CASE REPORT

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Staging surgery for intraventricular bilateral giant Rosai–Dorfman disease in children

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ABSTRACT

Introduction: Rosai–Dorfman disease (RDD) is an uncommon, benign, and idiopathic histiocytic proliferative disorder. Multiple intracranial RDD is extremely rare and treatment varies.

Case presentation: A 9-year-old girl was admitted with 3-month history of blurred vision and facial paralysis, a 2-month history of recurrent giggle, and cognitive impairment. Computed tomography and magnetic resonance imaging scans revealed bilateral ventricular masses based on the dural membrane and the diameters of the masses were 9.1 cm and 9.2 cm, respectively. The lesions were completely removed with staging surgeries. Fifteen months after operation, blurred vision was still present but facial paralysis and giggle and cognitive impairment disappeared. Imaging examinations suggested that there were no new or recurring lesions.

Conclusion: For multiple large intracranial masses, surgical treatment is necessary and staged surgery benefits perioperative safety. Active follow-up with magnetic resonance imaging is necessary.

KEYWORDS

Intraventricular, Pediatric, Rosai–Dorfman disease, Sinus histiocytosis, Staging surgery

INTRODUCTION

Rosai–Dorfman disease (RDD), also known as sinus histiocytosis, is a rare, idiopathic, histiocytic proliferative disease, predominant in young adults.[1–3] It is characterized by massive bilateral but painless cervical lymphadenopathy, with concomitant clinical manifestations and laboratory findings like fever, neutrophilia, elevated erythrocyte sedimentation rate, and polyclonal hypergammaglobulinemia.[3–5] About 25%–40% of patients have extranodal involvement, and those with intracranial lesions constitute approximately 5% of all RDD cases.[1–4,6] Most of these cases are associated with the endocranium or skull base and the condition is usually misdiagnosed as meningioma.[1–4,6–8] Treatment includes surgery, radiotherapy, and chemotherapy, but the treatment is not

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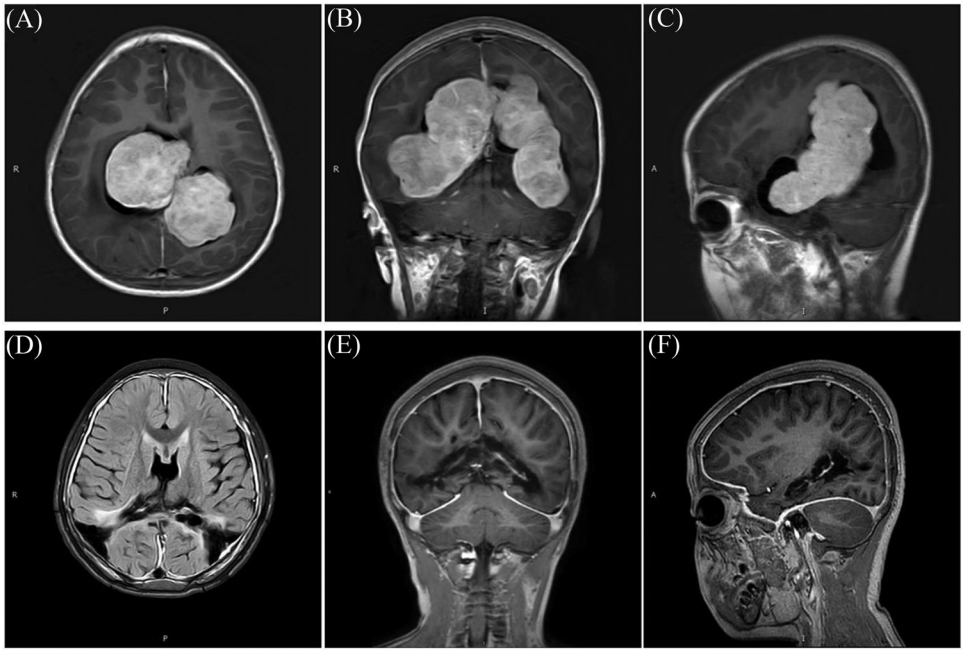

