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ANAESTHETIC MANAGEMENT OF FAT EMBOLISM SYNDROME (FES) AND MULTIPLE SMALL PULMONARY THROMBUS FOLLOWING CLOSE REDUCTION AND INTERNAL FIXATION (CRIF) IN CASE OF LEFT FEMUR FRACTURE: A CASE REPORT

Anaesthesiology

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ABSTRACT

Fat embolism syndrome is a rare complication, which occurs in orthopedic procedures mainly in long bone fracture. Fat embolism syndrome is a life threatening condition in which fat globules from long bone are released into blood that causes obstruction of blood vessels and ultimately causes tissue damage. Pulmonary embolism is another complication of orthopedic procedures that occurs due to mobilization of blood clots in the perioperative period from the fracture site which travels to the lungs. We report a case of a 30 year old male patient who presented to the emergency room with a unilateral shaft femur fracture after a mechanical fall and operated for Closed Reduction and Internal Fixation with an interlocking femur nail. The patient was complicated with development of fat embolism syndrome and pulmonary thrombus. He was managed in ICU for 3 days postoperatively with oxygen support, anticoagulants and fluid therapy. He was discharged on postoperative day 4.

KEYWORDS

Fat embolism syndrome, femur fracture, pulmonary embolism, orthopedist procedure

Introduction

Fat embolism syndrome is a rare and life threatening condition occurring mainly in patients with long bone fractures. In fat embolism fat globules from long bones are released into blood which causes tissue damage [1-2]. Fat embolism syndrome occurs in approximately 0.5-11% of patients who have long bone fractures [3]. 1-10% of cases of fat embolism syndrome can be fatal. It is necessary to monitor oxygen saturation, hemodynamic stability, and presence of any cutaneous changes present perioperatively. It helps in early diagnosis of fat embolism syndrome and improves the outcome [1]. Any delay in identification of symptoms, diagnosis or in the treatment leads to increase in morbidity and mortality of the patient. Increased risk of morbidity and mortality in fat embolism syndrome are present in patients with pre-existing respiratory and cardiovascular disease [1, 3]. Pulmonary embolism is another complication of orthopedic procedures that occurs due to mobilization of blood clots in the perioperative period from the fracture site which travels to the lungs, which causes respiratory distress [4]. Anticoagulants, like heparin or warfarin are used in treatment of pulmonary embolism to prevent further clot formation. It also helps in dissolving existing clots [4]. As there is no definitive diagnostic tool for the FES, we aim to emphasize the importance of observation for complications in the perioperative period and interpret those findings for early diagnosis and management of the case that decreases the morbidity and mortality to patients.

Case Presentation

A 30 year old male patient came to the emergency room with left lower limb pain after falling down at home prior to arrival. He had left lower limb pain and swelling. He was unable to ambulate. X-ray of the left leg showed closed, undisplaced shaft femur fracture. Patient was scheduled for closed reduction internal fixation with interlocking femur nail.

Pre-anaesthesia vitals were heart rate (HR) of 70-74 beats/min, blood pressure (BP) 124/80 mmhg, respiratory rate of 13-16 breaths/min and oxygen saturation (SpO2) of 99% on room air and oral temperature of 97.5 °F. Chest X-ray had no evidence of any cardiopulmonary abnormalities. ECG showed sinus rhythm and rate of 74 beats/min with normal axis, normal PR interval, absence of any ischemic changes. All investigations were in normal range. There was no past medical, surgical or allergic history. Airway examination was normal. Large bore iv cannula was taken and iv fluid started. Patient was induced with a subarachnoid block with 25G spinal needle with inj. bupivacaine heavy 0.5%, 3.6ml + inj clonidine 0.2ml in L3-L4 space with aseptic and antiseptic precautions. 15-20 minutes after starting the procedure, the patient's SpO2 dropped to 91% with complain of breathing difficulty, HR was increased to 92-110 beats/min, BP dropped to 90/60 mmHg. He also developed altered sensorium and tachypnea. Sensory level of spinal anaesthesia was T8. Initially 100% O2 was given to the patient with bain's circuit and mask; patient became conscious following verbal commands; HR settled to 76-82 beats/min; RR settled to 14-18/min with SpO2 of 100% with bain's circuit and mask. Then he was shifted to a simple mask with oxygen at 6 litre/min. Fat embolism was suspected as the patient was not maintaining SpO2 on room air and was having breathing difficulty without oxygen support.

