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Management of Fracture Shaft Femur

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Abstract:

Femoral shaft fractures in adults are reasonably common and can occur in isolation or in association with other injuries. They are typically high-energy in aetiology, especially in young adults, and require special consideration to the physiological impact of injury on the patient. The evolution of treatment for these fractures has seen changes in the timing of surgery as well as the techniques employed, but the principles of stable internal fixation remain. Good outcomes and low complication rates can be expected if the operating surgeon has a thorough understanding of the anatomy, basic science and surgical technique relating to the treatment of femoral shaft fractures.

Key words: surgery, Femoral, Management

Introduction:

Fracture shaft of femur is one of the most common fractures encountered in orthopedic practice. Injury is most common among persons younger than 25 years and those older than 65 years. (1)

With the ever-increasing road traffic accidents, pedestrian versus accidents, sports injuries, fall form height, industrial accidents, comminuted shaft fractures of femur are becoming common. In high velocity injuries one must have a high index of suspicion for complications or other associated injuries where the bone is subjected to sudden and violent force resulting in severe and extensive communition, jeopardizing the vascularity of bone and surrounding tissues. (2)

Fractures are most often due to a bending load applied to the femur with comminution occurring via higher magnitude forces. Torsional loads, in contrast, form a spiral fracture pattern.

Fracture shaft of femur is major cause of morbidity and mortality in patients who sustain high energy trauma. Morbidity arises from limb shortening, mal union, nonunion and the so called fracture disease. The muscle gets atrophied and fibrosed, the hip and knee joints lose their range of motion and chronic dependent edema develops. Mortality is infrequent, but can result from an open wound, fat emboli, adult respiratory distress syndrome (ARDS) or due to result of multiple organ failure especially in multiple injured patients, deep venous thrombosis (DVT), pneumonia development, long intensive care unit (ICU) stays, infection, hemorrhage nerve palsies and compartment syndrome. (3)

Currently, surgery is indicated for most femur fractures because of the high rate of union, low rate of complications, and the advantage of early fracture stabilization, which decreases the morbidity and mortality rates in patients (especially polytrauma patients) with these fractures. (4) Interlocking nailing of communited fractures with proximal and distal locking screws provides rotational stability and the nail functions as load-sharing, rather than bearing the load. (5,6)

Femoral shaft fractures are typically an emergency indication as delayed fracture stabilization is associated with an increased morbidity, and a longer hospitalization time (7).

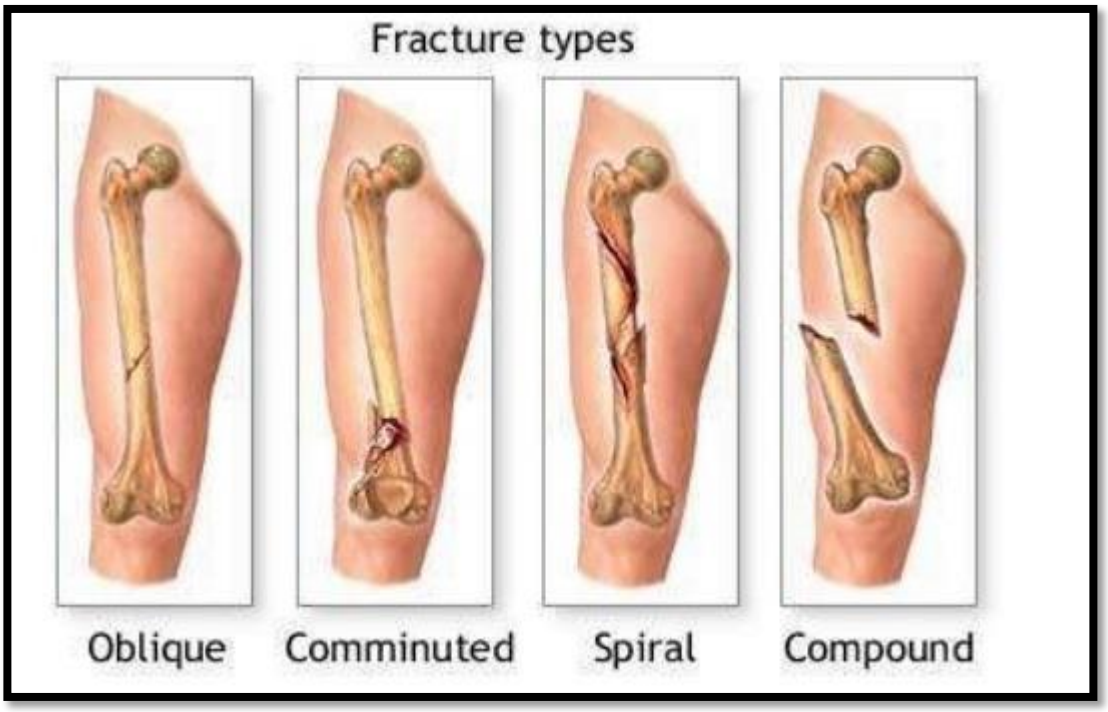
Types of Femoral Shaft Fractures:

