

FAT EMBOLISM SYNDROME IN FRACTURE TIBIA TREATED BY UNREAMED INTERLOCKING NAIL

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ABSTRACT

Fat embolism syndrome (FES) occurs when embolic fat macro globules pass into the small vessels of the lung and other sites, producing endothelial damage and resulting respiratory failure (ARDS-like picture), cerebral dysfunction and a petechial rash. The incidence of fat embolism in all kinds of fractures is about 16% but sometimes it is as high as 50% to 62%. The fat embolism is common in fatty and bed ridden patients and in whom reamed interlocking is performed under tourniquet and surgery is to be delayed. But in the case discussed by us unreamed interlocking was performed without tourniquet and the operative procedure was done within 4 hours after trauma and the pre-operative investigation were within normal limits. Patient was lean and thin. The present case report is discussed to convey the message that even when surgeon takes every precaution for prevention of fat embolism, it can occur in any case.

KEYWORDS: Fat embolism syndrome, Reamed interlocking nail, Tibia Fracture, Fat macro globulemia, Petechial rash, Pre-operative Investigations.

INTRODUCTION

Fat Embolism Syndrome is a major cause of morbidity and mortality after fractures in the patients with multiple Injuries. Fat embolism Syndrome (FES) occurs when embolic fat macro globules pass into the small vessels of the Lung and other sites, producing endothelial damage and resulting respiratory failure (ARDS – like picture, cerebral dysfunction and a petechial rash.

Although fat can be found in the lungs of almost all patients involved in major trauma, the clinical syndrome of fat embolism (FES) is found in approximately only 16% of such patients Fat embolism is common in fatty and bed ridden patients and in whom reamed inter locking nailing is performed under tourniquet and surgery is to be delayed. But in the case discussed by as unreamed inter locking nailing is performed without tourniquet.

The present case is discussed to convey the message that even when surgeon took every precaution for prevention of fat embolism it can occur in any case.

BODY

For more than a century FES has been puzzling many of us. Its relationship to skeletal and soft tissue injury is well recognized and many cases have been reported. FES is more frequently seen in young adults, perhaps due to their prediction to more motor trauma and may cause ARDS. It is less common in sporting injuries, children and elderly patients.

FES may also be associated with systemic lupus erythematosus, pancreatitis, Rapid Decompression, Lymphography, Sickle cell crisis (from marrow infarcts) etc.

But in this group it is usually a post mortem histological finding rather than a clinical syndrome.

PATHOPHYSIOLOGY

It is not clear. Various theories have been postulated, but the widely accepted ones are the following:

- A. Mechanical - By GAUSS
- B. Physico chemical - By MOORE

A. Mechanical - Following fracture, neutral fat (triglycerides) which present in the marrow is released into injured venous sinusoid for 2 reasons.

1. Raised intramedullary pressure following trauma.
2. Movement at the fracture site. This neutral fat from venous sinusoid can reach the following sites.
 - a) It can travel to lungs and occlude pulmonary capillaries i.e. there is macroaggregation of fat globules.
 - b) Neutral fat can enter systemic circulation and hence can occlude the vessels in brain, kidney and myocardium.

B. Physico Chemical: Neutral fat (triglycerides) after reaching the lungs are converted into free fattyacids (FFA) by the action of pulmonary lipase. These FFA's act by two ways.

- a) Again Mechanical destruction - Aggregation of chylomicrons.
- b) Toxic action - FFA are toxic to pneumocytes and will be there loss of lung surfactant and capillary endothelial interstitial haemorrhage, vascular congestion and pulmonary edema. Severe alveolar collapse will lead to ventilation perfusion mismatch. Lungs become less compliant, respiratory muscles fatigue and decrease in tidal volume will worsens gas exchange, and ultimately end in respiratory failure. The cerebral component could then relate to the hypoxia produced by pulmonary changes.

CLINICAL FEATURES

Sevitt has classified F.E.S in to 3 types; depending on time of onset of symptoms & severity of clinical picture.

