

## CASE REPORT

# Treatment of refractory partial status epilepticus with multiple subpial transection: case report

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Status epilepticus (SE) represents a medical emergency that annually affects 60 000–150 000 individuals in the United States. Selective neuronal loss in vulnerable areas has been pathologically demonstrated following convulsive SE primarily affecting the limbic system, thalamus and cerebellum.

Morbidity in those cases that follow refractory SE (RSE) is poorly documented. There have been anecdotal reports of surgical treatment for this condition, especially secondary to brain lesions.

We report a 6-year-old patient who was in RSE for 60 days, without a brain lesion documented by MRI.

The patient underwent multiple subpial transection (MST) of the sensorimotor cortex, which by ictal EEG and ictal SPECT proved to be the epileptogenic zone.

We conclude that MST should be considered as an alternative treatment for refractory partial SE.

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*Key words:* epilepsy surgery; multiple subpial transection; status epilepticus.

## INTRODUCTION

Status epilepticus (SE) is a major neurological emergency that annually affects 60 000–150 000 people in the United States<sup>1</sup>. Several reports have estimated the mortality rate following SE to be 12–20%<sup>2,3</sup>, which correlates primarily with both the duration of SE and the underlying aetiology. Unfortunately, morbidity related to this condition has not been fully dealt with in the literature, and only anecdotal reports have been found suggesting chronic changes in SE survivors.

SE unresponsive to medical treatment evolves into refractory SE (RSE), which carries a high mortality rate. There have been anecdotal reports of patients in partial RSE, who underwent surgery to ameliorate this condition, limited primarily to cases with underlying brain lesions.

Multiple subpial transection (MST), a novel disconnection procedure developed by Morrell *et al.*<sup>4</sup> repre-

sents a new approach for epilepsy surgery. This technique leaves the generator site itself unable to establish enough cell synchrony. These features support MST as a useful tool to treat pharmaco-resistant seizures that originate in the so-called 'eloquent area'.

We report a patient with intractable epilepsy partialis continua with negative MRI findings who improved his neurological status following MST.

## CASE REPORT

This 6-year-old patient was admitted to our institution after a 12-day history of SE unresponsive to medical treatment. The result of an uneventful pregnancy and normal delivery with a weight of 3.150 Kg, he had a mild motor and speech delay. At the age of 3 1/2 years he had his first SE which required thiopental to be controlled at another institution. Brief, isolated

episodes of myoclonic jerks were observed on the left side of his body and palate. After some of these myoclonic bouts a slight ipsilateral hemiparesis was noted with complete recovery within a few minutes. He had up to three episodes per week and with the addition of vigabatrin their frequency was reduced to one per month. Three weeks before admission he again developed myoclonic jerks that affected his left upper limb and after a few hours he went into partial motor SE which was controlled in 72 hours with thiopental. Five days later his SE relapsed, being uncontrolled after 12 days of vigorous treatment, thus he was referred to our institution. On admission he presented with continuous motor activity that involved left upper and lower extremities along with left facial twitching and unresponsiveness. An EEG showed bursts of bilateral independent and semiperiodic spike slow-wave discharges.

Antiepileptic drug treatment upon admission included vigabatrin  $35 \text{ mg kg}^{-1}$  per day, lamotrigine  $2 \text{ mg kg}^{-1}$  per day, phenobarbital  $5 \text{ mg kg}^{-1}$  per day, phenytoin  $5 \text{ mg kg}^{-1}$  per day and lorazepam  $0.4 \text{ mg kg}^{-1}$  per day. He was afebrile, without evidence of respiratory or cardiovascular distress. Midazolam  $0.1 \text{ mg kg}^{-1}$  was added with no response and he was ventilated and placed on thiopental  $2 \text{ mg kg}^{-1}$  per hour, when SE was arrested. Every time an effort was made to reduce thiopental, focal SE reappeared. Topiramate  $1.7 \text{ mg kg}^{-1}$  per day was added. A brain MRI obtained 12 days after admission showed dilatation of supratentorial ventricles with bitemporal predominance and increased signal intensity throughout the gray and white matter of right and left temporal-occipital lobes (Fig. 1). A skin biopsy proved normal.

Serial EEGs showed a high-frequency spike focus over the right central temporal area. An ictal SPECT showed right posterior frontal hyperperfusion (Fig. 2).

