Case Report

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Complicated Femur Fracture with Acute Respiratory Distress Syndrome Secondary to Fat Embolism Syndrome

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Abstract

Fat embolism (FE) is defined as a blockage of vasculature by fat globules that originate either from bone marrow or adipose tissue. It mainly affects the lungs, but can also affect the skin, retina, and central nervous system. FE is very common after long bone fractures, but this may lead to a rare clinical entity called fat embolism syndrome (FES), a systemic inflammatory cascade affecting multiple organ systems which has a high mortality and morbidity.

We report a case of a 22 year old male presented with left femur fracture after a mechanical fall. Orthopedic repair was done, but he developed FES and ARDS on 2nd day of the injury following which he was aggressively managed for these complications of his long bone fracture and was discharged in a stable condition after 16 days.

Keywords: Trauma; Femur Fracture; Fat Embolism Syndrome; Acute Respiratory Syndrome.

Introduction

Fat Embolism is a common complication of long bone and pelvic fracture. Up to 90% of patients who have sustained major injuries can have Fat Embolism. If it progresses, can led to the rare clinical entity known as Fat Embolism Syndrome (FES), which is a life threatening condition [1,2]. It accounts for only 2-5% of patients who have long bone fracture and 10-15% in polytrauma patients. When embolic fat macroglobus pass into the small vessel of the lung, it damages the endothelium resulting respiratory failure – Acute Respiratory Distress Syndrome (ADRS) [2,3,4]. Early diagnosis, supportive measures like splinting, maintenance of fluid and electrolytes and high PEEP has been the mainstay of treatment. Early stabilization of long bone fracture has been shown to decrease the incidence of Fat Embolism Syndrome. The mortality rate from Fat Embolism Syndrome (FES) is 5-15% [5,6,8,9].

Apart from the lungs, fat globules can affect the vasculature of the skin resulting in petechial rash which is pathognomonic of fat embolism; CNS resulting in altered mental status and coma; retina resulting in striate hemorrhages. FES is usually a clinical diagnosis, but fat globules can be detected in urine, sputum and retinal vessels.

Case Study

A previously healthy 22 years old female was brought to the emergency department with an alleged history of the fall from stairs the previous day with complaints of left thigh pain, inability to walk, chest pain and breathlessness. Initially he went to another hospital where temporary splinting was done for his suspected fracture femur and was then referred to us for further management.

On arrival to the ED, he was drowsy and intermittently responding to verbal commands and had breathlessness and pain over left hip and left thigh. He was afebrile, pulse was 124/min, blood pressure- 90/60mmHg, RR-32/min, Sp02 -86% on room air, RBS-94mg/dl, a temperature of 101.4 degree Celcius.

He was immediately assessed thoroughly as per ATLS protocol. In view of unstable hemodynamics and severe metabolic acidosis with respiratory alkalosis in the arterial blood gas analysis, he was intubated and put on a mechanical ventilator.

On systemic examination: There was no pallor, icterus, clubbing, pedal edema, cyanosis. Chest bilateral crepts present, air entry diminished, chest expansion reduced, CVS-S1S2 normal, no murmur. Abdomen soft and non tender, no organomegaly, bowel sound present.

On local examination: There was swelling, echymosis and abnormal mobility and deformity present on left thigh with the bony crepitus present.

X Ray left thigh was done which revealed a fracture shaft of left femur as in Figures 1 and 2.

Fig. 1a: X-Ray left femur (lateral view)

Fig. 1b: X-Ray left femur(AP view)

X-Ray chest which was done on day 1 is shown in Figure 2.

Fig. 2: Normal chest X-Ray of day 1 of injury

Later that day (day 2 of injury), the patient deteriorated in terms of hypoxemia and hemodynamics; X ray revealed bilateral infiltrates in bilateral lung fields. Knowing it is a case of femur fracture and suspecting Fat Embolism syndrome, immediate Orthopedic and Pulmonology consultation was done and the patient got admitted under orthopedic team and pulmonology team. He was planned for closed femur intramedullary Nailing but he was found not fit for operative intervention. And in view of low hemoglobin (Hb-7.8), multiple blood transfusion (4 unit of PRBC) were transfused.

