Epilepsy Surgery in MRI Negative Patient
Cirurgia da epilepsia em paciente com ressonancia magnética normal

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RESUMO
Introdução: Epilepsia não-lesional ou epilepsia sem alteração na ressonancia magnética é caracterizada pela ausência de um foco potencialmente epileptogênico. Nesta situação, procedimentos cirúrgicos são mais complexos e mais desafiadores. Relato do caso: Um paciente de 6 anos e 8 meses apresentava quadro de epilepsia refratária de início aos 8 meses: as crises eram predominantemente do tipo parciais complexas. Não havia sinais neurológicos focais, mas observavam-se alterações cognitivas, de comportamento e do aprendizado. O vídeo EEG mostrava foco temporo-occipital esquerdo, com irradiação para a direita. A ressonancia magnética e o PET inter-ictal eram normais, embora o SPETC ictal mostrasse focos occipital esquerdo e temporal direito, este de provável propagação secundária. A ressecção do foco à esquerda foi realizada em dois tempos, com uso de eletrodos subdurais. O estudo anátomo-patológico mostrou displasia cortical tipo IA. Na revisão de dois anos, o paciente apresentou apenas uma crise convulsiva anual, tendo apresentado melhora no comportamento e aprendizado, bem como melhora cognitiva. Conclusão: Neste caso de epilepsia refratária, sem alterações na RM, o SPETC foi essencial para a localização do foco epileptogênico.

Palavras Chave: Epilepsia; epilepsia com RM normal, SPECT, eletrodos intracranianos, grade subdural, cirurgia

ABSTRACT
Background: Non-lesional epilepsy or MRI-negative epilepsy is characterized by the absence of a potentially epileptogenic lesion. In these cases surgical procedures are more complex and rather challenging. Case Description: A 6-year-8-month-old boy presented with refractory epilepsy since 8 months-old onset age was 8 months. Crises were predominantly complex partial seizures. Patient had no focal neurological signs but showed cognitive, learning and behavioral alterations. Video-EEG: left temporal-occipital focus radiating to the right. MRIs did not show lesion, interictal PET was negative and ictal SPECT showed left occipital and right temporal focuses, which was interpreted as propagation. Resection surgery of left focus was performed in two stages, with subdural grid electrodes. Histopathological studies showed cortical dysplasia type IA. Follow-up (24 months): the patient presented only one annual seizure and showed cognitive, learning and behavioral improvement. Conclusion: In this case SPECT was very useful in localizing epileptogenic focus.

Keywords: Epilepsy Negative MRI – SPECT – Intracranial Electrodes – Subdural Grid – Epilepsy Surgery
INTRODUCTION

Total resection of a lesion diagnosed by MRI is associated, in 70 to 90% of the cases, with a better postoperative condition depending on the nature of the lesion. When the lesion is consistent with ictal and interictal EEG there is a 95% success rate\(^2,3,4,7,10,14\).

Non-lesional epilepsy or MRI-negative epilepsy is characterized by the absence of a potentially epileptogenic lesion. In these cases surgical procedures are more complex and rather challenging\(^1\). In order to talk about non-lesional or MRI-negative epilepsy, it is necessary to follow the guidelines of the International League Against Epilepsy (ILAE), which include: a) 1.5-tesla MRI scanners; b) 5 mm image cuts or less; c) coronal, axial and sagittal cuts; d) T1, T2 and FLAIR; e) the images of the temporal lobe must be obtained in oblique slices, which are perpendicular to the amygdala-hippocampal complex; f) measurement of quantitative volume of amygdala-hippocampal complex \(^5\). By following such guidelines, the 50% sensitivity of a standard MRI improves to 91%\(^16\).

In spite of the absence of lesion in MRI, neuropathological studies often show non-specific gliosis (most frequent finding), cortical malformations (from dysplasia to microdysgenesis), tumors and hidden AVMs (15% of the cases)\(^14\). The frequency of this type of epilepsy varies between 10 to 15% in surgical series\(^12\). The localization of the surgical site is complex, total resection is more difficult and postoperative status is less favorable since only 22% of the patients is seizure-free\(^12,14\).

