

EARLY INTERVENTION V/S DELAYED INTERVENTION? DILEMMA IN BILATERAL SHAFT FEMUR FRACTURES WITH EVOLVING FEATURES OF FAT EMBOLISM — DAMAGE CONTROL NAILING

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Abstract: Bilateral femur fractures are uncommon in the adult population with most of the patients presenting with or develop features of Fat embolism in early stages. The treating team including Emergency physician, Surgeon and Intensivist and Anaesthesiologist are often in a dilemma about appropriate management of these patients. The purpose of this study was to review our institutional experience with a study of simultaneous bilateral femur fractures with evolving symptoms of fat embolism and to highlight the presentation, treatment, and outcomes of these injuries , in order to identify any clinically relevant differences that may guide future management. Our study also helps us to guide for early intervention with damage control nailing with smaller diameter nail instead of waiting for the symptoms of fat embolism to wean off.

Introduction:

Patients with bilateral femur shaft fractures are known to have a higher rate of complications when compared with those who have unilateral fractures [1]. This fact can be explained in different ways: some authors favor the idea that the additional fracture and its associated local soft tissue trauma could be responsible. Others stress the fact that bilateral femur fractures are associated with numerous additional injuries that may be responsible for their high incidence of complications [2–5]. However, none of these studies [1–5] have focused on patients that have sustained multiple injuries. We therefore addressed the question of whether the additional injuries or the bilaterality of the femur fracture account for complications. . This study helps us to guide for early intervention with damage control nailing with smaller diameter nail instead of waiting for the symptoms of fat embolism to wean off.

Materials & methods:

We undertook a retrospective chart review of patients who had presented with bilateral femur fractures between 2017 and 2020 with a minimum of 9 months of follow-up. Descriptive information was provided about the case series of bilateral femur fracture patients with evolving fat embolism symptoms including time period of injury to surgical intervention, total duration of hospital stay and rehabilitation.

Management:

ED MANAGEMENT: Patients with femoral pathology need hemodynamic stabilization. Because of the risk of blood loss—from both the injury and its operative repair—patients with traumatic fracture of the hip or femur should be typed and crossmatched for at least 2 units of blood. Hemodynamic instability can result from dehydration and the loss of up to 3 units of blood into the fracture site. Operative repair should be performed after the patient is resuscitated and in optimal preoperative condition. The preoperative stabilization of an elderly patient with a hip fracture may require a multidisciplinary approach from emergency medicine, orthopedics, internal medicine, cardiology, and anesthesiology. Comprehensive programs co-managed by geriatricians and orthopedic surgeons have been shown to improve short-term outcomes for the elderly with hip fractures and might even lower the mortality rate, highlighting the importance of the medical management of these complex patients.⁷

Traction and Immobilization If prehospital personnel suspect a femoral fracture, they often place a Hare splint, Sager splint, or similar device that applies traction to the leg before transporting the patient. This management strategy is popular, because it provides pain relief, immobilization, and limits blood loss. However, great care should be taken to ensure the proper use of these devices. Prolonged traction while other injuries are being assessed and managed can cause or worsen serious neurologic injury in the thigh. Traction used in the field for transport can cause skin breakdown at pressure points and might produce potentially damaging tension on the nerve. Contraindications to the use of traction splints include pelvic fractures, patellar fractures, ligamentous knee injuries, and tibia or fibula fractures. In the prehospital setting, traction should not be applied to any open fracture that has exposed bone. Such reduction pulls grossly contaminated bone fragments back into the wound before adequate débridement. A study that evaluated patients with multisystem trauma in whom traction splints were placed in the field for femur fractures showed that up to 38% had contraindications to the splints that were placed. With or without traction, the injured extremity should be immobilized when the patient is moved, to prevent further damage from mobile bone fragments. In the prehospital setting, this can be achieved with simple splinting. In the ED, maintaining the leg in slight flexion at the hip reduces intracapsular pressure, whereas extension of the leg increases pressure and the potential for ischemic necrosis of the femoral head. Therefore, traction for proximal femur fractures should be discontinued once the patient has arrived in the ED. The leg can be supported in a position of comfort with a pillow placed under the thigh. The theoretic advantages for continuation of traction in the ED are pain control and fracture reduction, making operations easier to perform. This is likely true for patients