On the 3rd day of injury, team meeting with the critical care team, pulmologist team and orthopedic team discussion of internal fixation of femur was taken under very high risk to prevent further embolism. Under ventilatory support he was taken to Operation treatre for internal, external fixator and a quick unreamed femur interlocking nailing was done successfully. Post operative left Femur X-ray is shown below in Figure 3.

3(a): AP view

Fig. 3: Post Operative X-ray Left Femur

3(b): Lateral view

He had severe respiratory distress at 4th day for which he was kept on prone ventilation, and also high PEEP and oxygenation were supplied. And during his ICU stayed, serial supine chest X-ray chest were done.

The sequence shows the progression of the pulmonary opacity, which is non-specific finding and the improvement in the X-ray findings later on after supportive management. The X-ray images are as follows in Figure 4.

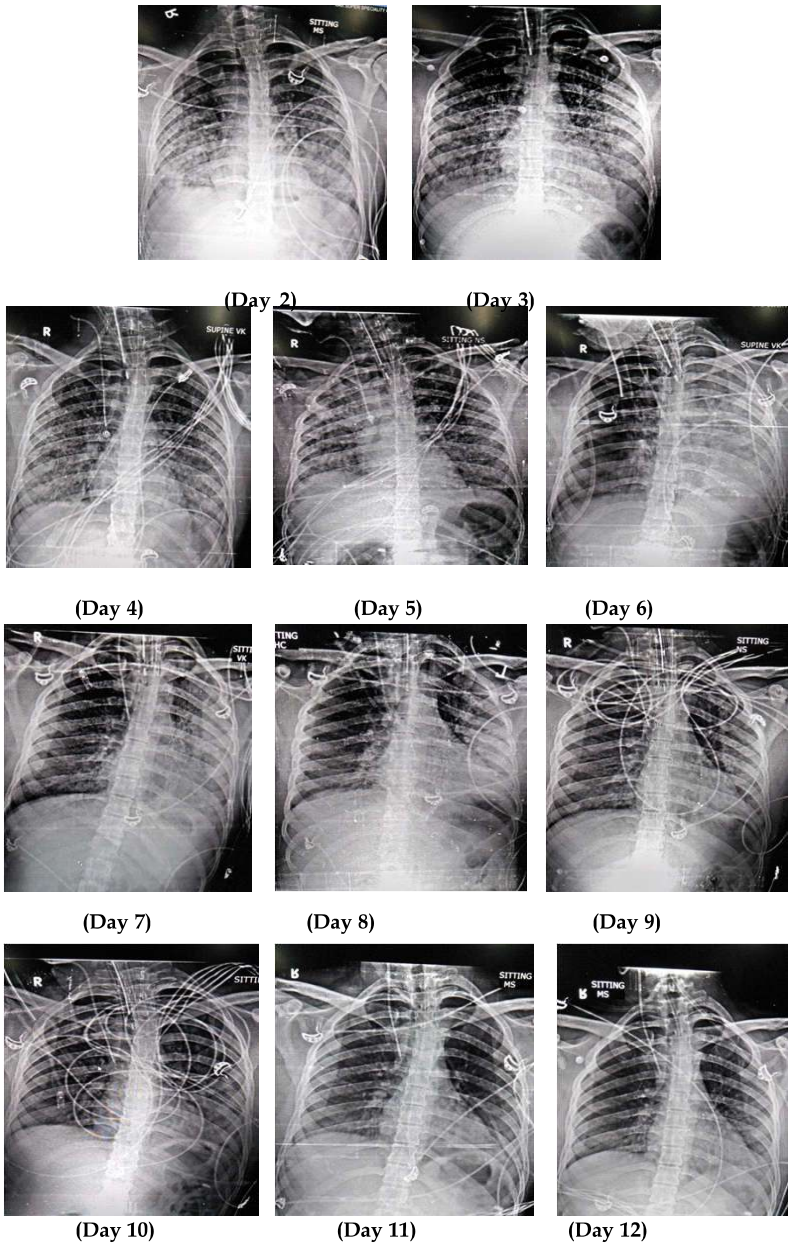

Fig. 4: Serial Supine X ray showing the progression at the initial stage and later improvement in opacity

Gradually, with all effort and multiple supports of antibiotics and ventilatory support, his condition was improved and his chest X-ray also showed signs of improvement as shown above in Figure 4, and requirement of the ventilation was decreased. On 10th day he was weaned off from the ventilator. After 2 days he was shifted in ward after 10 days of ICU stay and was discharged in hemodynamically stable state after 16 days of hospitalization.

