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Case Study

Neurological complications after gamma-knife radiosurgery for hypothalamic hamartoma

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ABSTRACT

Background: The Gamma-knife technique is a safe and effective option for the treatment of hypothalamic hamartomas that produce epileptic seizures refractory to medical treatment and/or serious behavioral disorders. After this type of radiosurgery, an adequate symptomatic control is normally achieved, with notable decrease or even disappearance of the seizures. Radiological changes, such as a decrease in the size of the tumor or adjacent edema secondary to non-necrotizing radioinduced inflammatory reaction are unusual consequences. Side effects and neurological complications are also rare events.

Case presentation: This report describes an unusual case of complete radiological resolution of a hypothalamic hamartoma as well as neurological complications after Gamma-knife surgery (receiving 13 Gy to the 85% isodose line, 1 cm^3 of tumor volume) in a 8-year-old boy who suffered from severe refractory seizures. After radiosurgery, the patient experienced a notable improvement in his symptoms, achieving seizure cessation within 3 months. However, 4 months after the procedure he presented drowsiness, fever and decreased level of consciousness due to a direct effect on the hypothalamus with local and regional edema secondary to the radiosurgery that was performed. He was successfully treated with corticosteroids (with a total duration of 11 months), and twelve months after the surgery, complete disappearance of both the nodular lesion and the secondary edema was observed. The patient remains seizure-free in the last 16 months, with remarkable changes in his behavior.

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Conclusions: The present case shows that complete radiological resolution of a hypothalamic hamartoma after Gamma-knife technique is unusual but possible, without long-term neurological consequences. Nevertheless, despite its low incidence, if a patient presents neurological symptoms, primarily during the first year after intervention, possible complications of this type of surgery must be taken into account.

1. Introduction

Hypothalamic hamartoma is a rare non-neoplastic malformation of the gray matter that is located in the hypothalamic area between the tuber cinereum and the mammillary bodies. The prevalence in children and adolescents is approximately 1–2 cases/100,000 inhabitants.[1]

Hypothalamic hamartomas can produce seizures of any kind, but the gelastic ones are considered to be the typical manifestation of this condition. They are defined as brief episodes of unmotivated and uncontrollable laugh, with no loss or a brief decrease of consciousness, and usually accompanied by autonomic signs. Crying seizures can sometimes coexist with the gelastic crises; and simple and complex partial seizures are often also present in this entity.[1]

This malformation can trigger severe behavioral problems and produce cognitive impairment. Attention deficit hyperactivity disorder (ADHD) is the mental imbalance that these patients most commonly present, as well as oppositional-defiant behaviors.

Endocrine alterations are also common; most notably central precocious puberty, which is present in 30–40% of cases.

In order to fully confirm the diagnosis of hypothalamic hamartoma, a brain magnetic resonance imaging (MRI) is needed. The typical image findings are isointense lesions of gray matter located in the hypothalamic area that are not enhanced with contrast.[1,2] Hypothalamic hamartoma morphology may influence the symptoms presented by the patient. In this way, pedunculated parahypothalamic hamartomas are associated more often with precocious puberty, while sessile intrahypothalamic lesions are more likely to result in epilepsy and behavioral disorders, especially when they are closely connected to the mammillary bodies.[1] When the latter are in contact with the tuber cinereum and/or the infundibulum they may be associated with a precocious puberty as well.[3]

Electroencephalography (EEG) does not usually demonstrate epileptiform activity due to the deep location of the lesion and its complex connections.[1]

Medical treatment usually results in insufficient control of symptoms, as seizures are usually refractory, even with a combination of antiepileptic drugs.[1] In these cases, surgical resection of the hamartoma would be necessary. Due to the deep location of the lesion, conventional surgery is technically complex and it presents high risk of complications. For this reason, in recent years, new stereotactic surgical techniques have been developed, that are less invasive and safer than the conventional ones. Among them, gamma-knife radiosurgery stands out for its positive results and fewer side effects.[1,2,4–6]

2. Case study

We report the case of a previously healthy boy who at the age of six, started to present episodes that consisted in sucking-chewing movements, staring, mydriasis and hypertonia, mostly during sleep. Later, he presented episodes of unmotivated laughter (identified as gelastic seizures) as well as partial complex seizures and even once a generalized tonic–clonic seizure. Treatment with levetiracetam and valproate was introduced, resulting in no signs of improvement. At the same time, the patient was further diagnosed with severe behavioral disorder, and ADHD; neither of these alterations responded to risperidone and methylphenidate treatment.

A brain MRI was performed, where an isointense lesion of 1.3 × 0.8 × 1 cm was observed on the floor of the third ventricle, without postcontrast enhancement, compatible with hypothalamic hamartoma (Fig. 1A–C). After diagnosis, drug treatment was intensified adding other antiepileptic drugs (oxcarbazepine and zonisamide), without achieving adequate control of symptoms.

Because of the serious persistence of the seizures, surgical treatment was preferred, using gamma-knife technique, receiving 15 Gy to the 99% isodose line at the 1 cm^3 tumor volume, and 13 Gy to the 85% isodose line at the planning target volume (tumor volume with 0.5 mm of margin volume). The procedure was performed on May 2014, under general anesthesia, without any incidents during the procedure.

After surgery, the patient experienced a notable improvement in his symptoms, with progressive decrease and finally disappearance of both gelastic and complex partial seizures within 3 months, with a marked improvement in his behavior.

Nevertheless, 4 months after surgery, the patient was taken to the emergency unit of our hospital, presenting drowsiness, fever and decreased level of consciousness (Glasgow coma scale of 13), without evidence of intracranial hypertension. Within the emergency study, a complete blood analysis, lumbar puncture, levels of valproate and a toxic analysis were done. None of them exhibited any important alterations. However, in the cranial CT scan that was carried