Cerebral microhaemorrhages secondary to fat embolus syndrome in sickle cell disease

INTRODUCTION

Fat embolus syndrome (FES) is a distinct pattern of clinical symptoms and signs following circulation of fat globules, or emboli, in the lung parenchyma and peripheral circulation. It leads to multi-system dysfunction, most commonly involving the lungs, skin, brain and kidneys. It is usually seen following trauma; however, it is a rare but potentially fatal and under-diagnosed complication of bone marrow infarction in patients with sickle cell disease. Neurological involvement forms part of the classical clinical triad of presentation, composed of respiratory changes, neurological abnormalities and a petechial rash. The Gurd and Wilson Criteria¹ are the most widely accepted criteria for diagnosis and require the presence of at least one major criterion and at least four minor criteria (table 1).

MRI should be performed on patients with neurological deterioration. The presence of numerous cerebral microhaemorrhages

Table 1 The Gurd and Wilson Criteria

Major criteria	Petechial rash Respiratory insufficiency Cerebral involvement
Minor criteria	Tachycardia Fever Retinal changes Jaundice Renal signs Thrombocytopaenia Anaemia High ESR Fat macroglobulinaemia

ESR, erythrocyte sedimentation rate.

on Gradient Echo (GRE) MRI is a key finding which can prompt the clinician to the diagnosis of FES. Early clinical and radiological diagnosis of FES is essential to institute life-saving therapies such as exchange transfusion.

CASE

An 8-year-old Afro-Caribbean girl, with sickle cell disease, presented acutely with fever and back pain. She rapidly

Figure 1 (A) Axial FLAIR series demonstrates multiple supra and infratentorial lesions, which demonstrate restricted diffusion (B) in keeping with small acute infarcts (closed arrows). (C) Gradient echo sequence, which is an MRI sequence highly sensitive to blood products, demonstrates numerous abnormal foci of susceptibility, seen as numerous tiny foci of scattered low signal (see arrows pointing to some of the more prominent abnormal foci). These are in keeping with the numerous foci of microhaemorrhages.

deteriorated with dyspnoea, tachypnoea and hypoxaemia, requiring intensive care admission.

A chest radiograph demonstrated bilateral diffuse airspace opacification, in keeping with acute respiratory distress syndrome. Full blood count showed anaemia (Hb 5.3 g%) and thrombocytopenia (platelet count 87).

She developed pulmonary hypertension and cor pulmonale, with echocardiography demonstrating increased right-sided pressures and a patent foramen ovale. She was intubated and ventilated for 2 days requiring nitric oxide, inotropes, and was treated with exchange transfusion.

The patient's condition subsequently improved. Following extubation, the patient was noted to have abnormal neurology, including aphasia, bilateral weakness and lethargy. Cranial MRI was performed, which demonstrated multiple acute infarcts and microhaemorrhages (see figure 1A–C).

MR angiography (not shown) showed no proximal vascular abnormality. In this clinical context, the MRI appearances and the presence of numerous microhaemorrhages shown on GRE sequence were typical for FES.

Serum PCR subsequently revealed evidence of parvovirus B19 infection (Parvo B19 IgM positive). MRI spine showed multiple previous bone infarcts (figure 2). The Gurd and Wilson criteria (table 1) for the diagnosis of FES were fulfilled.¹

DISCUSSION

FES is a rare but potentially fatal manifestation of sickle cell disease. It is thought that vaso-occlusive bone marrow necrosis (figure 2) leads to release of fat globules into the venous circulation. This results in intrapulmonary and systemic vascular occlusion via cardiac and intrapulmonary right-to-left shunts. Cerebral changes have been described in up to 86% of patients

with FES.² The neurological picture varies from a subclinical presentation to confusion, coma and seizures and, in rare cases, death. Brain autopsy reveals multiple petechial microhaemorrhages in the white matter, due to small haemorrhagic infarcts from occlusive fat emboli causing increased vascular pressure and vessel wall damage.^{3,4}

In this case of bone infarct and aplastic crisis precipitated by parvovirus B19 infection in a sickle cell patient, the presence of numerous cerebral microhaemorrhages on GRE MRI was a key finding, which prompted the diagnosis of FES. MRI is highly sensitive for cerebral changes in sickle cell crisis and FES and can demonstrate infarction as focal areas of restricted diffusion (figure 1A, B). However, restricted diffusion per se is not specific for FES and could also commonly be seen in acute infarcts related to sickle cell vasculopathy. The presence of microhaemorrhages, on the contrary, is a more specific finding for FES and the inclusion of sequences sensitive to haemorrhage (eg, GRE or susceptibility weighted sequences) in the MRI protocol is paramount for diagnosis (figure 1C). This is an under-recognised finding, even in the neuroradiological literature as there are only few case reports of MRI showing microhaemorrhages in FES.^{4,5}

The mainstay of treatment for FES is supportive and includes red cell exchange transfusion, which, if implemented early, can lead to improved prognosis. Our patient otherwise made an uneventful recovery and at 6 months had mild residual neurological deficits.

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REFERENCES

- 1 Gurd AR, Wilson RI. The fat embolus syndrome. *J Bone Joint Surg Br* 1974;56B:408–16.
- 2 Johnson MJ, Lucas GL. Fat embolism syndrome. *Orthopedics* 1996;19:41–8.
- 3 Zaitsev Y, Terae S, Kudo K, et al. Susceptibility-weighted imaging of cerebral fat embolism. *J Comput Assist Tomogr* 2010;34:107–12.
- 4 Mossa-Basha M, Izbudak I, Gurda GT, et al. Cerebral fat embolism syndrome in sickle cell anaemia/ β -thalassaemia: importance of susceptibility-weighted MRI. *Clin Radiol* 2012;67:1023–6.
- 5 Lee J. Gradient-echo MRI in defining the severity of cerebral fat embolism. *J Clin Neurol* 2008;4:164–6.

Figure 2 Sagittal T2WI of the spine demonstrating a geographical pattern of bone marrow signal heterogeneity within the (A) lower thoracic and (B) lumbo-sacral vertebral bodies in keeping with bone infarcts. The lesions demonstrate central areas of patchy low signal within the posterior vertebral bodies (arrows). Several of the lesions demonstrate a peripheral rim of high signal intensity surrounded by a rim of low signal intensity (arrowheads).