Discussion and Therapeutic Consideration

Fat Embolism is the process in which the fat particles pass in the blood stream, lodges within a blood vessel and travels through the circulation and eventually block a blood vessel causing numerous signs and symptoms. Fat emboli can deform and pass through the lungs, resulting in systemic embolization, most commonly to the brain and kidneys [2,3]. Up to 90% of patient who have sustained major injuries can have Fat Embolism. Fat embolism will lead to the rare and serious life threatening condition known as Fat Embolism Syndrome (FES). Fat Embolism Syndrome is a combination of respiratory, haematological, neurological and cutaneous sign and symptoms associated with trauma and other surgical process or medical conditions. It accounts for only 2-5% of patients who have a long bone fracture (in this case-the femur bone) and 10-15% in polytrauma patients. Men were more likely to develop the condition than women and it was rare in children aged 0-9 years. The age range most commonly affected was 10-39 years [4,7].

It is usually appeared within 24-72 hours after injury. As in this case report also, signs and symptoms of fat embolism syndrome started developing after 24 hours of femur fracture [6].

Fat Embolism Syndrome and its concept were first described by Zenker in 1861, and also he described the first autopsy case of fat embolism with the presence of pulmonary capillary fat deposition in a patient who suffered from a crush injury. In 1873, it was first described clinically by Bergmann in a patient who suffered a distal femur fracture [2].

As mentioned above, the most common cause of Fat Embolism Syndrome (FES) is the long bone, pelvic and rib fracture for which orthopedic procedures like intramedullary nailing, knee and pelvic arthropasty are done, but the main concern about the fracture is that the closed fractures produce more emboli than open fractures. Other than the fracture, other causes are Massive soft tissue injury, Severe burns, Bone marrow biopsy, Liposuction, Fatty liver, Prolonged corticosteroid therapy, Acute pancreatitis, Osteomyelitis, Sickle cell haemoglobinopathies [1,2,8].

Patients present with a classic triad of Respiratory changes, Neurological abnormalities, Petechial rash. Respiratory changes are often the first clinical feature to present. Most early findings include dyspnoea, tachypnoea, and hypoxaemia. In the most severe form it may progress to respiratory failure and a syndrome, acute respiratory distress syndrome (ADRS) like condition as in our case report also the above findings were significant [3,6,7].

Diagnosis of Fat Embolism Syndrome is difficult and remains the diagnostic challenge for emergency physician and clinician, hence prompt recognition is important so that supportive therapy can be implicated as early as possible to have a better outcome. For proper diagnosis, Gurd first described a criteria known as Gurd's criteria shown in Table 1, which stated that one major criteria and four minor criteria must be present to diagnose the Fat Embolism Syndrome (FES). Later a Fat Embolism Index (FEI) has been proposed by Schonfeld shown in Table 2, in which there are seven clinical features, each one is given a particular score. A score of five or more points over the first three days of hospitalization is diagnostic for Fat Embolism Syndrome [3,4,6].

Gurd's Criteria

One major criteria and four minor criteria must be present to diagnose the Fat Embolism Syndrome.

Table 1:

Major Criteria	Minor Criteria
Petechial Rash	Tachycardia >120beats/min
Hypoxia PaCo2 <60mmhg	Pyrexia < 38.5 degree
CNS Depression	Retinal emboli
Pulmonary Oedema	Fat in urine and sputum
	Thrombocytopenia
	Anemia
	Increase ESR
	Decrease Hemotocrit
	Diffuse alveolar infiltrates

Table 2:

Clinical feature	Score
Diffuse petechiae	5
Alveolar infiltrates	4
Hypoxemia (<70mmHg)	3
Confusion	1
Fever >38 degree C	1
Heart rate >120beats/min	1
Respiratory rate >30breaths/min	1

Schonfeld's Fat Embolism Index (FEI)