1. Sub clinical 2. Classical (Non fulminant) 3. Fulminant

1. Subclinical Type:

Seen in more than 60% of patients after the injury. Time taken to develop is 12-72 hrs. with mortality and morbidity rate of 0%.

2. Classical or Non fulminant type:

Seen in 1 to 5% of patients with single bone fractures, 2.5 to 16% of patients with multiple fractures.

Time taken to develop is 12-96 hrs with mortality rate 0-5%

3. Fulminant Type:

Seen in 0.2% of patients after a polytrauma, time taken to develop is few hours only, with mortality rate more than 50%.

Gurd and Wilson's Diagnostic criteria for Fat embolism Syndrome.

Major criteria

- Respiratory symptoms and signs (hypoxemia) and radiographic changes.
- Cerebral signs unrelated to head injury or other conditions.
- Petechial rash.

Minor criteria

- Tachycardia over 110 beats/minute
- Pyrexia $> 38.5^{\circ}C$
- Retinal changes of fat or petechiae
- Renal changes
- Jaundice
- Laboratory:
- Acute fall in hemoglobin
- Sudden thrombocytopenia
- High ESR
- Fat macroglobulemia

One major and four minor criteria, and fat macroglobulemia are required for diagnosis.

INVESTIGATIONS

I a) Blood – Hb – decreases by 30% within 24-48 hrs in upto 75% of patients with F E Syndrome.

b) Platelet count – Thrombocytopenia – Less than 1,50,000 seen in early stages.

c) Prothrombin and thromoplastin time will be elevated.

d) **Arterial blood gas analysis:**

a) PaO_2 - Less than 60 mm Hg is the hallmark of F.E.S. and is an important prognostic indicator.

b) AaO_2 - Alveolar arterial oxygen difference less than 20mm of Hg. More sophisticated investigation can be done by giving 100% O_2 for 10 minutes

c) PCO_2 - Hypercapnia (more than 55mm Hg)

Symptoms directly referable to respiratory system often are not present until the PaO_2 falls below 65mm Hg.

II CYTOLOGY

- a) Examination of sputum, blood & urine for fat droplets by staining with Sudan or Oil Red O stain.
- b) Bronchoalveolar lavage - more sophisticated test where quantitative microscopic evaluation of fat droplets in broncho alveolar lavage.
 - c) Guard Test - Filtration of Venous blood with micropore mesh with a pore size of 10 micron - allowing larger fat globules for staining.
 - d) Sizzle Test of Scuderi – Urine fat identification.
 - e) If coma persists & there is no other means of identification, Renal biopsy, lung biopsy or Skin biopsy can be undertaken
- **III. ECG:** Inversion of T waves, prominent S waves, RBB, Arrhythmias may be present.
- **IV. Chest X Ray** – ‘Snow storm’ appearance. These occur after fat embolism syndrome is well underway.
- **V. C.T. Scan of Lungs:** Shows mottled perfusion defects. GIVEN THE CHOICE ‘PaO₂’ is the INVESTIGATION OF CHOICE
- **VI. FUNDOSCOPE:** Cotton wool spots.

DIAGNOSIS

LINDEQUE ETAL gave criteria for diagnosis of F E S after long bone Fractures.

1. PaO₂ less than 60 mm of Hg.
2. PaCo₂ more than 55 mm of Hg.
3. Spontaneous respiration rate more than 35/min even after adequate sedation.
4. Clinical signs of increased risk of breathing.
5. Presence of at least ONE of the above finding in patients with long bone fracture is diagnostic.

