Images in neuroscience: Question

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Restricted diffusion on MR imaging of an acute cerebral lesion

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1. Clinical background
A 35-year-old woman with no previous medical history presented with a 3-day history of progressive left hemisensory loss, ataxia and hemiparesis. On neurological examination she had Medical Research Council (MRC) grade 4 pyramidal weakness, hyper-reflexia and mild incoordination on the left side. Sensory examination revealed decreased light touch, pain, temperature, vibration sense and proprioception on the whole left side. An MRI brain scan was performed 3 days after the onset of symptoms (Fig. 1 and Fig. 2).

2. What is the diagnosis?
1. Cerebral infarct.
2. Cerebral vasculitis.
4. First inflammatory demyelinating episode.

Answer on page 487.

Fig. 1. Diffusion MRI (A) and apparent diffusion co-efficient map (B) 3 days after the onset of symptoms showing restricted diffusion in the periventricular white matter.

Fig. 2. FLAIR sequence (A) showing hyperintense signal and T1-weighted image following gadolinium (B) 3 days after onset showing some enhancement of the lesion which abutted the posterior horn of the lateral ventricle. The lesion was hyperintense on T2-weighted images (not shown).
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1. Answer

4. First inflammatory demyelinating episode.

2. Discussion

The restricted diffusion was initially considered to represent a cerebral infarct. A lumbar puncture was performed which showed a CSF white cell count of 6 (all mononuclear cells) with oligoclonal IgG bands in the CSF and not the serum. A diagnosis of inflammatory demyelination was made and the patient was treated with intravenous methyl prednisolone 1 gm/day for 3 days.

Restricted diffusion usually indicates cytotoxic oedema and is a typical feature of ischaemic stroke within 2 weeks after onset. Restricted diffusion in inflammatory demyelinating lesions is uncommonly reported, but may represent direct immune-mediated cytotoxic oedema or a vasculitic subform with ischaemic cell damage.1 A repeat MRI performed 13 days after onset of symptoms showed normalisation of the restricted diffusion (Fig. 4).

Some clues in this case include the ‘onion rings’, which may represent concentric alternating bands of myelin loss and myelin preservation (Fig. 2A) and the periventricular location of the lesion which abutted the posterior horn of the lateral ventricle. Restricted diffusion can occasionally occur in other conditions such as tumour, brain abscess, hypoglycaemia, following seizures and with blood products.2

Fig. 4. Repeat diffusion MRI (A) and apparent diffusion co-efficient map (B) 13 days after onset showing normalisation of the restricted diffusion.

References