Pediatric Radiology
https://doi.org/10.1007/s00247-018-4326-2

CASE REPORT

Magnetic resonance imaging of cerebellar cysts in a neonate with congenital cytomegalovirus infection

Miguel Quintas-Neves[1] · João Paulo Soares-Fernandes[1]

Received: 13 September 2018 / Revised: 3 November 2018 / Accepted: 9 December 2018

Abstract
Congenital cytomegalovirus infection is one of the most common congenital viral infections in the world. Brain magnetic resonance imaging plays a key role in evaluating brain involvement and establishing prognosis; several characteristic features have been described. We present a description of cerebellar cysts in a neonate with polymerase chain reaction-confirmed cytomegalovirus congenital infection, and discuss the differential diagnosis and potential pathophysiological mechanisms.

Keywords Cerebellum · Congenital cytomegalovirus infection · Cysts · Magnetic resonance imaging · Newborn

Introduction

Congenital cytomegalovirus infection is one of the most common congenital viral infections in the world; it is typically associated with virus transmission across the placenta to the fetus from women who became infected primarily during pregnancy [1]. Congenital cytomegalovirus infection occurs in 32–40% of such cases, and among these, 11–13% of patients become symptomatic [2]. The most common clinical signs among affected children are hepatosplenomegaly and petechiae, and more than half of the patients have permanent neurological conditions, such as intracranial calcifications, microcephaly, chorioretinits and seizures [3]. Sensorineural loss was also described in about one-fourth of the patients [3]. Magnetic resonance imaging (MRI) plays a key role in the early diagnosis of congenital cytomegalovirus infection, potentially prompting a confirmatory cytomegalovirus-deoxyribonucleic acid test and proper antiviral treatment. Imaging features of brain involvement in congenital cytomegalovirus infection have been described in the literature [4], including intracranial calcification, migrational abnormalities, white matter disease, periventricular cysts, cerebral and cerebellar hypoplasia and dysplasia, ventriculomegaly, cortical development malformations, ventricular adhesions and lenticulostriate vasculopathy. We describe a patient with polymerase chain reaction-confirmed congenital cytomegalovirus infection in whom cerebellar cysts were demonstrated on MRI.

Case report

The patient was a female newborn, born at 31 weeks and 4 days of gestation to a primigravid Caucasian mother; the parents were nonconsanguineous. At 23 weeks of gestational age, fetal ultrasound (US) showed an intrauterine growth restriction, ventriculomegaly, mild cardiomegaly, mild pericardial effusion and a marginal placenta previa. An amniocentesis showed normal karyotype. Fetal echocardiogram was normal. The infant was admitted to the neonatal intensive care unit immediately after birth due to very low weight (1,066 g). Her physical examination was otherwise unremarkable. Total parental nutrition was administered. She remained stable until day 12, when she developed convulsive episodes with desaturation. There was no fever, her neurological examination was unremarkable and muscle enzymes were normal. Electroencephalogram showed bilateral epileptiform activity in the frontocentral and temporal lobes. Phenobarbital was immediately started. Brain MRI (1.5 T) performed at day 27 showed bilateral frontoparietal and perisylvian polymicrogyria, predominantly on the left side (Fig. 1). There were also signs of white matter lesions in the anterior periventricular and peritrigonal regions, bilaterally (Fig. 1). Cerebellar hypoplasia and dysplasia were also seen (Fig. 2), associated with peripheral cysts on the left cerebellar

✉ Miguel Quintas-Neves
mlqneves@gmail.com

[1] Division of Neuroradiology, Hospital de Braga, Sete Fontes - S. Vítor, 4710-243 Braga, Portugal