CASE REPORT

A 23 year old unmarried female was admitted to hospital 3 hours after being hit by motor cycle while she was crossing the road. The height of the patient was about 152 cm and the weight of the patient was 45 kg. Body mass index was 23.8. On examination there was swelling over middle third of her left leg and patient was unable to bear weight over her left leg. There was abnormal mobility at fracture site. Fracture ends were palpable. She sustained closed short oblique fracture of tibia and fibula at middle third junction (Fig. 1) with no history of any associated head or chest injury. Patient was admitted in hospital. Her X-ray left leg full length, X-ray chest PA view and routine blood investigations were done. On X-ray there was closed short oblique fracture of tibia and fibula at middle third junction of left leg without any neurological deficit. Distal pulses were palpable. Body temperature was 36.8°C, heart rate was 68 beats/min, and respiratory rate was 18/min.

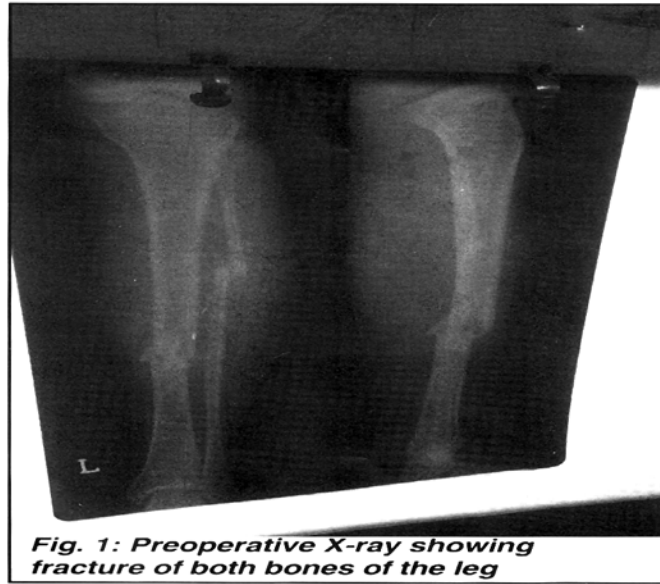


Fig. 1: Preoperative X-ray showing fracture of both bones of the leg

Routine blood investigations revealed

Hb-10.5gm%

TLC-8500/cmm

DLC-P-84, L-14, E-2

Random blood sugar-108 mg/dL

S.Creatnine-0.8mg/dL

HIV, HBsAg, HCV-all non reactive

X-Ray chest was within normal limit

After investigations, elective surgery was done by unreamed tibial interlocking nail under spinal anaesthesia, 4 hours after admission. Operative procedure took 45 minutes. Her vitals were stable in immediate post operative period.

8 hours after surgery, she was disoriented and was not responding to verbal command.

Body temperature was 39°C; respiratory rate was about 40/min and pulse rate was about 136 beats/min. She was investigated and was immediately shifted to ICU where she was put on ventilator and was oxygenated.

Arterial blood gas analysis was done which revealed

pO₂ 49.1mmHg.

pCO₂ 33.8.mmHg

O₂ Saturation 82.1%

S.Na⁺ 134mmol/L

S.K⁺ 4.2mmol/L

Her chest roentgenogram was done and opaque shadows/infiltration was seen in left side of chest.

CONCLUSION

Fat embolism is a common phenomenon following limb fracture. It usually occurs when reamed inter locking is performed under tourniquet. But in this case of patient unreamed interlocking nail was done without tourniquet. It develops in 0.5% to 2% of all patients with fractures of the long bones and has been associated with high morbidity and mortality. There is usually a latent period of 24 to 72 hours between injury and onset, but in this patient symptoms appeared within 16 hours after trauma and 4 hours after internal fixation. The onset was sudden, with:

- Breathlessness and chest pain, high pulse rate
- Petechial rash present in conjunctivae.
- CNS symptoms, disorientation, confusion
- Renal – oliguria
- Drowsiness.

Though FES is common in polytrauma, and for the patients treated with reamed Inter locking Nailing with Tourniquet it can also occur in patients with uni bone (Tibia) fracture and was treated with unreamed Inter locking Nail without Tourniquet.

So we want to convey the message that inspite of taking all precaution for prevention of fat embolism it can occur in any case. So surgeon should be conscious about that. Every case is a new case and complications can occur in any case.

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