Case Report

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Clinical diagnosis of fat embolism syndrome with septic shock following polytrauma: a case report

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Introduction and importance: Fat embolism syndrome (FES) arises from the systemic effects of fat emboli in microcirculation. While sepsis is characterized by pathological, physiological, and metabolic abnormalities caused by infection. Septic shock is identified by elevated blood lactate (> 2 mmol/l) and the need for vasopressors to maintain a mean arterial pressure of 65 mmHg or higher in the absence of hypovolemia.

Case presentation: This case report discusses the clinical course and treatment of a 50-year-old male involved in a road traffic accident resulting in polytrauma. The patient presented with multiple fractures, hemopneumothorax, lung contusions, and rib fractures. He was then stabilized following which fractures were reduced and managed operatively. Postoperatively, the patient developed FES with septic shock, manifested by altered consciousness, petechial rashes, and respiratory distress. He was managed with intubation, chest drainage, and a combination of antibiotics, anticoagulants, and vasoactive agents. A tracheostomy was performed due to respiratory insufficiency. Following 29 days in the SICU, the patient's condition was stabilized and shifted to the general ward for further management. He was discharged after 48 days, with a complete recovery and a 2-week follow-up. This case report depicts the challenges in the management of FES with septic shock following polytrauma.

Conclusion: This case report is a comprehensive overview of FES complicated with septic shock. It highlights the importance of supportive care as the primary treatment modality, incorporating various medical interventions. The successful outcome and complete recovery of the patient underline the significance of prolonged monitoring, wound care, and physiotherapy.

Keywords: fat embolism syndrome, polytrauma, septic shock

Introduction

Fat embolism syndrome (FES) is triggered by femoral or other long bone fractures or intramedullary nail surgery.[1] Fat droplets enter the circulatory system, causing fat embolisms in the lungs, brain, and skin, resulting in respiratory symptoms, central nervous system symptoms, and cutaneous petechial hemorrhages[2]. The most common FES symptoms that have been observed include respiratory distress, altered mental status, and rash. These symptoms usually appear 12–72 h after a long bone fracture-related trauma[3]. FES occurs in 1–22% of long bone fractures, and there is currently no proven cure for the condition. For FES, the death rate varies from 7 to 20%[2]. Because this is a rather uncommon occurrence, case reports make up the majority of the literature that describes it.

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HIGHLIGHTS

- The patient developed fat embolism syndrome with septic shock following polytrauma, manifested as altered consciousness, petechial rashes, and respiratory distress.
- It highlights the importance of supportive care as the primary treatment modality, incorporating interventions such as mechanical ventilation, vasopressors, and a combination of antibiotics and anticoagulants.

Case presentation

A 50-year-old male was admitted to the emergency department of a tertiary care center following a road traffic accident (hit by a minitruck).

He presented with pain over the left pelvic region, left leg, and around the chest and was unable to bear his weight following the accident.

Initially, he was given intravenous fluid (iii-pint normal saline) and a blood transfusion (I pint whole blood) was also done.

His clinical and radiological examination revealed a left closed intertrochanteric femur fracture (Boyd and Griffin Type iii) with superior pubic ramus fracture with left open GA I shaft of tibia/fibula fracture as shown in Figures 1 and 2 below and hemopneumothorax with bilateral lung contusion with multiple ribs fracture as present in Figure 3.

After investigation and resuscitation, the patient was shifted to SICU and surgery was performed after 15 h of admission. The intertrochanteric fracture was reduced under C armed and

Figure 1. Superior pubic ramus and intertrochanteric fracture.

fracture of tibia and fibula fixed by external fixator and intertrochanteric fracture stabilized by a long FNA2.

Two hours following surgery, the patient complained of pain at the surgical site and difficulty in breathing, he was looking

Figure 2. Open tibia fibula fracture after fixation.

Figure 3. HRCT showing hemopneumothorax.

drowsy and did not respond to verbal commands. His blood pressure was 108/66 mmHg, pulse 96 bpm, respiratory rate was 20 breathes/min, temperate 97.8°F, SpO_2 98%. Oxygen was provided via nasal mask (6 l/min) and vitals were monitored regularly. His blood reports revealed hemoglobin 9.1 mg/dl and hematocrit 27.1%.

On his 1st postoperative day, his consciousness level was decreased and his sensorium was altered. His GCS became 8/15 (E2V1M5) reached up to E1VetM1 on his fifth postoperative day, petechial rashes developed over his chest and axillary region as shown in Figure 4 below, he required more oxygen than previous day (SpO_2 99% with 15 l/min via venturi mask). Pulse decreased to 58 beats/min, respiratory rate was 22 breathes/min, blood pressure was 100/70 mmHg, and body temperature reached 102.4°F. The blood investigation revealed further decrease in hemoglobin to 7.7 mg/dl, new onset thrombocytopenia (90 000/mm^3), increased WBC count (14 730/mm^3), creatinine (0.99 mg/dl), erythrocyte sedimentation rate (46 mm/hr), which reached up to 90 mm/hr on his 3rd operative day, blood urea (38.47 mg/dl) and increased up to 56.57 mg/dl on his fifth postoperative day, total bilirubin (1.20 mg/dl), albumin (2.19 g/dl), total protein (4.43 g/dl), alkaline phosphatase (76.84 IU/l), SGOT/AST (68.30 mg IU/l), SGPT/ALT (40.29 IU/l), direct bilirubin (0.40 mg/dl), serum lactate was 0.7 mmol/L.1-3 fat globules were also seen in his urine. His serum procalcitonin level reached up to 2.07 on his third postoperative day.

