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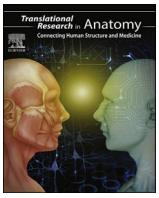

Successful surgical treatment of intractable hemifacial spasm: A case report and review of cerebellar hamartomas of the floor of the fourth ventricle

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ABSTRACT

Introduction: Hamartomas involving the floor of the fourth ventricle and cerebellum are rare, but can be associated with medically recalcitrant hemifacial spasm. These lesions present early in the neonatal or infantile period and respond well to surgical excision.
Case Report: A 3-month-old white male presented with recurrent left hemifacial spasm, left eye deviation, and absent movement of the extremities. The patient was found to have a left eccentric lesion in the floor of the fourth ventricle and cerebellum. The patient showed no improvement with medical therapy by 6 months of age. He was taken to the operating room for suboccipital craniotomy and removal of the posterior arch of C1 followed by intralesional recording of epileptogenic activity and gross total resection of the lesion. After histologic analysis, the lesion was determined to be ectopic cerebral tissue consistent with a hamartoma. Postoperative MRI showed complete removal of the lesion, and the patient exhibited complete remission of his hemifacial spasm and associated symptoms.
Conclusions: Hamartomas involving the floor of the fourth ventricle can present with hemifacial spasm and respond well to surgical excision.

Contents

1. Introduction

Hamartomas are benign lesions composed of irregularly arranged mature tissue normally occurring in the respective location of the mass. These lesions may present with partial seizures and

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hemifacial spasms that are poorly responsive to anti-epileptic drugs (AEDs). In addition to hamartomas, other lesions in the floor of the fourth ventricle, cerebellum, and brainstem have been associated with AED resistant seizures. The symptomatology of these lesions has even been described as “cerebellar epilepsy” [1–6]. The epileptic potential of these lesions has been described through intralesional electroencephalographic (EEG) recordings that demonstrated epileptic electrical activity, ictal single-photon emission computed tomography (SPECT) that demonstrated hyperperfusion of the lesion during the ictal onset, as well as gross total resection that resulted in cessation of the seizures [5–7]. Hamartomas of the floor of the fourth ventricle (HFFV) are remarkably rare but when symptomatic have a unique clinical presentation of recurrent partial seizures with hemifacial spasm [8–11]. A number of other symptoms may be present, which include eye blinking, eye deviation, and irregular breathing. As previously reported, these HFFV are generally resistant to AEDs but respond well to surgical therapy. Typically, surgical intervention for HFFV involves suboccipital craniotomy with gross total resection of the lesion [5,6]. Herein, we report a case involving a 6-month-old white male who underwent successful surgical resection of a HFFV.

2. Case Report

2.1. Initial hospital course

A 3-month-old white male who had multiple daily episodes of left hemifacial spasm involving the upper and lower face since birth was initially admitted to the neurology service. During each seizure episode, which would last approximately 10 s, the patient showed no movement in his upper or lower extremities while his eyes deviated to the left. Interictal neurologic examination demonstrated no abnormalities. Magnetic resonance imaging (MRI) performed shortly after birth at a previous hospital showed one non-enhancing left cerebellar mass that involved the floor of the fourth ventricle but spared the middle cerebellar peduncle and brainstem. No hydrocephalus was demonstrated on MRI. Subsequent computed tomography (CT) scan during his initial hospitalization revealed no changes. The patient's past medical and birth histories were remarkable only for hypospadias. The differential diagnosis for the lesion included ganglioglioma, ganglioneuroma, dysembryoplastic neuroepithelial tumor, hamartoma, or potentially Lhermitte-Duclos disease. The decision was made to continue with the AED Levetiracetam until 6 months of age and obtain an MRI of the lesion again at that time.