Femur fractures vary greatly, depending on the force that causes the break. The pieces of bone may line up correctly (stable fracture) or be out of alignment

(displaced fracture). The skin around the fracture may be intact (closed fracture) or the bone may puncture the skin (open fracture).

The fractures to each other using classification systems. Femur fractures are classified depending on: (8).

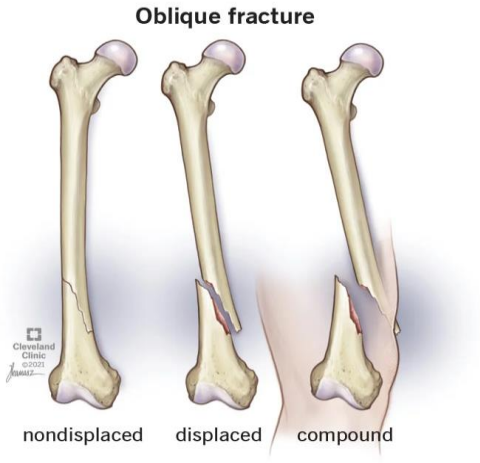
- The location of the fracture (the femoral shaft is divided into thirds: distal, middle, proximal)
- The pattern of the fracture (for example, the bone can break in different directions, such as crosswise, lengthwise, or in the middle)
- Whether the skin and muscle over the bone is torn by the injury.



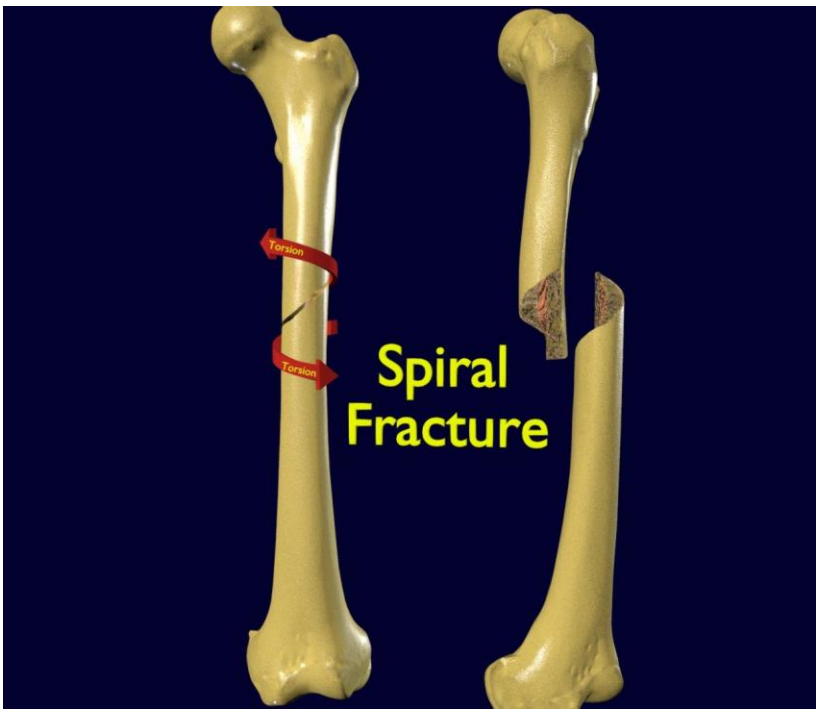
The most common types of femoral shaft fractures include:

Transverse fracture. In this type of fracture, the break is a straight horizontal line going across the femoral shaft.

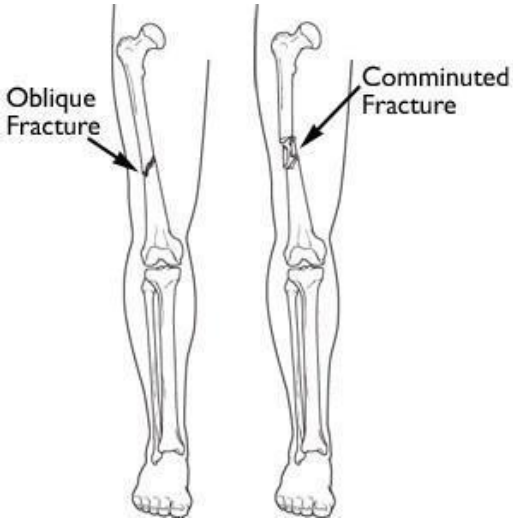
Oblique fracture. This type of fracture has an angled line across the shaft.



Spiral fracture. The fracture line encircles the shaft like the stripes on a candy cane. A twisting force to the thigh causes this type of fracture. (9).



Comminuted fracture. In this type of fracture, the bone has broken into three or more pieces. In most cases, the number of bone fragments corresponds with the amount of force needed to break the bone.



Open fracture. If a bone breaks in such a way that bone fragments stick out through the skin or a wound penetrates down to the broken bone, the fracture is called an open or compound fracture. Open fractures often involve much more damage to the surrounding muscles, tendons, and ligaments. They have a higher risk for complications—especially infections—and take a longer time to heal.

Table (1) show the Classification of Femoral Shaft Fractures

Winquist and Hansen Classification	
Type 0	No comminution
Type I	Insignificant amount of comminution
Type II	Greater than 50% cortical contact
Type III	Less than 50% cortical contact
Type IV	Segmental fracture with no contact between proximal and distal fragment

AO/OTA Classification	
32A - Simple	A1 - Spiral A2 - Oblique, angle > 30 degrees A3 - Transverse, angle < 30 degrees
32B - Wedge	B1 - Spiral wedge B2 - Bending wedge B3 - Fragmented wedge
32C - Complex	C1 - Spiral C2 - Segmental C3 - Irregula

Pathophysiology of the injury:

Even isolated femur fractures are associated with an increased risk of post-traumatic complications due to the high-energy mechanism with significant bony and additional soft-tissue injury resulting in substantial blood. The soft-tissue injury primary can initiate a local inflammatory response with release of zytokines which can trigger a secondary systemic inflammatory response syndrome (SIRS) (10).

In the context of multiple trauma, the additional femur fracture is of major importance as patients with bilateral femur fractures have a significantly higher mortality rate than with unilateral injury (16% versus 4%, (11).

The trauma-induced inflammatory response is not only determined by the bone or soft-tissue injury. Other body regions contribute significantly to the local synthesis and systemic release inflammatory mediators. Especially the lungs are a significant source of these mediators leading to a potential risk of a systemic inflammatory

response syndrome (SIRS) (10). However, in addition to the fracture-induced pathophysiological response (first hit), surgery can cause another release of inflammatory mediators (second hit) (11) which can increase the rate of systemic complications (12).