Published online: 05 January 2019

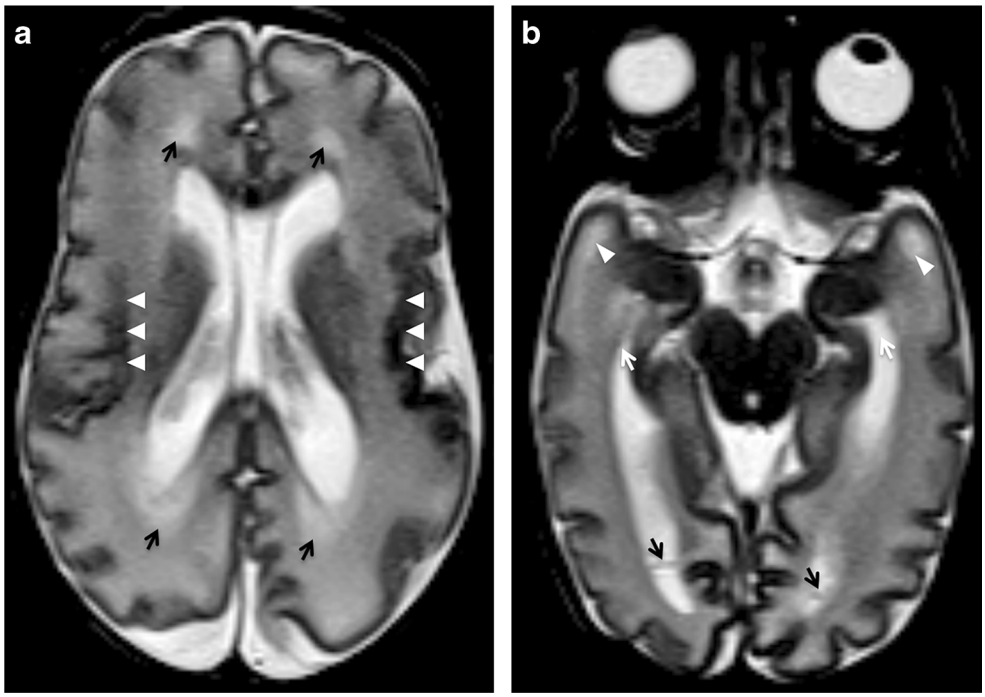

Fig. 1 Brain magnetic resonance imaging in a 27-day-old girl with congenital cytomegalovirus infection. **a** Axial T2-weighted image (repetition time [TR]/echo time [TE] 8,000/188 ms) demonstrates bilateral frontoparietal and perisylvian polymicrogyria, with left predominance (*arrowheads*), as well as white matter high signal intensity in the anterior periventricular and peritrigonal regions (*arrows*). **b** Axial T2-weighted image (TR/TE 8,000/188 ms) reveals bilateral septa on both occipital horns (*black arrows*) and ectasia of the anterior recesses of both temporal horns (*white arrows*). Anterior temporal white matter hyperintensity suggestive of vacuolation is also seen (*arrowheads*)