2.2. Operation

At 6 months of age, the patient showed no improvement with medical therapy and his parents reported approximately 200 seizure episodes per day. MRI again showed the non-enhancing left cerebellar mass with no significant interval change (Fig. 1, Fig. 2). A positron emission tomography (PET) scan was performed and demonstrated increased fluorodeoxyglucose uptake within the mass. At that time, surgical intervention provided the best possible solution for treating his intractable seizures. The patient was taken to the operating room and ventriculostomy was placed at Kocher's point on the right side. The patient was then placed in the prone position and an incision was made from the inion down to C2 and removal of the posterior arch of C1 performed. A suboccipital craniotomy was performed and the dura opened. Using a surgical microscope, the cerebellar hemispheres were retracted to expose the subependymal lesion that was present on the medial aspect of the left cerebellar hemisphere. A 4-probe intralesional electrode was placed and showed epileptogenic activity. Biopsies obtained

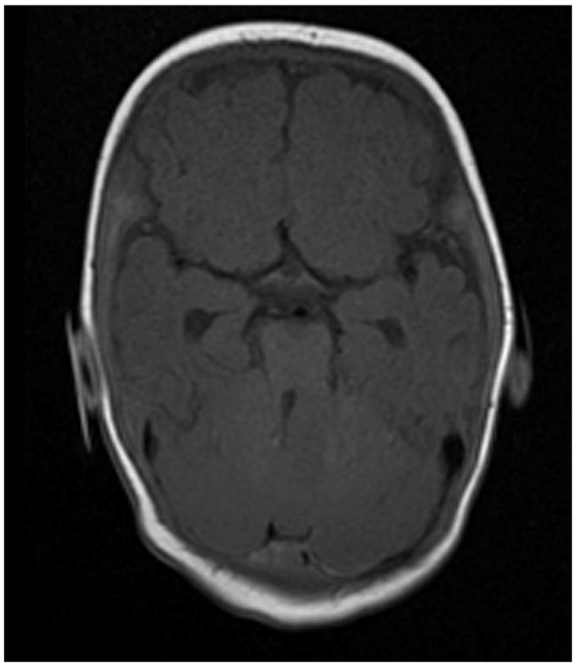

Fig. 1. Preoperative axial T1 MRI of the left-centered HFFV involving the cerebellum.

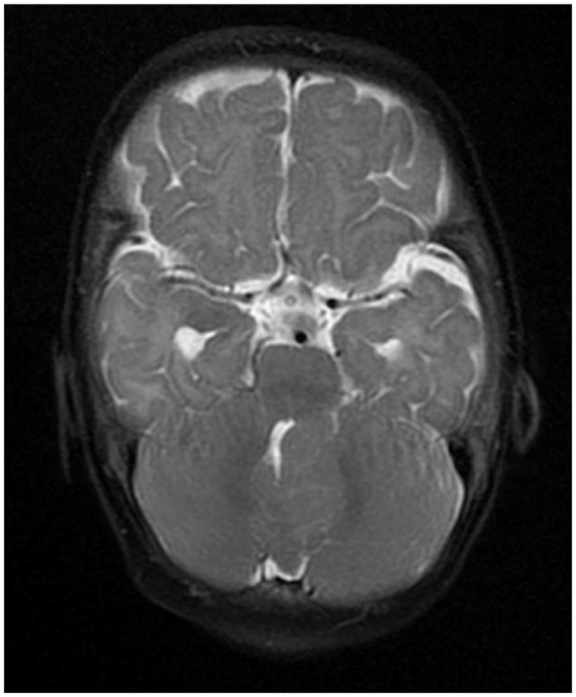

Fig. 2. Preoperative axial T2 MRI of the left-centered HFFV involving the cerebellum.

exhibited mature pyramidal neurons, with occasional dysplastic neurons showing abnormal processes and clumped Nissl substance, surrounded by reactive astrocytes with pink cytoplasm and spider-like processes (Fig. 3). Staining for glial fibrillary acidic protein, Neu-N, and neurofilament protein were positive. These findings were consistent with a hamartoma. To ensure complete resection of the lesion, measurements were made that corresponded with the dimensions of the lesion itself. In addition, an electrode was placed just within the middle cerebral peduncle