FIGURE 1 (A–C) Preoperative cross-sectional, coronal, and sagittal enhanced images of magnetic resonace imaging (MRI) scans of the patient with Rosai–Dorfman disease. Preoperative MRI scans revealed large, irregular, and well defined lesions in the posterior part of bilateral lateral ventricles, the triangle area, and the temporal horn, based on the dural membrane. The right and left lesions were about 9.2 cm and 9.1 cm in diameter respectively. The lesions were avid and unevenly enhanced on contrast administration. (D–F) Cross-sectional, coronal and sagittal enhanced images of MRI 15 months after the second operation. An MRI scan revealed intraventricular and surrounding tissues postoperative changes. Bilateral ventricles were smaller.

standardized.[1,2,4,9,10] We report the case of a 9-year-old girl with giant bilateral intraventricular RDD lesions and a favorable prognosis obtained, with staging operations.

CASE REPORT

Medical history

A 9-year-old girl was admitted to our hospital with 3-month history of blurred vision and facial paralysis (House–Brackmann grade II) on both sides, a 2-month history of recurrent giggle, and cognitive impairment. No lymphadenopathy was observed. Neurological examinations revealed no abnormalities.

Preoperative computed tomography (CT) and magnetic resonance imaging (MRI) scans revealed large, irregular, and well defined lesions in the posterior part of bilateral lateral ventricles, the triangle area, and the temporal horn, based on the dural membrane. The lesions on the right and left were about 9.2 cm and 9.1 cm in diameter, respectively. The lesions exhibited heterogeneous density on CT scans, were isointense on T1-weighted MRI, were slightly hypointense on T2-weighted MRI, and were avid and unevenly enhanced on contrast medium administration. There were high-density flakes in the lesion in the CT scan, which were hypointense on T1- and hyperintense on T2-weighted images and fluid-attenuated inversion recovery images (Figure 1A–C). No evidence of any calcification was noted.

Laboratory examinations revealed slightly increased fibrinogen, C-reactive protein, D-dimer on quantitative detections, and prolonged activation of partial thromboplastin. The results of erythrocyte sedimentation rate, hemoglobin, neutrophil count, red blood-cell count, thyroxine, prolactin, cortisol levels, and further routine hematological and biochemical tests were normal.

Surgical treatment and follow-up results

The clinical diagnosis was intraventricular RDD. The lesions were bilateral and huge, so we decided to resect in stages. The right one was larger and was first resected to relieve the symptoms. Through parieto-occipital sulcus approach, under ultrasound guidance, yellow-white, solid, leather-like, hypervascular nodules (Figure 2A) with clear boundaries, tight adhesion, and overall size of 9 cm × 6 cm × 5 cm, in both ventricles, were completely removed. The interval between two operations was 3 months. The lesions were completely removed, as confirmed by postoperative CT.

Histopathological examinations revealed emperipolesis, a lymphocytic engulfment by the proliferative histiocytes, and chronic inflammation with lymphocyte and plasma cell

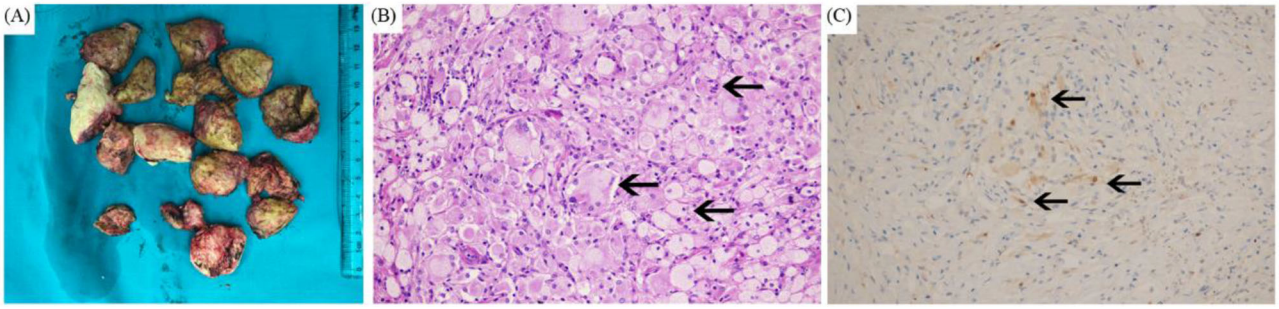

FIGURE 2 (A) Intraoperative views revealed yellow-white, solid, leather-like, hypervascular nodules removed in pieces. (B) Histopathologic examinations revealed emperipolesis, a lymphocytic engulfment by the proliferative histiocytes (black arrows) and fibrous stroma infiltrated with scattered lymphocytes and plasma cells (hematoxylin and eosin staining, ×200). (C) Immunohistochemical analysis revealed that the histiocytes were positive for S-100 protein (black arrows).