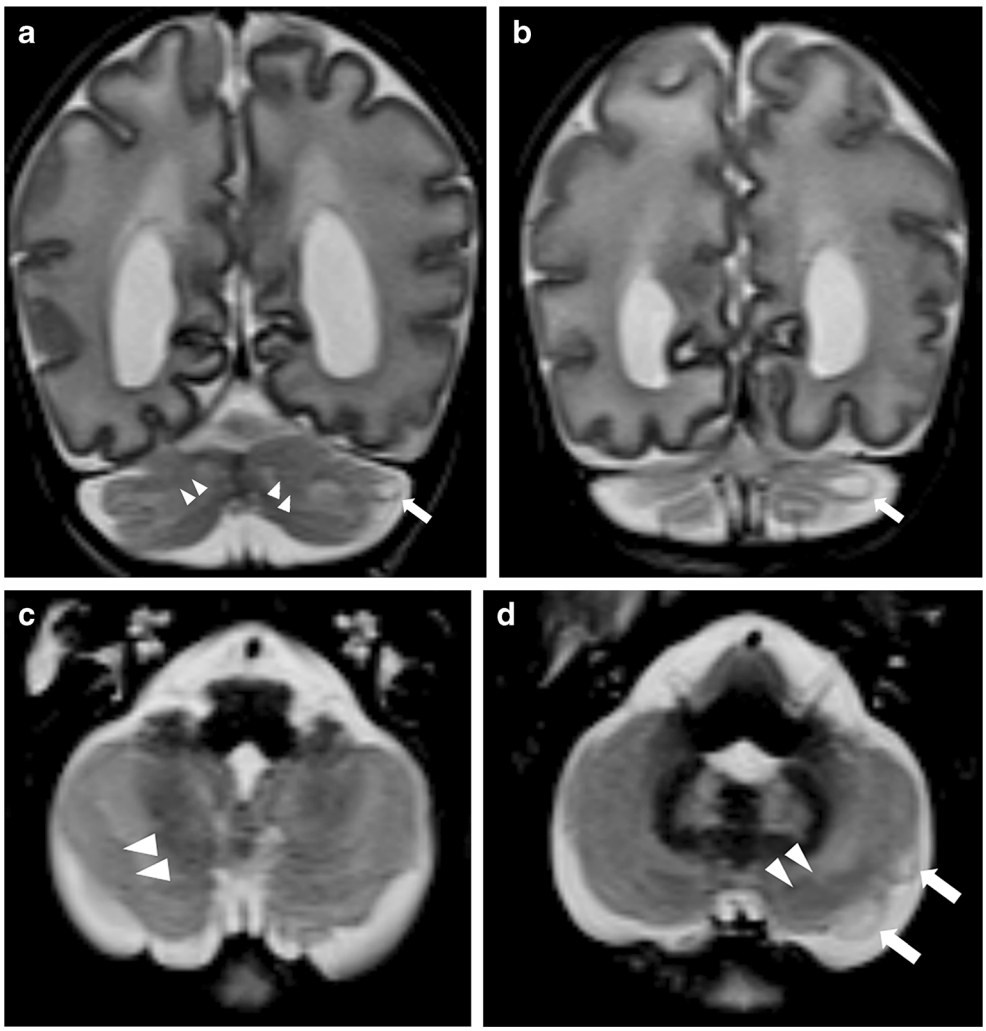

Fig. 2 Brain MRI in a 27-day-old girl with congenital cytomegalovirus infection. **a-d** T2-weighted image (TR/TE 8,000/188 ms) in the coronal (**a**, **b**) and axial (**c**, **d**) planes demonstrates mild cerebellar hypoplasia, abnormal orientation of the cerebellar folia with irregular thickened cerebellar cortex and irregular gray-white matter junction, suggesting bilateral cerebellar dysplasia **(***arrowheads***).** Peripheral juxtacortical cysts **(***arrows***)** are seen in the left cerebellar hemisphere, in the vicinity of the dyplastic tissue

hemisphere (Fig. 2). No signs of cerebellar hemorrhage were found. Bilateral septa on both occipital horns and ectasia of the anterior recesses of both temporal horns were demonstrated (Fig. 1). These findings suggested brain involvement by cytomegalovirus congenital infection. Cytomegalovirus-deoxyribonucleic acid was detected in a urine test. Ophthalmological examination excluded chorioretinitis. Anti-cytomegalovirus immunoglobulins G and M antibodies were identified in the serum and the viral load was 703 copies/ml. Valganciclovir was initiated and the patient has been hemodynamically and neurologically stable during the first 2 weeks of treatment.

Discussion

In this newborn, brain MRI showed several characteristic features of congenital cytomegalovirus infection, such as cerebral polymicrogyria and periventricular white matter disease with anterior temporal lobe vacuolization, likely a precursor of cyst formation. Ventriculomegaly may be a manifestation of mild cerebral atrophy; when associated with migrational abnormalities (such as polymicrogyria) and cerebellar hypoplasia, it is typically caused by late second trimester (18–24 weeks) infection [4]. In our patient, the absence of more severe cerebral atrophy is explained by the fact that neurogenesis occurs between 8 and 20 weeks of gestation [5], presumably before infection onset.