After 62 days of refractory SE with EEG and SPECT confirmation of a localized epileptogenic area, it was decided to carry out a MST of the ictal area under intraoperative electrocorticography guidance. After transecting the motor area, a  $4 \times 5$  grid was placed on the underlying area. Frequent spike discharges were seen in the ipsilateral frontal region and this prompted the decision to disconnect the frontal lobe, which resulted in the disappearance of spike discharges (Fig. 3).

An intraoperative brain biopsy was obtained and pathology showed preserved cortical layers, astroglial hyperplasia and subpial gliosis. The postoperative course was uneventful and SE ceased.

At 12 month of follow up, although the patient remained seizure free, he had a moderate left hemiparesis with mild cognitive impairment.

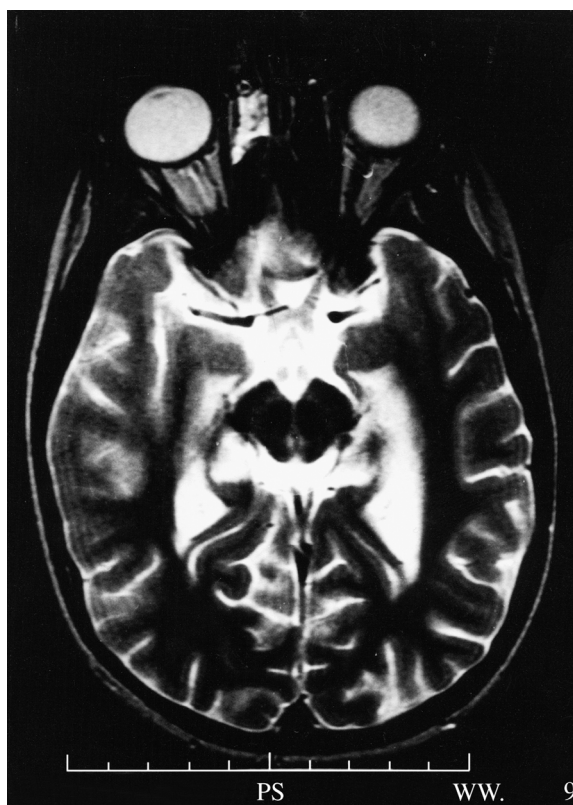


Fig. 1: Axial FSE  $T_2$ -weighted image showing increased signal intensity throughout the gray and white matter of the right and left temporo-occipital lobes.

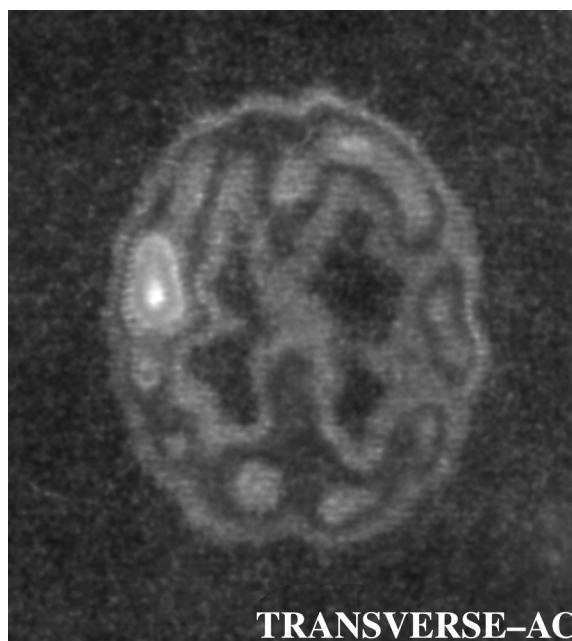


Fig. 2: Ictal SPECT disclosing the presence of hyperperfusion over the right central region and relative bilateral hypoperfusion.