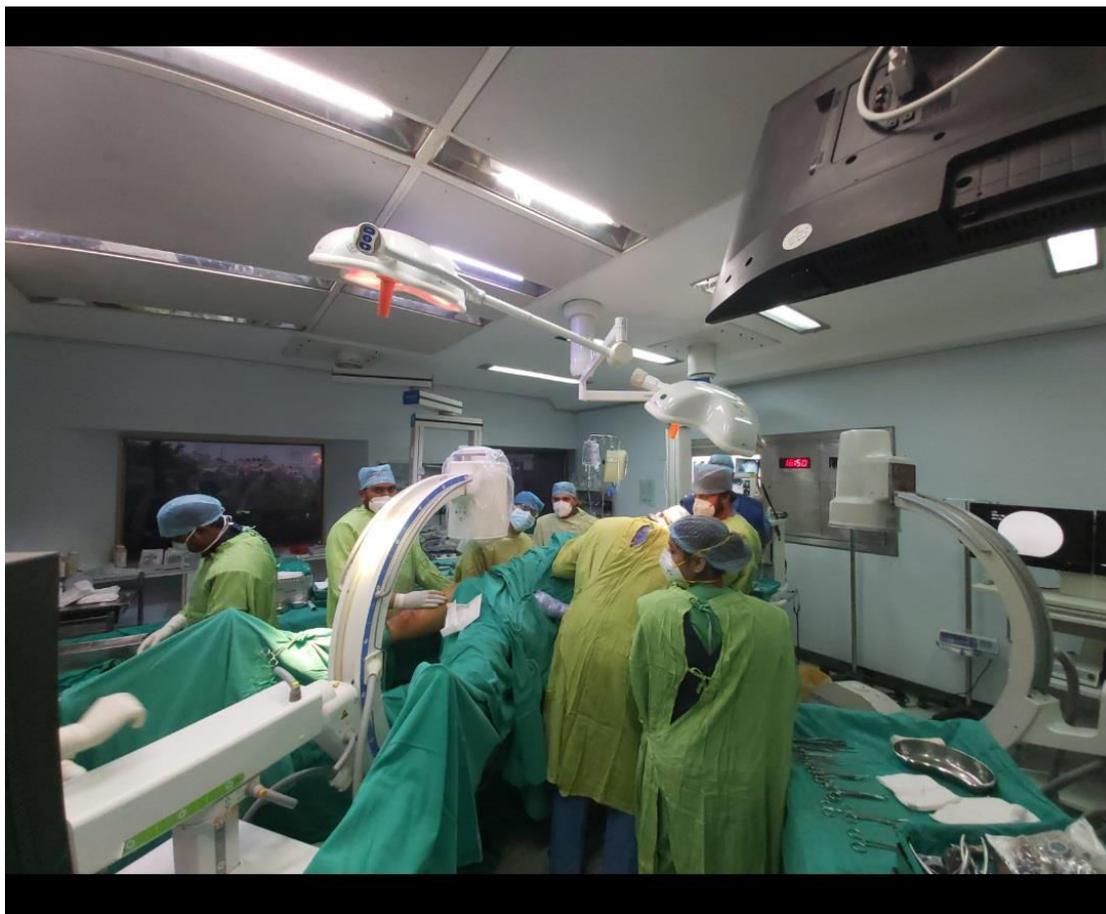
with femoral shaft fractures; however, a Cochrane systematic review that looked at preoperative traction for fractures of the proximal femur in adults found no evidence to support these proposed advantages. Open Fracture Care By definition, an open fracture is any fracture in which a break in the integrity of the skin and soft tissue allows communication with the fracture and its hematoma. Any nearby wound or break in the skin must be considered to communicate with the fracture. A bone piercing from the inside outward often causes only a small wound, after which the contaminated bone tip slips deceptively back into the soft tissue. Open wounds should be irrigated and then covered with sterile saline-moistened gauze. For all type I open fractures, a first-generation cephalosporin (such as, cefazolin, 1 g) should be administered intravenously. Types II and III might require additional gram-negative coverage depending on the amount of devitalized tissue and the extent of involvement of the groin and its gram-negative skin flora. This additional coverage could be provided by an aminoglycoside (such as, tobramycin, 1.5 mg/kg). The use of perioperative 3rd generation cephalosporins reduces the risk of postoperative infection even in patients with closed fractures. Great care should be taken to identify tetanus-prone wounds so that appropriate prophylaxis can be provided with tetanus immune globulin when indicated. Immunization status should be verified in all patients and updated as needed. Compartment Syndrome Because of the thigh's larger volume, compartment syndrome within the thigh is far less common than in the lower part of the leg. A large amount of bleeding into the thigh compartment is required before the pressure rises above capillary perfusion pressure. When compartment syndrome does occur in the thigh, only 50% of the cases are associated with a femur fracture. It is difficult to clinically differentiate the expected swelling after an injury from early compartment syndrome. Clinical examination and the use of direct pressure measurements can detect the development of compartment syndrome at an early stage. Pain Management Systemic Analgesia Pain control in EDs is often inadequate. For patients with femoral fractures, opioid analgesia is often indicated in combination with other pain-relief strategies. In addition to parenteral medications, other pain-relieving strategies include immobilization of the injured extremity, placement of the injured extremity in a position of comfort, and the consideration of local analgesia in the form of nerve blocks. Pharmacologic Approaches The classic pharmacologic treatment for pain management in patients with traumatic femoral injuries is opioid analgesics. Morphine, fentanyl, and hydromorphone are all acceptable options. Meperidine should not be used because of unacceptable side effects. Pentazocine is contraindicated in the elderly because of its central nervous system (CNS) effects (eg, lowered seizure threshold). Nonsteroidal antiinflammatory drugs (NSAIDs) can also be difficult to titrate, especially in the elderly, due to their renal and gastrointestinal side effects. Femoral Nerve Block TYPE III >10 cm Extensive muscle devitalization; nerve and arterial involvement often classified as type IIIb High-energy shotgun blast, high-velocity gunshots The femoral nerve block is an excellent option as an adjunct or alternative to systemic analgesics in patients at risk for hypotension. Femoral nerve blocks significantly decrease the time to the lowest pain score compared with intravenous narcotics, and patients require significantly lower doses of narcotics. The

