An Unusual Cause of Fat Embolism Syndrome

Xavier Repesse, M.D.,* Laurent Bodson, M.D.,* Siu Ming Au, M.D.,* Bernard Page, M.D.,† Jean-François Côté, M.D., Ph.D.,‡ Cristi Marin, M.D.,§ Mostafa El Hajjam, M.D.,|| Cyril Charron, M.D.,† Antoine Viellard-Baron, M.D., Ph.D.#

Fat embolism syndrome (FES) is a combination of respiratory, neurologic, cutaneous, and hematologic symptoms associated with physical trauma to fat tissue secondary to bone fracture or to medical or surgical soft-tissue injury.1–4 The incidence in patients with bone fractures is usually reported as low (0.5–10%),4 but can reach more than 30%.2,5 Diagnosis is based on major or minor criteria historically described by Gurd and Wilson.6 We report the case of a 67-yr-old female polytrauma patient who developed FES secondary to unusual bone fractures.

CASE REPORTS

A 67-yr-old woman was admitted to our intensive care unit because of polytrauma after high-speed injury. Despite an initial loss of consciousness, neurologic findings were normal on arrival. First clinical findings revealed left thoracic trauma and clavicle fracture. Heart rate was 81 beats/min, respiratory rate was 25 per min, vesicular breathing was abolished in the left lung field, oxygen saturation was 98% with oxygen therapy of 6 l/min, and Glasgow Coma Scale score was 14. Auscultation was consistent with the diagnosis of pneumothorax. There was no external bleeding or circulatory instability. Chest radiograph revealed a left hemopneumothorax due to five rib fractures without thoracic outlet, and a left clavicle fracture (fig. 1). Body scan showed a left pulmonary contusion and a right piriform muscle hematoma. No other visceral or vascular lesion was noted. Brain computed tomography scan was normal. Hemoglobin concentration at admission was 11.8 g/dL. Coagulation was normal and platelet count was 202,000/mm³. Otherwise, the patient presented with minor liver cytolysis (twice normal) and a moderate increase in creatine kinase (277 U/L). The hemopneumothorax was safely drained with a 24 French tube in the intensive care unit where the patient was then followed up. Six hours after admission, she suddenly lost consciousness (Glasgow Coma Scale score 3) and became hypoxemic, requiring mechanical ventilation with a high amount of oxygen. The patient’s hemodynamics remained normal. Her chest radiograph showed diffuse alveolar-interstitial infiltrates. Bronchoalveolar lavage fluid revealed a high amount of lipid-laden macrophage-like cells (47%) showing Oil red O staining with red intracellular lipid droplets (fig. 2). At the same time, the patient’s body temperature was 38.4°C in the 4 h after the neurologic degradation. Brain magnetic resonance imaging showed multiple cerebral emboli on a diffusion-weighted sequence without abnormality on a T2 gradient echo sequence, attesting to the absence of hemorrhagic axonal injury (fig. 3). Transesophageal echocardiography with bubble contrast demonstrated no evidence of a patent foramen ovale. No left atrial thrombosis was found. Ocular fundus findings were normal. Despite the initial severe neurologic presentation, the patient started to recover progressively 1 month after admission and was transferred to a rehabilitation center. Two months after transfer the patient had recovered the ability to walk with a cane. The patient was oriented to time and location when last examined.

Discussion

The combination of neurologic signs confirmed by imaging, respiratory symptoms with alveolar-interstitial infiltrate and hypoxemia, thrombocytopenia, and a high amount of lipid-laden macrophages in bronchoalveolar lavage fluid...
led us to the diagnosis of FES. The only missing symptom was petechiae, which are absent in more than 40% of cases of FES.\textsuperscript{1–3} FES is a rare complication of bone fractures and soft tissue injury, generally associated with long bone fractures\textsuperscript{1–4} and sometimes also caused by multiple fractures.\textsuperscript{2,3} In our case, FES was a quite unexpected complication of isolated rib and clavicle fractures. The absence of patent foramen ovale in the current case, as well as in most published studies,\textsuperscript{8} raises the key issue of the pathophysiology of FES. Explanations described thus far remain controversial and include the infloating theory, which holds that high pressure on fat tissue leads to lipid embolism in the systemic circulation \textit{via} a transient patent foramen ovale; the lipase theory, according to which lipid stores could be saponified before embolizing; the free fatty acid theory, in which these toxic molecules create vasculitis; the coagulation theory, in which a procoagulant state is generated by the contact of bone marrow fat with platelets; and the systemic embolization theory, which argues that the combination of the deformability of fat emboli with the rise in pulmonary arterial blood pressure forces the fat globules through the pulmonary capillary bed.\textsuperscript{3} In the current case, one possible mechanism could be the passage of fat droplets directly from bone marrow to injured pulmonary veins. The clinical improvement of our patient despite the severe initial presentation illustrates the potentially good prognosis of cerebrovascular accidents caused by fat embolism.

**Conclusion**

FES without long bone fracture is an authentic clinical entity that should be considered in patients with polytrauma and soft-tissue injury or multiple fractures. This case report highlights an unexpected complication of rib and clavicle fractures. It also reemphasizes the value of complementary examinations, such as magnetic resonance imaging, bronchoalveolar lavage, and ocular fundus examination, in typical presentations or in sudden neurologic or respiratory distress without clear explanation. Physicians ought to be aware of such a complication even in the absence of patent foramen ovale and of its potential resolution even if the presentation is initially severe.
References

ANESTHESIOLOGY REFLECTIONS FROM THE WOOD LIBRARY-MUSEUM

The Boston Post’s Obituary of Oliver Wendell Holmes, Sr.

Physician Oliver Wendell Holmes, Sr. (1809–1894) is widely regarded as one of America’s leading authors of the 19th Century. Essays like his “The Autocrat at the Breakfast-Table” helped launch the magazine that Holmes himself had named, The Atlantic Monthly. And understandably, The Boston Post headlined Holmes’ obituary with “The Autocrat Is Dead” (lower left). Holmes’ namesake son, the future Associate Justice of the U.S. Supreme Court, recorded just how peacefully his father had passed by noting that Holmes Senior had “simply ceased to breathe.” Although it was once New England’s leading daily paper, The Boston Post would not last beyond 1956. However, the word that Holmes Senior popularized for W. T. G. Morton’s etherizing, anaesthesia, would last to the present day. (Copyright © the American Society of Anesthesiologists, Inc.)

George S. Bause, M.D., M.P.H., Honorary Curator, ASA’s Wood Library-Museum of Anesthesiology, Park Ridge, Illinois, and Clinical Associate Professor, Case Western Reserve University, Cleveland, Ohio. UJYO@acnl.com.