Based on the above clinical and laboratory findings his diagnosis as septic shock with FES following polytrauma was established.

Figure 4. Petechial rashes over trunk on 1st postoperative day.

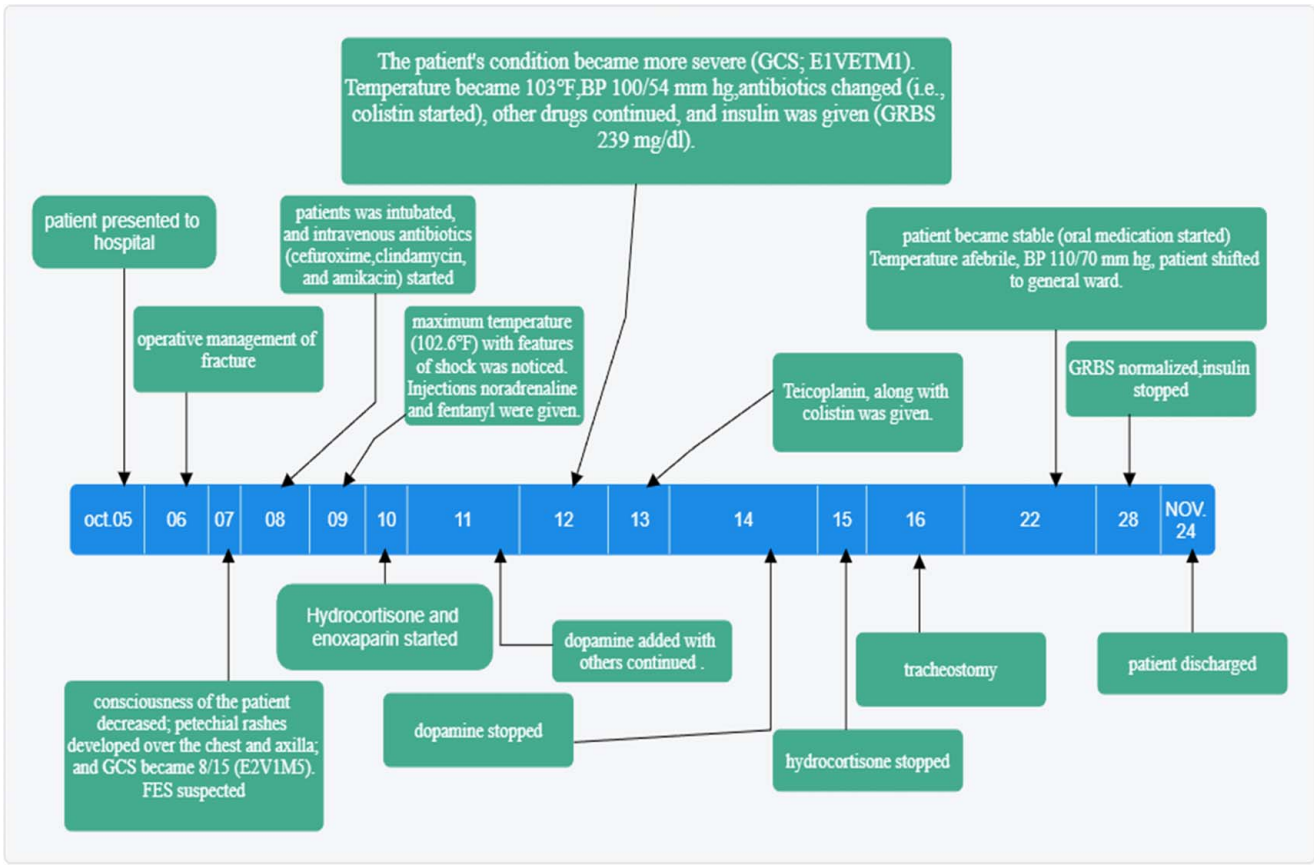

Figure 5. Timeline showing management and progression summary of patient

Patient was intubated (FiO_2:30%, PEEP: 7 mmHg) and continuous chest drain along with Hb correction and regular monitoring of vitals with ECG were planned. Dopamine (9 ml/hr), fentanyl (5 ml/hr), noradrenaline(9 ml/hr), and hydrocortisone 2 ml/hr were started. IV antibiotics cefuroxime, clindamycin along with anticlotting agent enoxaparin sodium was started to the patient. Due to early use of antibiotics, his blood and urine culture revealed negative results for culture. Eventually he was planned for tracheostomy from ENT department on his 10th day of postoperative day because of his fluctuating clinical symptoms and respiratory insufficiency. After 18 days of close observation at SICU and postoperative room, patient's vitals were stable, inflammatory reactions, and swelling of the whole body had

Figure 6. Stabilization of tibial fracture and status of wound on 25th postoperative day.