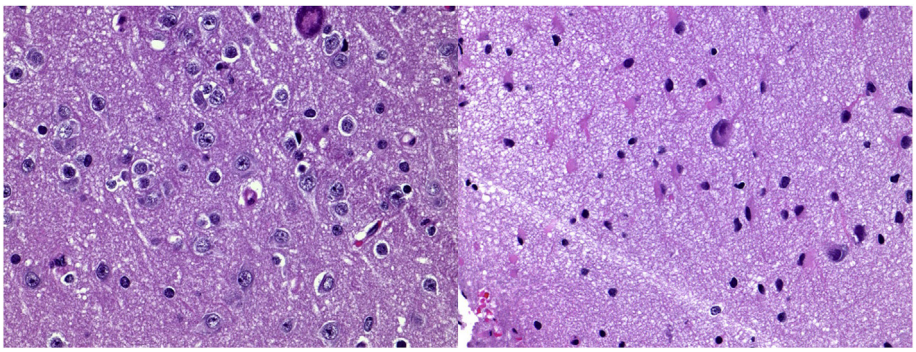

Fig. 3. Hematoxylin and eosin stain of biopsied lesion exhibiting mature pyramidal neurons, with occasional dysplastic neurons showing abnormal processes and clumped Nissl substance, surrounded by reactive astrocytes with pink cytoplasm and spider-like processes.

underneath the surgical resection bed to record any epileptic electrical activity from the area. No seizure discharge was noted for 10 min. With no significant swelling in the cerebellum or surrounding structures and with complete resection of the lesion, the wound was irrigated and closed. A graft was used to facilitate dural closure. Blood loss was approximately 600 ml, a head wrap was placed, the patient was taken intubated to the intensive care unit (ICU).

2.3. Postoperative course

The patient was stabilized post-operatively in the ICU. As he experienced no elevations in intracranial pressure, he was transferred to the medical floor. Postoperative CT scan showed a satisfactory post-operative result with no other abnormalities, and so the ventriculostomy catheter was weaned over several days and removed. After spontaneous resolution of a small CSF leak and no evidence of infection, the patient was discharged. The patient returned one month later for CSF leakage from the site of the original ventriculostomy catheter associated with a small subdural hygroma. These complications were treated with the replacement of a new ventriculostomy catheter, which was slowly weaned. The patient did not require permanent CSF diversion and follow-up at three years revealed no further difficulties. Postoperative MRI demonstrated the complete removal of the lesion (Fig. 4, Fig. 5). Additionally, the patient demonstrated an Engel 1a outcome with complete post-operative seizure freedom and discontinuation of all AED.

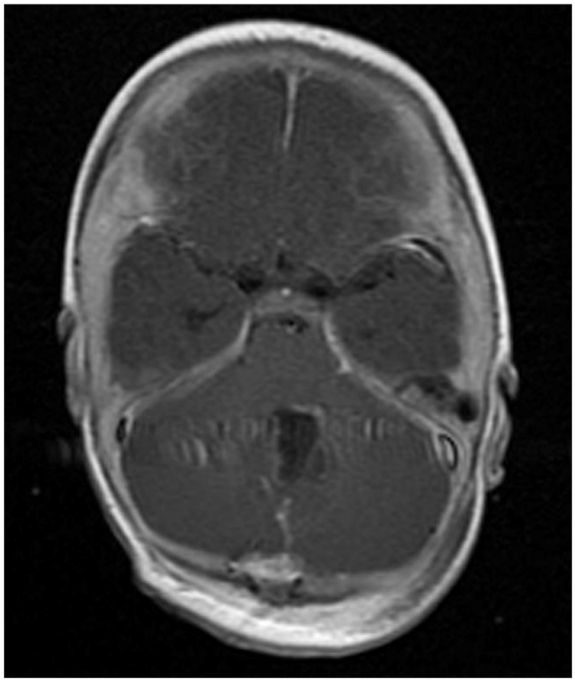

Fig. 4. Postoperative axial T1 MRI of the completely resected lesion.

3. Discussion

Very few cases of HFFV have been reported in the medical literature. The clinical presentation of this patient is similar to other reported cases of HFFV through symptoms including classic hemifacial spasms, eye deviation, eye blinking, autonomic dysfunction, irregular breathing, and involvement of the extremities. Interictal neurologic examination generally reveals no abnormalities, as was the case with this patient, or only slight developmental delays. These seizure episodes occur multiple times daily and are often resistant to anti-epileptic medication [1,5,6,8–11].

