CASE REPORT

Reversible splenial lesion syndrome in cerebral malaria

Neuropaludisme et lésion réversible du corps calleux

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\begin{abstract}
A 71-year-old Caucasian man living in Congo was investigated by serial magnetic resonance imaging (MRI) after having presented cerebral malaria due to \textit{Plasmodium falciparum}. The clinical picture was characterized initially by coma and seizures. The patient developed multiple organ failure. There was, at 4 months follow-up only, a minimal neurological improvement consistent with minimally conscious state. The first cerebral MRI on day 17 showed a lesion of the splenium of corpus callosum with high signal intensity on DWI and FLAIR sequence and reduced ADC, and small cortical infarcts in the internal occipital regions. Follow-up MRI obtained 36 days later showed a complete resolution of splenial lesion, though without clinical improvement. Cerebral malaria should be added to the list of possible causes of reversible lesion of the splenium of corpus callosum.
\end{abstract}

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Introduction

Cerebral malaria is one of the most serious complications in \textit{Plasmodium falciparum} infection. The clinical picture is usually characterized by encephalopathy with seizures and loss of consciousness. The final prognosis of the comatose forms is usually poor. The pathogenesis of cerebral malaria is still unclear. It seems that the cerebral complications may result from concomitant microvessel obstruction and inflammation\textsuperscript{[1,2]}. There are in the literature relatively few data regarding the in vivo imaging studies of cerebral malaria and only one case with splenial lesion\textsuperscript{[3]}.

Case report

A 71-year-old Caucasian man with a previous medical history of arterial hypertension, coronary disease, diabetes, hypercholesterolemia, and nephrolithiasis was diagnosed \textit{Plasmodium falciparum} cerebral malaria. He had been living in the Democratic Republic of Congo for 35 years and did not take any prophylaxis. When visiting his daughter in Canada, he developed fever, confusion, and general weakness. \textit{Plasmodium falciparum} was seen on the blood smear and the parasitemia was estimated at 5%. The patient became...
rapidly comatose, with a Glasgow Coma Scale (GCS) at 5. He experienced in the Emergency Department an episode of tonic-clonic seizures lasting 30 seconds that was controlled by phenytoin administration. Other complications of malaria included acute renal failure with severe metabolic acidosis requiring continuous renal replacement therapy, diffused intravascular coagulation with thrombocytopenia, acute lung injury and hepatic failure. The patient was placed on mechanical ventilation. Specific treatment was started with intravenous doxycycline and quinine dihydrochloride. Exsanguinotransfusion was performed on day 2 when parasitemia had increased up to 29%. Soon after the first dose of quinine, he presented transiently tachycardia with large QRS complexes and hypotension, and he received norepinephrine. The GCS remained at 5. Serial EEG recordings disclosed diffuse slowing of cerebral activity without evidence of epileptiform changes. Three brain CT scans (on days 1, 6, 12) failed to reveal any specific lesion. A first brain magnetic resonance imaging (MRI) was obtained on day 17 and showed diffuse leucoaraiosis, hyperintensity on T2- and FLAIR-weighted images in the splenium of the corpus callosum, and small cortical infarcts in the occipital regions (Fig. 1). There was no enhancement on T1-weighted images. There was also no evidence for dural sinus thrombosis.

A tracheotomy was performed on day 20. Intermittent hemodialysis was started from day 10.

The GCS slightly improved up to 8 (E3, V1, M4). Three weeks after the onset of neurologic symptoms, he was transferred to Belgium. The neurological examination was not modified (E3, V1, M4). He was progressively weaned from the mechanical ventilation. There was also a recovery of renal function.

The EEG recordings obtained on days 24, 33, 40, and 54 confirmed diffuse slowing (5–6 Hz) without epileptiform changes.

Eight days after the first examination (day 25), MRI showed no modification of the extent of the lesions (Fig. 2). There was a high signal intensity of the splenium of the corpus callosum on Fluid-Attenuated Inversion Recovery (FLAIR) and T2-weighted sequences and diffusion weighted images (DWI) with homogeneously reduced Apparent Diffusion Coefficient (ADC) (71%). There was still no enhancement on post-contrast T1-weighted images. Thirty-six days after the first MR (day 53), there was a complete resolution of abnormal images of the corpus callosum (Fig. 3).

On day 32, the patient had been discharged to a rehabilitation unit. After a 4 months follow-up, no significant neurological improvement was noted and the patient was classified as having a minimally conscious state.

Discussion

Cerebral malaria may occur in approximately 2% of patients infected by Plasmodium falciparum. In comatose patients, it...
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is possible to observe brain edema on brain CT scan, but usually no significant change is apparent. As *falciparum* malaria is characterized by a hypercoagulable state, cerebral venous and dural sinus thrombosis are possible complications that could be missed on brain CT scan [4]. The presence of focal neurological deficits combined to images suggestive of venous infarction and brain edema on CT scan should lead to confirm the diagnosis by an appropriate technique (MR angiography).

There are few reports of MRI findings in cerebral malaria. In a large study of 24 patients investigated by MR on a 0.2-T system, only a slight increase in brain volume was noted, without cerebral edema or other lesion [5]. Other reported cortical and subcortical infarctions or lesions in the white matter [6,7]. Focal infarcts were also found in the basal ganglia, thalamus, pons, and cerebellum. To our knowledge, only two other publications described diffusion imaging findings in cerebral malaria. Restricted diffusion on ADC map of DWI was noted within centrum semi-ovale in a 13-year-old girl [8]. Another observation of multifocal areas of restricted diffusion is also consistent with cytotoxic edema [9].

Our patients presented two types of lesions: a reversible lesion of the splenium of the corpus callosum appearing hyperintense on DWI with low ADC values and small cortical infarcts. Reversible focal splenial lesions have been found in patients with several different conditions, but exceptionally after cerebral malaria [3,10–14] (Table 1). They could be related to cytotoxic edema due either excitotoxic or inflammatory mechanisms. Even if such mechanisms have been involved in cerebral malaria, the lesions of the splenium of the corpus callosum could be at least also explained by direct complications like fever or seizures. The cortical infarctions have a low specificity, particularly in elderly patients. The other hypothesis in accordance with the possible pathogenesis of cerebral malaria is an ischemic injury due to the sequestration of infected erythrocytes in brain capillaries.

**Table 1** Other possible causes of reversible splenial lesions.

<table>
<thead>
<tr>
<th>Viral encephalitis</th>
<th>Antiepileptic drug toxicity/withdrawal</th>
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<tbody>
<tr>
<td>Seizures</td>
<td>Metabolic disorders: fever, hypoglycemia, hyponatremia, hypernatremia</td>
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<tr>
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<td>Wernicke encephalopathy</td>
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<td>Marchiafava-Bignami disease</td>
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<td>Hemolytic uremic syndrome</td>
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<td>Traumatic brain injury</td>
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**Conclusion**

During cerebral malaria, in addition to global cerebral swelling, MRI can detect small cortical infarcts and reversible splenial lesion of the corpus callosum. These lesions although not totally specific are consistent with the pathogenesis of cerebral malaria.

**Conflict of interest**

None.

**References**