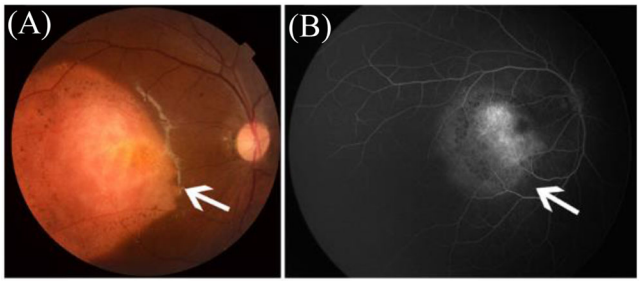

FIGURE 3 Fundus examination (A, white arrow) and fluoroscopy (B, white arrow) revealed round, orange-yellow uplifts of about 3 × 4 pupillary distance size and spotted pigmentation could be seen in the posterior poles of both eyes.

infiltration in hyperplastic fibrous stroma. Immunohistochemical analysis showed that the histiocytes were positive for cluster of differentiation 68 (CD68) and S100 proteins in a scattered or disordered manner and negative for CD1a, glial fibrillary acidic protein (GFAP) and IgG4 (Figure 2B–C). Finally, the lesions were diagnosed as intracranial RDD.

Six months later, the patient was admitted to the ophthalmology ward for poor vision. During fundus photography and fluorography, round, orange-yellow uplifts of about 3 × 4 pupillary distance size and spotted pigmentations could be seen in the posterior poles of both eyes (Figure 3). They were considered to be choroidal osteoma of fundus of both eyes. A regular follow-up was recommended.

Fifteen months after the second operation, blurred vision still existed while facial paralysis (H–B I degree), giggle, and cognitive impairment disappeared. MRI and contrast scans revealed that the bilateral ventricles were smaller, and no new or recurring lesions were found (Figure 1D–F).

DISCUSSION

Most cases of intracranial RDD present with isolated lesions.[1,2,4,8,11] Twenty-eight isolated cases of intracranial RDD with multiple lesions, and three systemic ones, have been reported. Among eight intraventricular cases (Table S1, in the supplementary material, including our case) in the literature, the lesions were all isolated, with five multiple ones and three single ones.[2,7,12–15]

Clinical manifestations of intracranial RDD are not specific and vary greatly in location, size, and number of lesions. Common sites of intracranial RDD consist of the cerebral convexity, the cranial base, the parasagittal and the suprasellar regions, the cavernous sinus, and the petroclival region, and most lesions are attached to the dura.[2,5,12] RDD can also be primary in the brain parenchyma, but this is very rare and it can be misdiagnosed as lymphoma or metastatic tumor.[16]

Imaging is significant in intracranial RDD diagnosis. The lesions in our case were well defined and dural based, exhibited heterogeneous density on CT scans, were isointense on T1-weighted MRI, were slightly hypointense on T2-weighted MRI, and were avid and unevenly enhanced on contrast medium administration.[1,2,4,10,12,17] To the best of our knowledge, our case was the first to describe an intracranial RDD case with an internal hemorrhage on CT scans. The large size of the lesions leads us to believe that the hemorrhage may be caused by a rupture of proliferating blood vessels.[3,5,10] Zhang et al.[18] also reported a case of RDD with necrosis and calcification on CT scans.[18] Hemorrhage, necrosis, and calcification on CT scans cannot help rule out the diagnosis of RDD.