Cerebellar hypoplasia and dysplasia are also known imaging milestones of congenital cytomegalovirus infection, but, to our knowledge, the coexistence of cerebellar cysts has not been described. Cerebellar cysts may represent normal structures (e.g., Virchow-Robin spaces), be destructive (such as in some types of pontocerebellar hypoplasias), malformative (like in some forms of congenital muscular dystrophies and GPR56-related migration disorders) or disruptive (such as in some cerebellar dysplasias) [6]. In an encephalopathic newborn with cerebellar cysts, the main imaging differential diagnosis is congenital muscular dystrophies [5, 7], namely "pure" congenital muscular dystrophy, Fukuyama congenital muscular dystrophy, muscle-eye-brain disease and Walker-Warburg syndrome. This is a heterogeneous group of disorders characterized by hypotonia, muscle weakness and contractures, muscular dystrophic changes on muscle biopsy, and with the exception of "pure" congenital muscular dystrophy, ocular anomalies [5]. On brain MRI, "pure" congenital muscular dystrophies are typically associated with central cerebral hypomyelination with pontine and cerebellar vermis hypoplasia. The presence of cerebellar polymicrogyria (with or without cysts) typically directs differential diagnosis toward Fukuyama congenital muscular dystrophy, muscle-eye-brain disease or Walker-Warburg syndrome [5]. In the described patient, however, the supratentorial imaging findings were not suggestive of congenital muscular dystrophies, the karyotype was normal, there was no hypotonia and muscle enzymes were normal. Moreover, cytomegalovirus-deoxyribonucleic acid detection in urine confirmed the congenital cytomegalovirus infection diagnosis, and there was also a significant serum viral load. Cerebellar cysts in association with cerebellar dysplasia (as seen in our patient) may be formed from subarachnoid spaces that were engulfed by the abnormal cerebellar folia, particularly in the transition between normal and abnormal cortices [6, 8]. Alternatively, they could result from direct damage to the cerebellar germinal matrix – granulosa cells – by cytomegalovirus. This would mimic the mechanism of selective nonhemorrhagic germinolysis, previously established for supratentorial subependymal cysts.

In conclusion, we present a description of neonatal MRI detection of cerebellar cysts in a neonate with congenital cytomegalovirus infection. In a proper clinical and laboratorial setting, this finding may provide early and easily identifiable additional evidence for congenital cytomegalovirus-induced cerebellar injury.

Compliance with ethical standards

Conflicts of interest None

References

1. Fink KR, Thapa MM, Ishak GE, Pruthi S (2010) Neuroimaging of pediatric central nervous system cytomegalovirus infection. Radiographics 30:1779–1796
2. Kenneson A, Cannon MJ (2007) Review and meta-analysis of the epidemiology of congenital cytomegalovirus (CMV) infection. Rev Med Virol 17:253–276
3. Dobbins JG, Stewart JA, Demmler GJ (1992) Surveillance of congenital cytomegalovirus disease, 1990-1991. Collaborating Registry Group. MMWR CDC Surveill Summ 41:35–39
4. Barkovich AJ, Lindan CE (1994) Congenital cytomegalovirus infection of the brain: imaging analysis and embryologic considerations. AJNR Am J Neuroradiol 15:703–715
5. Barkovich AJ (1998) Neuroimaging manifestations and classification of congenital muscular dystrophies. AJNR Am J Neuroradiol 19:1389–1396
6. Boltshauser E, Scheer I, Huisman TA, Poretti A (2015) Cerebellar cysts in children: a pattern recognition approach. Cerebellum 14: 308–316
7. Patel S, Barkovich AJ (2002) Analysis and classification of cerebellar malformations. AJNR Am J Neuroradiol 23:1074–1087
8. Aida N, Yagishita A, Takada K, Katsumata Y (1994) Cerebellar MR in Fukuyama congenital muscular dystrophy: polymicrogyria with cystic lesions. AJNR Am J Neuroradiol 15:1755–1759