The extent of this „second hit“ is potentially dependent on the type of primary fixation as initial definitive treatment of femoral fractures (“Early Total Care”, ETC), e.g. reamed femoral nailing, can lead to a significantly increase of the inflammatory response with increased cytokine levels (IL-6), activation of granulocytes, endothelial cells and pulmonary permeability (13).

Identified a special subgroup of patients with a higher risk of developing systemic complications (borderline patients), where the stabilization method and the duration of surgery affected the outcome (14). Therefore, minimization of the initial surgical trauma by primary temporary stabilization with external fixation techniques is thaught to result in less complications and better prognosis: „Damage Control Orthopedics.

Imaging:

Imaging tests will provide your doctor with more information about your injury.

X-rays. The most common way to evaluate a fracture is with x-rays, which provide clear images of bone. X-rays can show whether a bone is intact or broken. They can also show the type of fracture and where it is located within the femur.

Computerized tomography (CT) scans. If your doctor still needs more information after reviewing your x-rays, he or she may order a CT scan. A CT scan shows a cross-sectional image of your limb. It can provide your doctor with

valuable information about the severity of the fracture. For example, sometimes the fracture lines can be very thin and hard to see on an x-ray. A CT scan can help your doctor see the lines more clearly. (15-18).

Management of Fracture:

Femoral shaft fractures usually require surgical management; non-surgical or conservative management is carried out only in young children or non-displaced fractures in patients with multiple medical comorbidities such as cardiovascular or cerebrovascular diseases, respiratory diseases, etc. It is based on the patient's age, weight, and fracture type. The main aim is to realign the fractured fragments and immobilization to promote healing. Non-surgical management includes(19-23).

- **Pavlik Harness Treatment**: It is used to treat infants less than six months of age. It is a soft splint with chest and leg straps. The chest strap is

positioned across the baby's back, reaching around to close in the front. The leg strap is attached in the front with a loop under each foot, crossed over at the back, and attached to the top of the body strap. It immobilizes and supports the legs in an outwardly rotated position, promoting healing. It is regularly monitored by ultrasound for around three weeks. (24-26).

- **Spica Casting**: It is recommended for children under five years of age but is contraindicated in cases of multiple injuries, open fractures, or in cases of shortening of the femur that is more than three cm (centimeters). It is a soft padded lining wrapped around the leg and hip joint with a plaster cast or a fiberglass cast for around six weeks, followed by periodic monitoring. In some cases, a gentle and steady pulling of the bones (traction) is done to realign the bones, and then a cast is applied to promote healing. (27).

Femoral shaft fractures usually require immediate care and management to avoid further complications. Surgical management includes (28).

- **External Fixation**: In this procedure, metal screws and pins are used above and below the site to fix the fractured bone fragments. A bar is placed outside, which attaches the pins and screws to stabilize the fracture and facilitate healing. It provides good support and stability to the healing tissues but is a temporary treatment for patients who have multiple injuries and are not yet healthy for the final surgery. (29).
- **Intramedullary Nailing**: It is a standard gold method to treat femoral shaft fractures, during which a metal rod is inserted into the canal of the femur bone, which passes across the fracture and fixes its position. Intramedullary nails made of titanium are inserted either at the hip or knee, with the screws placed above and below the fractured bones to maintain proper alignment during the healing process. In cases where

intramedullary nailing is not feasible, metal screws and plates are attached to the outer surface of the femur bone to hold the fracture fragments to facilitate healing, followed by antibiotics to prevent infections, and analgesics such as Acetaminophen, Ibuprofen to reduce pain and swelling. (26).

Conclusion:

Non-operative treatment of femoral shaft fractures in patients is an exception. With the available surgical stabilization techniques, numerous studies support the advantage of surgical therapy in terms of morbidity, mortality and functional outcome. Femoral shaft fractures are typically an emergency indication as delayed fracture stabilization is associated with an increased morbidity, and a longer hospitalization time.

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