Non-invasive pre-operative assessment has its limitations: invasive EEGs with deep brain electrodes cause neurological complications in 4 to 5% of the cases, and subdural electrodes in 20% of the cases, according to literature\(^14\).

CASE REPORT

A 6-year-8-month-old boy presented with refractory epilepsy to medication. It started at 8 months of age with a typical febrile convolution; seventeen months later, the patient had a second seizure during sleep, characterized as nonfebrile, complex partial. EEG and brain CT scan were normal and valproic acid treatment was prescribed. The seizures recurred in spite of the prescribed anticonvulsants: first occurring once a month, then 3 to 4 times a month and finally 4 times a day. The crises were polymorphic, although predominantly complex partial with left versive movements of the head and eyes associated with clonic movements in left hand and foot. Medications prescribed were valproic acid, carbamazepine, topiramate, levetiracetam and lamotrigine.

The first pathological EEG was performed 30 months after the epilepsy onset, showing a right temporal-occipital spike focus. However, video-EEG showed a left temporal-occipital focus radiating to the right (Fig. 1). MRIs did not show lesion (Fig. 2); a 1.5-tesla MRI scanner was used, with 1.5 mm image cuts, T1, T2 and FLAIR, oblique slices for temporal lobe and quantitative measurements of the amygdala-hippocampal complex were performed.

![Figura 1: Video-EEG showing left temporo-occipital epileptic focus with irradiation to the right side.](image)

![Figura 2: MRI (coronal and axial cuts) - normal exam](image)

Interictal PET was negative (Fig. 3) and ictal SPECT showed left occipital and right temporal focuses, which was interpreted...
as propagation due to electrophysiological findings (Fig. 4).

A neuropsychological assessment showed cognitive, learning and behavioral alterations.

The operation was performed in two stages. First, 32 subdural grid electrodes were placed, with continuous EEG monitoring during 48 hours: a left occipital focus was disclosed. During the second stage, left occipital and posterior temporal resections were performed, and also a left parietal subpial transection was made due to the extension of the electrical focus detected with intraoperative electrocorticography (Fig. 5 a and b). Histopathological studies showed a cortical dysplasia type IA. The patient is being followed on for two years, showing remarkable improvement in cognitive, behavioral and learning aspects. He is still on lamotrigine 25 mg daily and has had only two crises, one each year.

Discussion

MRI and extracranial electroencephalography are the two best procedures to localize an epileptic focus at the early stage of preoperative assessment of patients with refractory epilepsy. When MRI is negative, an extracranial electroencephalography plays an important role in achieving such goal[14].

In extra-temporal epilepsy, between 35 and 50% of extracranial recordings are non-localizing, that is why invasive intracranial electroencephalography is performed[17]. In non-lesional epilepsy, it is difficult to determine the number of subdural intracranial electrodes, given the quantity of complications that have been published (around 20%)[6,15]. Surgical resection should extend to the zone that presents abnormal encephalographic recordings, taking always into consideration the perioperative morbidity.

Positron emission tomography (PET) performed between crises can disclose an area of glucose metabolism in the epileptogenic focus[13]. In extratemporal nonlesional epilepsy, only 9% of the cases achieve exact localization[13]. Our case was negative.

Ictal single-photon emission computed tomography (SPECT) is more sensitive during a crisis and, in patients with refractory epilepsy and negative MRI, a better focus localization can be
achieved than with interictal PET[8]. Our case showed a left occipital focus and another right temporal focus which was interpreted as propagation.

The placement of intracranial electrodes in non lesional epilepsy is required in most of the cases, especially when the epileptic focus is extra-temporal. They are aimed to localize and delimit the epileptogenic zone, the related irritative areas and the eloquent cortex. Subdural electrodes must cover the area where the surgical resection or the subpial transection (eloquent area) will be made[9,11,14].

**CONCLUSION**

Patients with non-lesional epilepsy or negative MRI may benefit from surgery as long as an exhaustive assessment of the crises are made, including the use of extra and intracranial electrophysiology, with interictal PET and ictal SPECT.

The surgical procedure can be just resective or associated with subpial transection, when the epileptogenic focus stretches over eloquent areas. Very good results are achieved in terms of seizure control.

**REFERENCES**


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