Intraventricular tumors in children, meningioma, and choroid plexus papilloma are the first to be differentiated from RDD. Meningiomas are hypo-iso-hyperintense lesions on T2-weighted MRI with clear borders. They are hypervascular in angiography and show increased alanine peaks in the proton spectrum. Bone changes often accompany them, like bone hyperplasia, bone destruction, and calcification. RDD is generally an irregular solid mass with a low signal on T2-weighted MRI, hypovascular features, and no bone changes. Lipid and *N*-acetyl aspartate peaks

elevate owing to features of granulomatous inflammation, and choline peaks also raise. Choroid plexus papilloma is also a highly vascularized mass with a high signal on T2-weighted MRI. The mulberry-like imaging features can help distinguish it from RDD.[3,19]

Histopathological analysis is the gold standard to establish a diagnosis of intracranial RDD. Emperipolesis is a hallmark of RDD and may relate to immune response abnormalities. The phenomenon is not unique, however, and may also exist in leukemic processes. Emperipolesis can be observed in only 70% of RDD cases and even less in intracranial ones.[1–5,7,8,12,20] In immunohistochemical examination, RDD lesions show positive for S-100 protein, CD68, α1-antitrypsin, lysozymes, MAC-378 but negative for CD1a, GFAP and epithelial membrane antigen, displaying characteristics of antigen presenting cells and phagocytic histiocytes.[4,7,12,20] Yang et al.[7] revealed 15/high power field IgG4 positive lymphocytes in RDD lesions, which may explain why some RDD lesions respond to steroid therapy like IgG4-related disease.

In laboratory diagnoses, we found that the child had increased fibrinogen quantity and prolonged activation of partial thromboplastin, which had not been reported in other literature.[1,2,5] We therefore believe that laboratory tests may not be specific, and the abnormal coagulation function of our patient may be related to RDD itself involving the blood and lymphatic systems.

Surgery is the cornerstone for the management of multiple intracranial RDD with a favorable prognosis. The lesions in our case were bilateral and huge, so surgery was undertaken to relieve compression symptoms. Among 28 isolated multiple intracranial RDD lesions mentioned above, most of them were removed surgically in combination with chemotherapy and/or radiotherapy for residual lesions. Twenty-one patients were alive (20 patients with stable masses and 1 patient with enlarged mass), two patients died of RDD, one patient died of respiratory failure, and four patients were unknown. For the eight patients with intraventricular RDD, six received surgical treatment only, one received surgical treatment combined with chemoradiotherapy, and one received drainage and steroids. In the follow-up, five patients were in stable condition, one patient's mass enlarged, one patient died, and one patient did not provide a follow-up result.[2,7,12–15]

Staged surgery and appropriate surgical intervals help children to tolerate surgical treatment and obtain a good prognosis. The overall fluid volume in children is lower than that in adults. When the volume of blood loss is certain, children are at higher risk of hemorrhagic shock than adults. Excessive operation time may increase the risk from anesthesia. Consequently, we adopted the strategy of staged surgery and the second operation was performed 3 months later. The prognosis of the child was good. Ma et al.[21] reported 50 cases with pediatric intracranial tumors who underwent staged resection. All the tumors were totally removed without any serious outcome such as death, coma, or hemiplegia. They recommended 3–5 months interval between operations.[21] We also support that for staging operations of RDD, an interval of 3–5 months is appropriate.

Postoperative treatment is not uniform in adults or children. In this patient, staging surgery removed the tumors completely. Complete excision is ideal, because no recurrence after complete resection has been reported in intracranial RDD, while the recurrence rate with subtotal resection is about 14%.[3,8] The curative effects of postoperative radiotherapy, chemotherapy, or steroid for RDD vary individually and they all have certain side effects.[1–5,7,12,20,22–26] We therefore recommend active follow-up with MRI. Once the condition deteriorates, radiotherapy and chemotherapy may play a role.

In our case, the symptoms of blurred vision still existed 6 months after the second surgery, and the ophthalmology department suggested bilateral choroid osteoma. As far as we know, RDD with choroid osteoma has not been reported in other literature. Mehraein et al.[17] also reported four RDD patients with huge numbers of parvovirus B19–positive cells in their tissues, indicating a variety of inflammatory vasculitis. One of them had concomitant RDD and Takayasu arteritis.[17] We suspect that RDD may be related to other specific abnormal histiocytic proliferation diseases. More experiments are needed to confirm this.

In conclusion, multiple huge bilateral intraventricular masses of children need to be differentiated for RDD. Surgery is the first line of treatment and staged resection is helpful for perioperative safety. Operation time intervals ranging from 3 to 5 months are advisable and active follow-up with MRI is necessary.

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CONSENT FOR PUBLICATION

Written consent was provided by the patient and guardians.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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