Figure 7. Status of sutured wound on 40th postoperative day.

Figure 8. Follow up status of patient on 2nd week of discharge.

basically subsided, and consciousness was gradually regained. Then he was transferred to the general ward where he was planned for wound care, chest, and limb physiotherapy along with continuous monitoring of vitals and oral medications.

After 48 days of hospital stay with a complete regain of hemodynamic stability he was discharged from hospital with advice of some drugs, physiotherapy of limbs and chest, high protein diet and a follow up after 2 weeks. The case progression soon after admission of patient, fracture stabilization, status of wound and follow up is depicted in Figures 5, 6, 7 and 8, respectively.

Discussion

Fat embolism is a rare condition with diverse clinical manifestations[3]. FES presents as a triad of acute respiratory failure, neurological issues, and mucocutaneous petechial signs, often not occurring simultaneously. Symptoms typically emerge 12–72 h after the initial event, such as a long bone fracture[4]. The tissue damage and increased pressure lead to the release of fatty acids or free fat into the bloodstream or organs, particularly affecting the lungs, kidneys, and brain. Although the pathogenesis of FE is not yet fully understood, two distinct but interconnected theories are postulated: the biochemical theory and the mechanical theory. The biochemical theory proposes that changes in lipid metabolism can cause fatty acids and chylomicrons to reach the lungs, leading to injuries and impaired gas exchange. The mechanical theory suggests that fat droplets from broken bones can block blood vessels, affecting the lung, heart, and brain. The severity of FES depends on factors like trauma energy, bone involved, and fracture type[5].

The presentation of FES is frequently nonspecific, creating challenges with diagnosis. The most frequently used diagnostic criteria are Gurd's and Wilson's, which consists of a combination of major and minor criteria. Major criteria include respiratory distress, cerebral symptoms in the absence of a head injury, and petechial rash. Minor criteria include tachycardia, fever, jaundice, retinal changes, new-onset anemia, thrombocytopenia, elevated erythrocyte sedimentation rate, and fat macroglobulinemia. A diagnosis of FES requires two major criteria or one major criterion accompanied by four minor ones[3]. In our case, the patient had respiratory distress, cerebral symptoms, and petechial rashes as well as tachycardia, pyrexia, anemia, thrombocytopenia, increased ESR, and fat macroglobulinemia fulfilling the Gurd's and Wilson's criteria of FES. It was accompanied with increased procalcitonin, increased cell count, and vasopressor requirement to maintain normal mean arterial pressure (i.e. >65 mmHg). He was then managed for FES complicated with septic shock. Despite significant advances in medical technologies such as anti-infective medicines in recent years, the frequency of sepsis has increased. Sepsis affects 1–2% of all hospitalized patients[6]. In sepsis, phospholipase A2 levels rise by 300 times, leading in the mobilization of free fatty acids in pulmonary macrophages and an increase in pulmonary severity. As a result, the patient's clinical severity increased as he/she acquired FES alongside sepsis[7]. Attention should be directed to better patient management, such as in our situation.

The most effective approach to the treatment of FES is prevention. Early stabilization of fractures, especially those of the tibia and femur, which enables patients to mobilize more quickly, is the most accepted preventive strategy. It has been discovered to shorten the hospital stay and lower the incidence of FES, ARDS, and pneumonia[8]. Supportive care is the sole viable therapeutic option if FES develops. Correcting hypoxia is part of supportive care, and it frequently entails mechanical breathing. Hypovolemia must be corrected in order to avoid shock and deteriorating CNS ischemia. Pulmonary vasodilators and inotropic drugs are commonly employed. A platelet or packed red blood cell transfusion may be necessary if anemia or thrombocytopenia are present. With supportive care, the CNS symptoms associated with FES are usually fully reversible. While fat embolization is nearly always present in patients with long bone fractures, FES development is a less frequent side effect[9].

Conclusion

This case report provides a detailed insight into the challenges and comprehensive management of FES complicated by septic shock in a polytrauma patient. The clinical presentation, diagnostic criteria fulfillment, and subsequent systemic impact reflects the complexity of FES, emphasizing the need for a vigilant approach in its recognition and management. The case highlights the importance of supportive care as the primary treatment modality, incorporating interventions such as mechanical ventilation, vasopressors, and a combination of antibiotics and anticoagulants. The successful

outcome and complete recovery of the patient after an extended hospital stay underline the significance of prolonged monitoring, wound care, and physiotherapy.

Ethical approval

Since this case report has not involved clinical trials upon patient, we have not acquired ethical approval.

Informed consent

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

B.N., A.S. and N.K.: conceptualisation, visualization, drafting, and writing and review; Dr B.B.S.: writing and review; S.K.G., D.G., M.G., A.K., and M.K.: review.

Conflicts of interest disclosure

The authors declare no conflicts of interest.

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Publicly available.

Provenance and peer review

Not applicable.

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