eNeurologicalSci 14 (2019) 19–20

Contents lists available at ScienceDirect

eNeurologicalSci

journal homepage: www.elsevier.com/locate/ensci

Case report

Cerebral fat embolism syndrome in sickle cell disease without evidence of shunt

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ARTICLE INFO

Keywords:
Stroke
Fat embolism
Hemoglobin SC disease

ABSTRACT

Fat embolism syndrome (FES) is a known complication of sickle cell disease (SCD) that occurs secondary to vaso-occlusive crises, bone marrow infarction, and the subsequent release of fat globules into the venous circulation. Although neurologic involvement is common, the pathophysiology of cerebral fat emboli remains controversial. While fat microemboli can enter the arterial circulation through right-to-left shunts, the systemic release of free fatty acids may also cause indirect endothelial damage and disruption of the blood-brain-barrier. We present an unusual case of cerebral fat emboli in SCD that occurred in the absence of acute chest syndrome or right-to-left shunt, favoring a biochemical etiology. Treatment of FES includes supportive care and emergent red cell exchange transfusions.

1. Introduction

Fat embolism syndrome (FES) is a constellation of clinical signs and symptoms that occurs following the release of fat emboli into systemic circulation, often in the setting of orthopedic trauma. [1] The typical presentation is a triad of hypoxemia, neurologic abnormalities, and petechial rash, although these symptoms do not occur together in all cases. Other less common features include fever, tachycardia, anemia, renal and retinal changes. These signs/symptoms are nonspecific, and thus FES is considered a diagnosis of exclusion.

FES is a known complication of sickle cell disease (SCD) predominantly affecting those with heterozygous hemoglobin S mutations. [2] Vaso-occlusive crises can cause bone infarcts and the subsequent release of fat globules into venous microcirculation. These globules then embolize to the brain, though the exact mechanism of arterial involvement is unknown. We present a patient with HbSC disease who developed extensive cerebral fat emboli without features of acute chest syndrome (ACS), intrapulmonic or intracardiac shunt.

2. Case report

A 27-year-old man with history of HbSC disease presented to an outside hospital with lower back pain. X-rays revealed sequelae of osteonecrosis in the lumbar spine and bilateral femoral heads consistent with a sickle cell pain crisis. Two days after admission, he became acutely altered with decorticate posturing requiring intubation for airway protection. CT head, CT angiography head, and CT chest were unremarkable. EEG showed diffuse slowing. During this time, he was febrile with a hemoglobin drop from 10 to 6.5 g/dL and platelet drop from 100 to 10 tho/μL. He received two units of packed red blood cells and one unit of platelets. He was empirically started on vancomycin, cefepime, and metronidazole then transferred to our intensive care unit.

Upon admission, he underwent immediate red cell exchange transfusion (nine units of packed red blood cells) for suspected fat emboli. After therapy, MRI brain showed findings suggestive of extensive fat emboli and a small parenchymal hemorrhage in the right frontal lobe (Fig. 1). Blood cultures from the outside hospital grew MRSA of unknown source. Transthoracic and transesophageal echocardiograms with bubble studies were negative for endocarditis, intrapulmonary shunt, or inter-atrial deformities. CSF studies were unremarkable. Serum parvovirus B19 IgM and IgG were negative. Post-exchange transfusion Hgb electrophoresis showed HgbS 5.7% and HgbC 5.4%.

Within three days of exchange transfusion, his mental status improved and he was successfully extubated. Deficits at time of discharge included right hand weakness, mild cognitive slowing, and generalized weakness.

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https://doi.org/10.1016/j.ensci.2018.11.012
Received 16 October 2018; Accepted 17 November 2018
Available online 22 November 2018

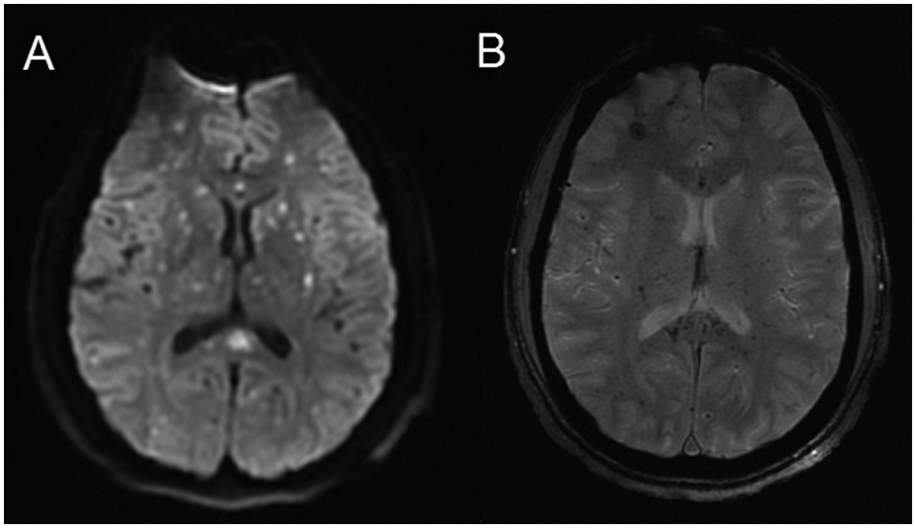

Fig. 1. Axial diffusion weighted imaging shows innumerable punctate foci of restricted diffusion involving the periventricular, deep, and subcortical white matter; cortex; deep gray nuclei and corpus callosum (A). Axial gradient echo shows diffuse microhemorrhages (B).

3. Discussion

The pathogenesis of FES is unclear but thought to involve mechanical obstruction and biochemical injury. [1,3] The mechanical theory postulates that fat microemboli enter venous sinusoids, collect in the pulmonary microvasculature, and occasionally migrate into systemic circulation via the pulmonary capillary bed or right-to-left shunts. [3] The biochemical theory postulates that plasma mediators cause a systemic release of free fatty acids causing inflammation and endothelial damage. [1,3,4] Our patient did not develop ACS and CT chest was negative for fat emboli, eliminating an obvious pulmonary origin. Additionally, workup was negative for shunting, suggesting that the development of cerebral fat emboli may have been mediated by a biochemical, rather than mechanical, process.

To our knowledge, few reported cases of cerebral fat embolism in SCD have occurred in the absence of ACS, shunt, or parvovirus B19 raising concern that cerebral fat emboli may be underdiagnosed in cases of FES. Although MRI aids in diagnosis and classically reveals multifocal punctate infarcts and microhemorrhages in a “starfield” pattern, imaging should not delay treatment. [5] Early initiation of red cell exchange transfusion breaks the sickling cycle and halts further bone necrosis and fat embolization, leading to improved prognosis. [6] If exchange transfusion is not feasible, then simple blood transfusions can improve outcomes.

4. Conclusion

Cerebral fat emboli should be suspected in patients with SCD who experience changes in mental status during a sickle cell pain crisis, even in the absence of ACS or right-to-left shunt. Prompt evaluation with MRI can aid in diagnosis, but should not delay treatment with red cell exchange transfusion.

Sources of support

This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations of interest

None.

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