws allow controlled axial compression and sliding. Headless fully threaded CS have shown some biomechanical advantages but are more expensive**(7).**

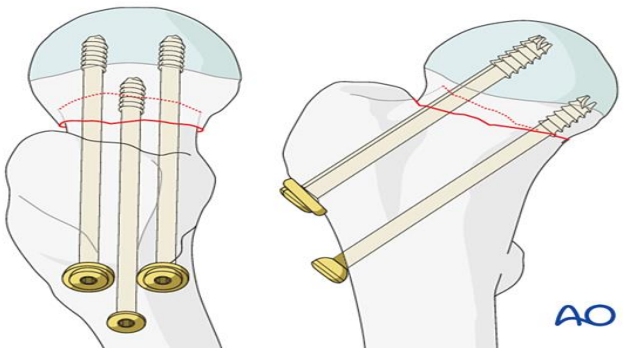

Figure (4): Cannulated screws **(AO).**

CS fixation is the procedure that can be performed in the shortest time and with the least blood loss. Valgus impaction or undisplaced fractures can often be treated with percutaneous CS fixation in situ using the traditional inverted triangle configuration. CS show good outcomes in fixation of stable Garden type 1 and 2 fractures **(8).**

Cannulated screw fixation is indicated in nondisplaced, intracapsular FNFs in elderly patients, and in displaced fractures in younger patients with ideal bone quality. The technique consists of inserting 3 or 4 cannulated screws in an inverted triangle or diamond configurations, respectively.

References:

1. Alanazi, A. M., Alotaibi, H. D., Alahmari, S. A., Almutairi, A. K., Babakr, S. A. A., Abdrabalnabi, H. A. Al, Ali, A. A., Shamat, R. A. A. Al, Husain, Z. A., & Abdulla, A. H. A. (2019). Hip Bone Fracture Diagnosis and Management. Archives of Pharmacy Practice, 10(4).
2. Gómez Roselló, E., Quiles Granado, A. M., Artajona Garcia, M., Juanpere Martí, S., Laguillo Sala, G., Beltrán Mármol, B., & Pedraza Gutiérrez, S. (2020). Facial fractures: classification and highlights for a useful report. Insights into Imaging, 11(1). https://doi.org/10.1186/S13244-020-00847-W
3. Wang, J., Breda, K., Moon, C. N., Little, M. T. M., & Lin, C. A. (2021). COVID-19 Shelter-In-Place Orders Associated With Delayed Presentation and Deep Venous Thrombosis in Geriatric Hip Fractures. Orthopedics, 44(4), 223–228.
4. Schwartsmann, C. R., Lammerhirt, H. M., Spinelli, L. de F., & Ungaretti, A. da S. (2018). Treatment of displaced femoral neck fractures in young patients with DHS and its association to osteonecrosis. Revista Brasileira de Ortopedia, 53(01), 82–87.
5. Fernández-Codina, A., & Pope, J. E. (2021). Osteoporosis and osteonecrosis in systemic lupus erythematosus. Revista Colombiana de Reumatología, 28, 3–11.
6. Nam, D., Salih, R., Nahhas, C. R., Barrack, R. L., & Nunley, R. M. (2019). Is a modular dual mobility acetabulum a viable option for the young, active total hip arthroplasty patient? The Bone & Joint Journal, 101(4), 365–371.
7. Tanoğlu, O., Arıcan, G., Özmeriç, A., Şahin, Ö., İltar, S., & Alemdaroglu, B. (2020). Predictors of early mortality in geriatric patients after hemiarthroplasty for femoral neck fracture. Acta Medica Alanya, 4(3), 220–225.
8. Yong, T. M., Austin, D. C., Molloy, I. B., Kunkel, S. T., Jevsevar, D. S., & Gitajn, I. L. (2020). Screw fixation versus hemiarthroplasty for nondisplaced femoral neck fractures in the elderly: a cost-effectiveness analysis. Journal of Orthopaedic Trauma, 34(7), 348–355.