Although the relationship between HFFV and hemifacial spasms has been well described, the exact origin of these epileptic episodes remains elusive [1,2,9,11,12]. Several reports have suggested the lesion itself is the epileptic focus [1,5,6]. Some authors have concluded the seizures originate from the lesion itself based on a number of important findings. First, the actual anatomic location of these lesions shows poor demarcation and direct connection to the floor of the fourth ventricle. This is because hamartomas have overlapping histological features with focal cortical dysplasia and have been shown to be ectopic non-neoplasms partially constituted by neurons and glia [1]. Second, histologic analysis demonstrates irregularly arranged mature tissue, including neurons with interneuronal connections. Similar to epilepsy in hypothalamic hamartomas, these two details suggest that it is feasible for electrical activity to be distributed from this non-cortical lesion through anatomic connections to affected areas, including brainstem cranial nerve and sympathetic nuclei. Since heterotopic gray matter is metabolically active and epileptogenic, it is thought that seizure activity is due to aberrant connections from neuronal structures, especially dysplastic neurons [5].

Third, based on electrode placement prior to resection, intraoperative recordings within the lesion resembled the rhythmic electrical activity of a seizure episode. A number of other reports, including this case, observed similar findings such as hyperexcitable, hypersynchronous, and hypermetabolic neuronal activity characteristic of an epileptic process [4,5]. Fourth, ictal SPECT confirmed hyperperfusion of the lesion during the seizure episode, and studies performed with subtraction ictal SPECT coregistered to

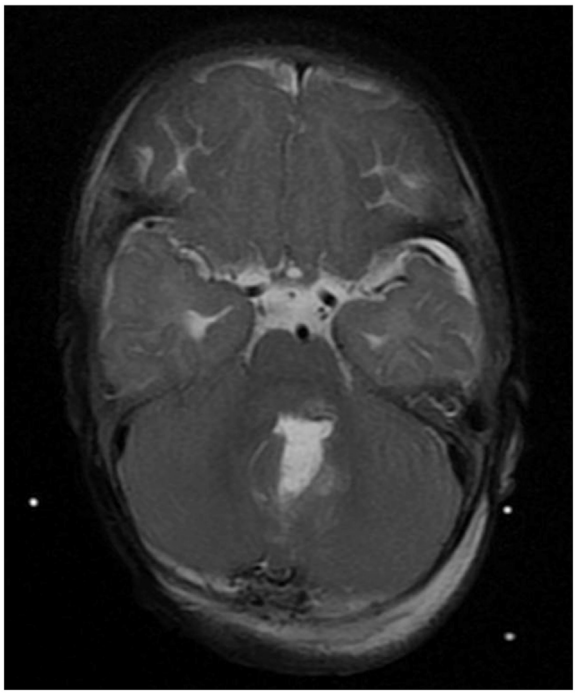

Fig. 5. Postoperative axial T2 MRI of the completely resected lesion.

MRI (SISCOM) have illustrated the ictal activation of the hamartoma, pons, and nearby cerebellar parenchyma during seizures. This aligns with previous findings that suggest the presence of a short subcortical network activated by the lesion [5,6]. Finally, surgical resection of the hamartoma resolves the attacks completely, while incomplete resection may result in continued or worsened epilepsy. Demonstration of the intralesional electrical activity, hyperperfusion and activation of the lesion during a seizure, and excellent response to surgical intervention provides perhaps the strongest evidence that the lesion itself may be the epileptic focus.

In general, early surgical intervention is warranted for recalcitrant seizures in children with poor response to medication in order to resolve the epileptic episodes and improve development. This is because there is a critical period during which the neonatal brain triples in size before the age of two. Seizures are thought to adversely affect mechanisms in this critical period such as dendritic arborization, spine formation in dendrites, and synaptogenesis [13,14]. In patients with HFFV, some authors recommend surgery rather than medical intervention at an early age, even early infancy, due to the possible progression of these hemifacial spasms into status epilepticus [5]. This corresponds to studies involving HFFV that demonstrate the recurrence of epileptic episodes despite medical therapy and verify that surgical intervention to remove the lesion provides complete resolution of the associated seizures. Even other lesions, aside from hamartomas, that are involved in cerebellar epilepsy are treated in a similar manner [15,16]. Therefore, in a patient with classic recurrent hemifacial spasms and associated symptoms, it is important to establish the existence of a lesion of the floor of the fourth ventricle through MRI and ictal EEG, SPECT, and SISCOM to ensure the lesion is most likely responsible for the seizures. This can determine the likelihood that the epilepsy will not respond to medical therapy and should be treated with surgical intervention, regardless of age. This complex surgery does carry the risk of numerous complications but provides patients with the best chance of achieving a seizure free outcome.