A score of five or more points over the first three days of hospitalization is diagnostic for Fat Embolism Syndrome. In our case report, the patient was in a confusion state (score 1), febrile of temperature of 39.4 degree C (1), hypoxic of Po2 of 62mmHg (score 3), respiratory rate of 32breaths/min (1), heart rate of 124beats/min (1)and X-ray chest showing bilateral infiltrates (score 4). So there is total score of 11 which is highly suggestive of Fat Embolism Syndrome. Laboratory investigation may also be used in the diagnosis of Fat Embolism Syndrome, including Blood gas analysis which shows low oxygen (hypoxia) and high CO_2 (hypercapnia), complete blood cell count, erythrocyte sedimentation rate (ESR), coagulation profile for search for petechiae. An electrocardiogram may show signs of right-sided heart strain. Serial chest radiographs which can reveal increasing diffuse bilateral pulmonary infiltrates. A high-resolution chest CT scan will show bilateral or centrilobular ground-glass opacities. Head CT can also be done to see the parenchymal changes consistent with lung contusion, or Acute Respiratory Distress Syndrome (ARDS) but is usually negative for any abnormalities the first one to two days post-injury. MRI brain is the most sensitive imaging technique for diagnosing cerebral fat embolism showing typical white matter changes along the boundary zones of major vascular territories [6,7,8].

Treatment of fat embolism syndrome consists of general supportive measures, including splinting, maintenance of fluid and electrolyte balance and the correction of hypoxemia with supplemental oxygen, use of prone positioning or mechanical ventilation and high PEEP (positive end-expiratory pressure) are often necessary. Early surgical stabilisation of long bone fractures reduces the risk of the syndrome. If central nervous system dysfunction is present, frequent neurological examinations are required and intracranial pressure monitoring should be considered. Albumin has been recommended for volume resuscitation in addition to balanced electrolyte solution as it not only restores blood volume, but also binds fatty acids and may decrease the extent of lung injury. For prolonged ventilatory support, placement of a tracheostomy are considered beneficial. The mortality rate from Fat Embolism Syndrome is 5-15% [6,7,8,9]. As mentioned above, we treated our patient with early splinting, maintained fluid and electrolyte, closed femur intramedullary nailing done under ventilator support. For respiratory distress, he was kept on prone ventilation with high PEEP (positive end-expiratory pressure) and oxygenation.

Conclusion

Fat Embolism Syndrome is a rare clinical entity that most commonly occurs after high-risk orthopaedic injury and an important contributor to the development of acute respiratory distress syndrome which is a serious life threatening condition. Diagnosis is quite difficult and remains the diagnostic challenge for emergency physician and clinician, hence prompt recognition is important so that supportive therapy can be implicated as early as possible to have a better outcome. Early diagnosis, supportive measures like splinting, maintenance of fluid and electrolytes and high PEEP has been the mainstay of treatment. Mortality rate decreases with advance supportive care and early stabilization of long bone fractures has been shown to decrease the incidence of pulmonary complication. So for emergency physician it is very important to take quick action if the suspicion of Fat Embolism Syndrome is high and identify its serious complication.

References

1. Huang BK, Monu JU, Wandtke, J. Pulmonary fat embolism after pelvic and long bone fractures in a trauma patient. Emerg Radiol 2009;16(5):407-9.
2. Akoh, CC, Schick C, Otero J, Karam M. Fat Embolism Syndrome after Femur Fracture Fixation: A Case Report. Iowa Orthop J 2014;34:55-62.
3. Gupta A, Reilly CS. Fat embolism. Continuing Education in Anaesthesia Critical Care & Pain 2007;7(5):148-51. https://doi.org/10.1093/bjaceaccp/mkm027.
4. Högel F, Gerlach UV, Südkamp NP, Müller CA. Pulmonary fat embolism after reamed and unreamed nailing of femoral fractures. Injury 2010;41(12): 1317-22.
5. Kosova E, Bergmark B, Piazza G. Fat Embolism Syndrome. Circulation 2015;131:317-20. doi: 10.1161/CIRCULATIONAHA.114.010835.
6. Powers KA, Talbot LA. Fat Embolism Syndrome after Femur Fracture With Intramedullary Nailing: Case Report. Am J Crit Care 2011;20(3):264-7. doi:10.4037/ajcc2011694.
7. Richards RR. Fat Embolism Syndrome. Can J Surg 1997;40(5):334-39.
8. Mellor A, Soni N. Fat embolism. Anaesthesia 2001;56:145±54.
9. Gossling HR, Donohue TA. The Fat Embolism Syndrome. JAMA 1979;241(25):2740-2. doi:10.1001/jama.1979.03290510048031.