After completion of the procedure, the patient was transported to ICU with oxygen support. A confirmatory CT angiogram of chest was done which was suggestive of thrombus in left interlobar artery, its segmental branches in lower lobe and lingual segment; right main pulmonary artery at its bifurcation, superior trunk, interlobar artery and its segmental branches without filling defect. Except for the O2 requirement, the patient was clinically stable. Inj LMWH 0.6mg subcutaneously 12 hourly and tab warfarin 5mg OD started in ICU for the management of pulmonary thrombus. On postoperative day 3, he was shifted to ward and discharged on postoperative day 4.

Discussion

FES is commonly associated with orthopedic traumatic injury particularly with closed long bone fracture of lower limb like femur, tibia, pelvis. Fat globules from long bones are released into the bloodstream which causes vascular occlusion and results in respiratory, cardiovascular, and neurological complications [2]. Mainly 2 theories were proposed to. Explain pathophysiology of FES.

1. Mechanical theory, described by Gossling et al. [5]: After an injury, there is increased intramedullary pressure due to which large fat droplets are released into the venous system, which occludes systemic vasculature, occludes pulmonary capillaries after reaching to lung, enters arterial circulation. Thus causes neurological, dermatological and pulmonary symptoms.

2. Biochemical theory, described by Baker et al. [6]: Tissue lipase causes hydrolysis of triglyceride emboli and releases glycerol and free fatty acid; which causes injury to pneumocytes and pulmonary endothelial cells. This leads to vasogenic and cytotoxic pulmonary edema causing acute lung injury or respiratory distress syndrome.

The differential diagnosis of FES is related to the system which this systemic disease affects. In the respiratory system, it includes pulmonary contusion, pulmonary edema, aspiration pneumonia and pulmonary thromboembolism. CT scan of the chest helps in distinguishing FES from these lung pathologies. Localized ground glass opacity is found in pulmonary contusion, filling defect is seen in pulmonary thromboembolism and pleural effusion with ground glass opacities is seen in pulmonary edema. In the central nervous system, it

includes meningitis, encephalitis, brain tumor; epidural, subdural or subarachnoid bleed. Bleeding and tumor are easily differentiated with CAT scan. Meningitis and encephalitis can be ruled out with CSF analysis. Idiopathic thrombocytopenic purpura, thrombotic thrombocytopenic purpura, leukemia should be considered in presence of skin rash and Hemato-oncology consultation should be taken.

Diagnosis of fat embolism syndrome can be done clinically with triad of symptoms - Petechial rash, respiratory symptom with radiographic change, Central nervous system sign unrelated to trauma or other conditions [1-3,7] or with diagnostic criteria by Gurd and Wilson in which FES is diagnosed one major criteria and four minor criteria or at least two major criteria are present [8-9]. This patient was diagnosed of having fat embolism due to high clinical suspicion, as he was having breathing difficulty, was not maintaining oxygen saturation on room air and had altered sensorium.

Major criteria:
- Petechial rash
- Respiratory symptoms with radiographic changes
- Cerebral signs unrelated to head injury

Minor criteria:
- Tachycardia
- Pyrexia
- Retinal fat or petechiae
- Sudden drop in hemoglobin level
- Sudden thrombocytopenia
- High ESR
- Fat globules in sputum

Cases of fat embolism syndrome do not have any standard protocols for management. Treatment mainly includes supportive measures like [10,11,12]

- Maintain oxygen saturation and oxygen delivery to tissue with oxygen support or ventilator if needed. Intubation is indicated when GCS <8 or respiratory distress syndrome not responding to non-invasive ventilation.

- Maintain hemodynamic stability with iv fluids or ionotropic supports, peripheral vasoconstrictors, pulmonary vasodilator; blood products if needed.

- Prevent further injury and management of comorbidities

Some studies show limited efficacy towards use of corticosteroids and heparin [13-14]. Anticoagulants like heparin are used for management of pulmonary embolism, but in fat embolism syndrome it should be used cautiously as there are chances of bleeding. Free fatty acids are released from hydrolysis of fat emboli present in the lung; it causes tissue damage by activating inflammatory processes and cytokine cascade which is responsible for respiratory symptoms. Corticosteroids are useful in prophylaxis of fat embolism syndrome. It prevents hypoxia in patients with long bone fractures [15-16]

Prevention of FES in long bone fractures is important [17].
- Use of corticosteroids
- Early surgical fixation within 24 hours
- External fixation or fixation with plates produces less lung injury
- Usage of small diameter nails or unreamed nails
- Using modified reamer systems which decreases intramedullary pressure

Conclusion

We have discussed a case of fat embolism syndrome and pulmonary thrombus which occurs after closed reduction and internal fixation of a unilateral shaft femur fracture in a 30 year old male patient. The patient was managed with supportive measures, like oxygen support and fluid therapy. Anticoagulants heparin and warfarin were administered to prevent further clot formation. Awareness about early recognition and treatment of complications decreases morbidity and mortality among these patients.

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