4. Compliance with ethical standards

The authors have no conflicts of interest.

References

[1] O. Delalande, D. Rodriguez, C. Chiron, M. Fohlen, Successful surgical relief of seizures associated with hamartoma of the floor of the fourth ventricle in children: report of two cases, Neurosurgery 49 (3) (2001) 726–730.
[2] A.S. Harvey, P. Jayakar, M. Duchowny, T. Resnick, A. Prats, N. Altman, J.B. Renfroe, Hemifacial seizures and cerebellar ganglioglioma: an epilepsy syndrome of infancy with seizures of cerebellar origin, Ann. Neurol. 40 (1) (1996) 91–98.
[3] D.G. McLone, P.E. Stieg, R.M. Scott, F. Barnett, P.D. Barnes, R. Folkerth, Cerebellar epilepsy, Neurosurgery 42 (5) (1998) 1106–1111.
[4] A.H. Mesiwala, J.D. Kuratani, A.M. Avellino, T.S. Roberts, M.A. Sotero, R.G. Ellenbogen, Focal motor seizures with secondary generalization arising in the cerebellum. Case report and review of the literature, J. Neurosurg. 97 (1) (2002) 190–196.
[5] Y.S. Park, M.C. Oh, H.D. Kim, D.S. Kim, Early surgery of hamartoma of the floor of the fourth ventricle: a case report, Brain Dev. 31 (5) (2009) 347–351.
[6] O.M. Pontes-Neto, L. Wichert-Ana, V.C. Terra-Bustamante, T.R. Velasco, G.O. Bustamante, R.M. Fernandes, P.M. Azevedo-Marques, L.F. Oliveira, A.C. Santos, M. Kato, L.M. Inuzuka, H.R. Machado, A.C. Sakamoto, Pontine activation during focal status epilepticus secondary to hamartoma of the floor of the fourth ventricle, Epilepsy Res. 68 (3) (2006) 265–267.
[7] P.B. Jayakar, S.S. Seshia, Involuntary movements with cerebellar tumor, Can. J. Neurol. Sci. 14 (3) (1987) 306–308.
[8] D.C. Bills, A. Hanieh, Hemifacial spasm in an infant due to fourth ventricular ganglioglioma. Case report, J. Neurosurg. 75 (1) (1991) 134–137.
[9] U. Flüeler, D. Taylor, S. Hing, B. Kendall, J.P. Finn, E. Brett, Hemifacial spasm in infancy, Arch. Opthalmol. 108 (6) (1990) 812–815.
[10] N. Milani, V. Scaioli, S. Giombini, M. Grisoli, L. Angelini, Hemifacial spasm in a child, Childs Nerv. Syst. 7 (8) (1991) 466–468.
[11] S.A. al-Shahwan, B. Singh, A.R. Riela, E.S. Roach, Hemisomatic spasms in children, Neurology 44 (7) (1994) 1332–1333.
[12] J.W. Langston, B.R. Tharp, Infantile hemifacial spasm, Arch. Neurol. 33 (4) (1976) 302–303.
[13] O.C. Snead III, Surgical treatment of medically refractory epilepsy in childhood, Brain Dev. 23 (4) (2001) 199–207.
[14] E. Vasconcellos, E. Wyllie, S. Sullivan, L. Stanford, J. Bulacio, P. Kotagal, W. Bingaman, Mental retardation in pediatric candidates for epilepsy surgery: the role of early seizure onset, Epilepsia 42 (2) (2001) 268–274.
[15] J.H. Chae, S.K. Kim, K.C. Wang, K.J. Kim, Y.S. Hwang, B.K. Cho, Hemifacial seizure of cerebellar ganglioglioma origin: seizure control by tumor resection, Epilepsia 42 (9) (2001) 1204–1207.
[16] M.S. Duchowny, T.J. Resnick, L. Alvarez, Dysplastic gangliocytoma and intractable partial seizures in childhood, Neurology 39 (4) (1989) 602–604.