block can be created with the assistance of a peripheral nerve stimulator to localize the nerve or bedside ultrasound to directly visualize the nerve before the anesthetic is injected.⁸ The procedure can also be performed by emergency clinicians without the assistance of peripheral nerve stimulators or ultrasound. If a long-acting anesthetic such as bupivacaine is used, the expected onset of analgesia is within 30 minutes and its duration is 6 to 8 hours.⁹ Careful neurovascular examination should be performed and documented before the femoral nerve block is performed. After the nerve block procedure, continued assessment of the femoral muscular compartments is advisable to check for the development of compartment syndrome. If an injury is considered at especially high risk for compartment syndrome, orthopedic surgery consultation should be obtained before the block, and measurement of compartment pressures after the block should be considered. Because the sciatic nerve innervates the compartments of the lower limb, a femoral nerve block will not mask the clinical presentation of compartment syndrome in the lower leg.

ORTHOPEDIC MANAGEMENT:

Treatment protocol of B/L Femur fracture patients:

Immediately after resuscitation in the Triage, patient is shifted to the surgical intensive care unit and Patient is put on continuous monitoring of Oxygen Saturation by pulse oximeter, apart from TPRBP. Volume or component replacement continued as per the Intensivist protocol. Warning signs of impending fat embolism like, fall in oxygen saturation or desaturation despite oxygen administration, increasing pulse rate, fever, axillary or supraclavicular freckling, breathlessness, irritability or delirium are closely monitored. Patients with early features of Pulmonary embolism who are not able to maintain saturation on Hiflow are put on Ventilatory support by Endotracheal intubation. Apart from the routine preoperative blood work like CBC, CRP, LFT, KFT, RBS, PT/INR, APTT, viral markers, Urine R/M, urine for fat globules, ECG and X ray chest, where indicated, certain special investigations like Echocardiogram and CT Pulmonary Angiogram, CT abdomen, HRCT Chest, CT Head, CT Cervical spine and/ whole spine screening where indicated, are carried out, as these patients are usually afflicted by Polytrauma involving various Viscera apart from skeletal trauma. As a routine protocol, D-Dimer levels, NT pro- BnP, are also sent baseline and followed up with 24 hrly or 48 hrly repeat samples to pick early impending or worsening of fat embolism.



