

Extreme delta brushes and BIRDs in the EEG of anti-NMDA-receptor encephalitis

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Accepted 22 February 2016
Published Online First
18 March 2016

IMAGE OF THE MOMENT

A 23-year-old Caucasian woman presented acutely to the emergency department with mild confusion and recurring stereotyped seizures that comprised a tingling sensation in her right arm and leg, followed by a generalised tonic-clonic seizure. She had been diagnosed with anti-N-methyl D-aspartate (NMDA)-receptor encephalitis 4 years previously, having presented with psychosis and generalised convulsive status epilepticus that required intubation. She had made an excellent recovery with no further symptoms and had been maintained on methotrexate until 3 months previously when it was stopped as she was stable.

MR imaging of the brain was normal. Investigations for malignancy, including whole-body positron emission tomography/CT and transvaginal ultrasound, were normal. She was treated as a relapse with intravenous corticosteroids and plasma exchange. Repeat testing of her

NMDA receptor antibodies returned positive.

Electroencephalographic (EEG) studies found widespread excess of delta activity (slow rhythms <4 Hz), suggesting a degree of diffuse cerebral dysfunction. We also observed two particular patterns:

1. *Delta brushes* over the left cerebral hemisphere (figure 1). These are slow waves with overriding fast (β) activity. They are normal features of premature neonatal EEGs but have only recently been described in adults—solely in association with anti-NMDA receptor encephalitis—and have been termed ‘extreme delta brushes’.¹ From a practical perspective, detecting this unique EEG pattern should prompt consideration of anti-NMDA receptor encephalitis and subsequent serological investigation.¹ Their presence also suggests a more prolonged disease course.¹
2. *Abrupt onset of paroxysmal rhythmic activity evolving in frequency and amplitude* (figure 2). Note, however, that this



Figure 1 Extreme delta brushes over the left cerebral hemisphere. Note the slow waves with overriding fast activity (circled).



To cite: Abbas A, Garg A, Jain R, et al. *Pract Neurol* 2016;16:326–327.

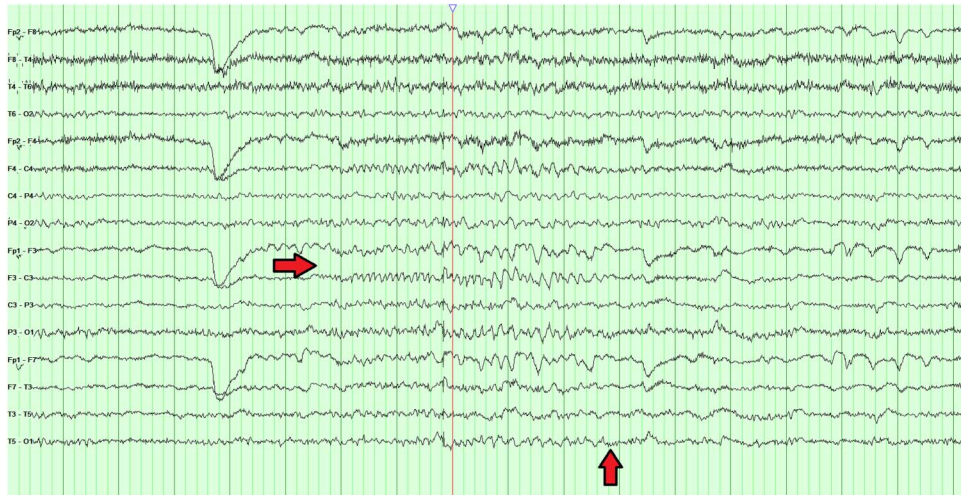


Figure 2 A brief ictal rhythmic discharge, most prominent over the left cerebral hemisphere. Note the abrupt paroxysmal rhythmic activity lasting 5 s. Horizontal arrow: onset; vertical arrow: offset.

also ends abruptly in 5 s and therefore does not satisfy the standard definition for an electrographic seizure: traditionally required to last a minimum of 10 s. Nevertheless such a pattern, occasionally seen in critically ill patients, remains important and is termed a ‘brief ictal rhythmic discharge’, or BIRD.² The ictal nature of this pattern is currently uncertain, and thus the ‘I’ in the acronym is often represented between parentheses, B(I)RD, denoting a potentially ictal discharge.² From a practical perspective, whether B(I)RDs themselves are ictal or not, patients with these are at a significantly high risk of developing full-length electrographic seizures.² This is similar to other EEG phenomena such as periodic lateralised epileptiform discharges, which are not always considered to be ictal but are frequently temporally related to electrographic seizures and whose presence therefore denotes a higher risk of seizures.

Key point

This patient showed two important electroencephalographic patterns of practical significance: extreme delta brushes—thought to be unique to anti-NMDA receptor encephalitis in adults—and brief ictal rhythmic discharges, which indicate a temporally high risk of developing seizures.

Unfortunately, this patient’s seizures recurred on the last day of plasma exchange therapy. We therefore added rituximab to her regimen of methotrexate, anti-epileptic medication and weaning corticosteroid course. Her condition stabilised and we discharged her on this treatment with plans for review.

Contributors AA: summarised the patient’s presentation and investigation results. Proposed initial draft manuscript and performed initial literature search. AG: significant contributions to discussion section on electrophysiological features of extreme delta brushes and brief ictal rhythmic discharges (BIRDS). RJ: significant contributions to discussion section on electrophysiological features of extreme delta brushes and BIRDS. GM: revised the work critically and redrafted aspects. SJ: revised the work critically and redrafted aspects. All authors agree to be accountable for all aspects of the published case report.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed. This paper was reviewed by Nick Kane, Bristol, UK.

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