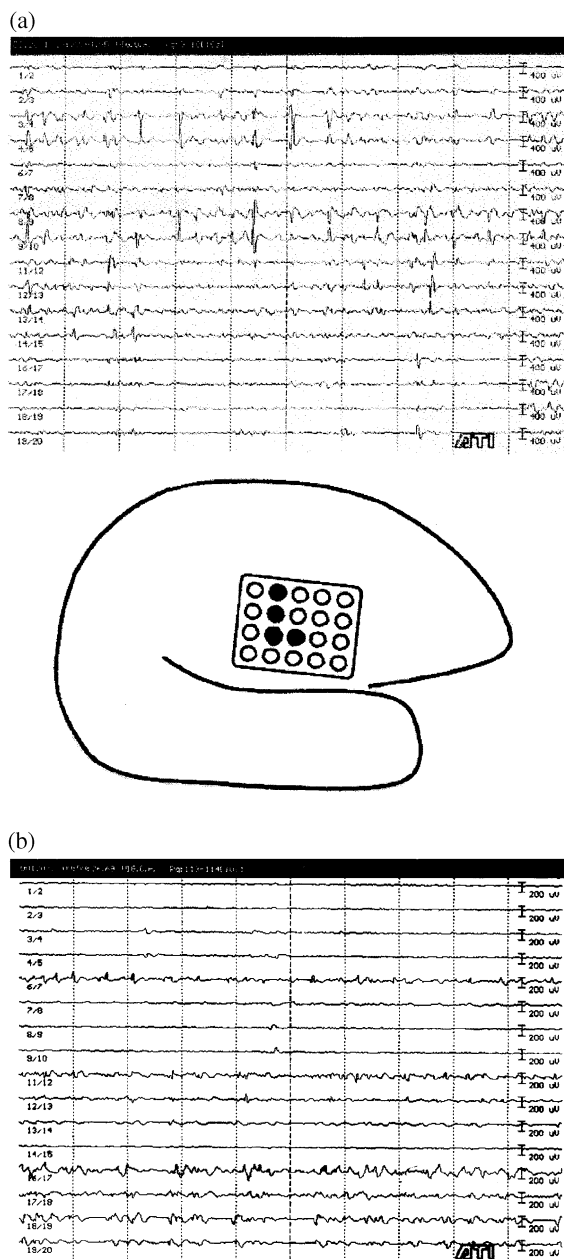


Fig. 3: Intraoperative electrocorticography (EcoG) before (a) and after (b) multiple subpial transection (MST). A  $4 \times 5$  subdural grid placed over the right perirolandic region. Frequent and semiperiodic discharges are present before MST, maximum over contacts marked with black dots (a). No discharges were seen post-MST (b).

## DISCUSSION

The mortality rate following convulsive status epilepticus has dropped considerably, but still remains at 10–20%<sup>3</sup>. There are sporadic case reports of cognitive dysfunction secondary to SE, whether convulsive or non-convulsive, but there is scant indication of its frequency. Data from the Collaborative Perinatal Project suggests that SE per se has limited adverse

effects in childhood. Ellenberg *et al.*<sup>5</sup> report no evidence of cognitive decline in children whose SE presented between ages 4 and 7.

## Neuropathological changes in SE

A detailed description of the neuropathological findings in the brain of epileptic patients was published by Sommers<sup>6</sup> over 100 years ago. Wasterlain *et al.*<sup>7</sup> reported similar findings in the brain of three patients who died after non-convulsive SE (NCSE).

Such data agree with Meldrum and colleagues<sup>8</sup> original report of anatomical changes following NCSE in animals well ventilated and perfused, which further supports the need to immediately stop electrographic seizures to avoid irreversible neuronal damage.

In acute stages of SE both hippocampi tend to be affected. Neuronal necrosis is more marked in CA1 and CA3 compared with CA2 and CA4.

## The role of surgical treatment in refractory status epilepticus

Only a few anecdotal reports have addressed the possibility of performing surgery, especially in cases like ours that exhibit *epilepsia partialis continua*. In contrast to the present report, most cases, like those of Gorman *et al.*<sup>9</sup> and more recently the one described by Molyneux *et al.*<sup>10</sup>, were patients with an underlying brain lesion, specially focal cortical dysplasias, which are increasingly recognized as treatable etiologies of refractory partial epilepsies.

In the case of lesions involving eloquent areas, new surgical techniques are being developed, more particularly MST. This technique disrupts intracortical horizontally oriented fibres in a defined cortex area while preserving the columnar architecture and avoiding, at least in theory, neurological deficits. As a result, the epileptogenic region, limited by MST, may be unable to spread the seizure discharge. Recent studies have demonstrated the efficacy of MST<sup>11–15</sup>, although it has been recognized that only a few patients have been treated exclusively with this technique.

To the best of our knowledge, the present case is the first report using such technique on a patient with *epilepsia partialis continua* with negative MRI findings, shown on pathology to have changes consistent with SE and its complications, namely hypoxia and ischaemia, in contrast to Molyneux and colleagues who found anatomopathological findings compatible with focal cortical dysplasia. Like theirs, our case enjoyed a marked postoperative improvement in seizure control presenting to date with only brief self-limiting clonic movements involving the face.

To conclude, surgery should be considered as an alternative for the treatment of patients with refractory focal SE with suspected brain pathology, especially at centers where thorough intraoperative monitoring is available. Experience in larger groups of patients is required to allow more definitive conclusions to be drawn.

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