OT SETUP IN BILATERAL SHAFT FEMUR FRACTURE ON FRACTURE TABLE

Routine higher antibiotic cover and Inj. Clexane 0.4 mg subcutaneous injections once daily as prophylaxis or 0.6 mg twice daily as therapeutic in cases of patients with features of fat embolism are part of our standard protocol in these patients. Multiple rib injuries which may or may not be notable in initial examination, slowly lead to evolving hemopneumothorax (may be compounded by the IPPV) in the first 48 to 72 hours, despite a negative initial radiology. They also contribute to sudden desaturation, necessitating urgent bedside ICD insertion and follow up by thoracic surgeon. After getting a rapid work up of patients and an interdepartmental meeting including, Orthopedic Surgery team, Pulmonologist, Intensivist , Thoracic surgeon ,Anaesthesiologist (and where required General Surgery team, Neurosurgery team)and with patients relatives, surgical intervention is planned on 1st or second day of admission. Mild or moderate features of evolving fat embolism is not a contraindication for B/L femur fracture fixation (DCO/ ETC) , rather it is considered essential to achieve early control of the Pulmonary embolism in such patients, so patient relatives are counselled for the early surgical intervention, Unreamed femoral nailing of both femoral in the same sitting, and high risk consent is obtained. Clexane Inj. is withheld 12 hrs before surgery and restarted 6 hrs after surgery. Patient is shifted to the OR preferably within 24 to 48 hrs of admission, and under General anaesthesia , on Fracture table , Unreamed

Interlocking nailing of femur is done one side followed by the other in the same sitting preferably.

Patient is usually transferred to ICU on ET ventilatory support and after overnight ventilation, he is weaned off Ventilator next day, if parameters are stable. If not, ventilatory support is continued over next few days and weaned off Ventilator and extubated when stable. Prone ventilation was done where necessary and this was made possible and facilitated by the B/L femur nailing which has already been completed. Once out of the ICU, patient is monitored in the ward, mobilized to bed edge, and in bed exercises were started and discharged around 5th day of admission or later as warranted by the other associated injuries and General Condition.

Results & Discussion::

Eight patients were identified after chart review. Mean age at the time of injury was 30(16 to 38 years). Mechanism of injury was high energy trauma in all patients. Features of fat embolism was present in all cases. Six of 8 patients had presented with at least one significant associated injury. All patients underwent definitive operative fixation bilaterally. Average length of stay was 10 days (range 7-15days). Complete healing occurred in all patients. We found that patients who underwent early bilateral femur fracture fixation with damaged control nailing in presence of evolving fat embolism symptoms had significant improvement in the cardiopulmonary parameters post surgery as well as decreased length of hospital stay. There was statistical difference in complications preoperatively and postoperatively.

Case 1:



Preop

postop



Follow up

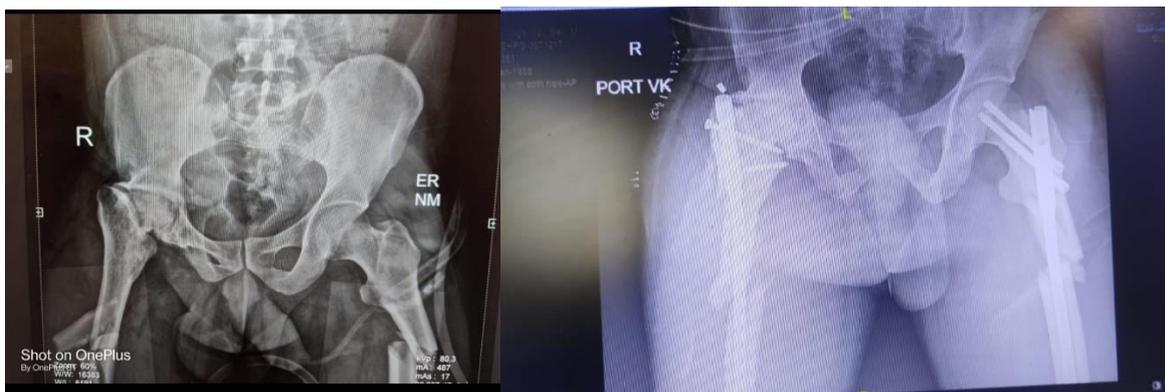
Case 2:



Preop

postop

Case 3:



Preop

postop

Conclusion:

Our case series illustrates the presentations and outcomes of this fracture injury pattern in presence of evolving fat embolism symptoms with damage control antegrade nailing . These results may help guide healthcare personnel in making informed management decision regarding early intervention in such patients .This may prove useful to prevent further complications associated with fat embolism and improve overall outcome, most appropriate for the Indian conditions, taking into consideration the Socioeconomic fallouts involved with such major injuries.

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