

# Not a Dandy Walker Malformation but Congenital Cytomegalovirus Infection

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## Abstract

We report a male neonate who was prenatally diagnosed as having Dandy Walker malformation. Post natal cranial computerised tomography showed periventricular calcifications and ventriculomegaly. Cranial magnetic resonance imaging demonstrated findings that could be interpreted as a Dandy Walker malformation. Aetiologic investigations revealed a positive viral culture and a polymerase chain reaction for cytomegalovirus DNA indicating a congenital cytomegalovirus infection.

## Key words

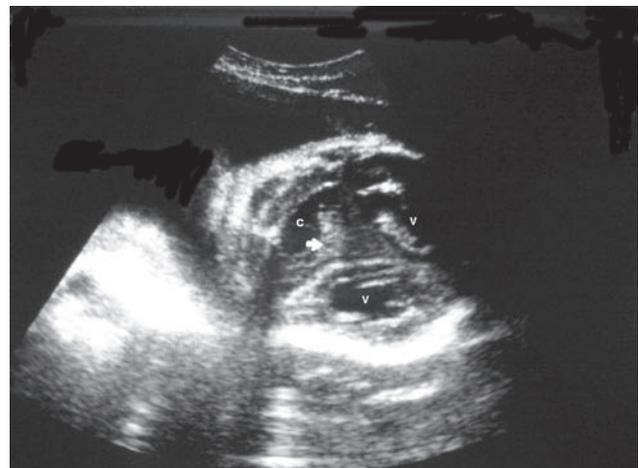
Cytomegalovirus infection; Dandy Walker malformation; Neonate; Periventricular calcifications

## Introduction

Congenital cytomegalovirus (CMV) is the most common cause of congenital infection in the United States. This occurs in approximately 1% of all live births. While 85% to 90% will have asymptomatic or "silent" congenital infection, 10% of infected infants have symptoms at birth.<sup>1</sup> CMV can severely damage the central nervous system (CNS) and cause microcephaly. Neuroradiographic studies in congenitally infected infants often demonstrate periventricular calcifications. These calcifications have been considered a hallmark of congenital CMV infection.<sup>2,3</sup> However, a variety of structural CNS lesions have also been described. Our case illustrates that congenital CMV infection may mimic developmental malformations of the CNS.

## Case Report

A 20-year-old African American female G4 P1 was seen for abnormal fetal ultrasound at 28 weeks of gestation. Bilateral enlargement of the lateral ventricles and cisterna magna were noted on an obstetric ultrasound at 32 weeks of gestation, a Dandy Walker malformation was suspected (Figure 1). The biparietal diameter (BPD) was 68 mm (25th percentile) and head circumference (HC) was 253 mm (15th percentile). Serial fetal ultrasounds at 32 weeks



**Figure 1** Prenatal sonogram, transverse cerebellar view, at 32 weeks of gestation showing posterior fossa cyst (c) displacing cerebellum (arrow) and enlarged lateral ventricles (v).

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[HC 292 mm (20th percentile) and 36 weeks [HC 298 mm (<3rd percentile)] gestation showed lagging of the head growth. There was no progression of the ventriculomegaly. On a fetal ultrasound at 39 weeks of gestation, the BPD was 85 mm (<10th percentile) and the HC 305 mm (<10th percentile). The mother refused a genetic work-up. Her CMV IgM antibody was negative at 32 weeks of gestation.

She delivered a male infant at 40 weeks of gestation by vaginal delivery. The birth weight was 3015 gm (50th percentile), the length was 50 cm (50th percentile), and head circumference was 30 cm (<10th percentile). There were no other associated anomalies noted. Cranial computerised tomography (CT) showed periventricular calcifications and enlarged lateral ventricles with a cystic posterior fossa (Figure 2). A cranial magnetic resonance imaging demonstrated posterior fossa cyst and hypoplasia of the cerebellum and brainstem (Figure 3). CMV was detected in the urine samples by polymerase chain reaction (PCR). CMV was isolated from the urine on culture as well. At one week of age, the baby developed respiratory distress, a chest X-ray showed bilateral pulmonary infiltration; blood cultures for bacteria were negative. A 6-week-course of Gancyclovir (10 mg/kg/day) was begun at 2 weeks of age. He required oxygen therapy for pulmonary insufficiency during and after 5 weeks hospitalisation, he passed hearing screen (ALGO®3, Natus Medical Inc.) prior to hospital discharge. At 3 months of age his weight was 5050 grams (50th percentile), length 60 cm (50th percentile), head circumference 35 cm (<3rd percentile). The head growth was lagging, the fontanelles and sutures were prematurely closed. There was no seizure activity noted at 3-month follow-up.

## Discussion

Cytomegalovirus, the most common cause of congenital infection in the United States, affects approximately 1% of all live births, or between 30,000 and 40,000 newborns annually; 85% to 90% will have asymptomatic or "silent" congenital infection, and 10% to 15% will be symptomatic at birth.<sup>1</sup> Neuroimaging studies of patients with symptomatic congenital cytomegalovirus infection have revealed multiple cranial abnormalities such as



**Figure 2** Head CT scan at 1 day of age shows posterior fossa cyst, enlarged lateral ventricles. There are calcifications in the brainstem (open arrow), periventricular calcifications and calcification in the third ventricle (solid arrow). The prominent subarachnoid spaces indicate brain atrophy.



**Figure 3** Cranial MRI at 2 days of age shows posterior fossa cyst, cerebellar and brainstem hypoplasia.

lissencephaly, pachygyria, polymicrogyria, paraventricular cysts, cortical atrophy, ventricular dilatation, subdural effusions and haemorrhage, migration abnormalities, white-matter abnormalities, and intracranial calcifications.<sup>2,4-9</sup> Intracranial calcification is the most common abnormality seen on neuroradiologic imaging of infants with congenital CMV infection. The calcifications are distributed in a linear, periventricular pattern ranging from tiny, punctuate lesions to large deposits of calcium that appear to line the entire ventricular system.<sup>2,3</sup> The frequency of the various CT abnormalities in symptomatic newborn with CMV infection was 70%. The intracerebral calcifications were the most frequent findings and were seen in 77% of those with an abnormal CT scan.<sup>2</sup> Cortical atrophy and ventricular dilatation were seen in 10% of the study subjects. Frequency of other intracranial abnormalities are ventriculomegaly (10-37%), white matter abnormalities (0-22%), neuronal migration abnormalities (0-10%) and an extensive destructive encephalopathy (5-13%). Although direct viral infection of neural structures plays a major role in the pathogenesis of these central nervous system (CNS) abnormalities; infectious vasculitis also occurs, as suggested by case reports with porencephaly. In addition, defects in neuronal migration, polymicrogyria and cerebellar hypoplasia, indicate a teratogenic effect of CMV on the fetal brain development.<sup>3</sup> Because congenital CMV infections can be associated with marked thrombocytopaenia, intracranial haemorrhage could also contribute to CMV-related CNS injury.

During pregnancy, CMV infections, both primary and reactivated, are well known causes of neurologic impairments in children. Depending on when the infection occurs during gestation, the sequelae may differ. In the case of primary infection before the 27th week, children more often have signs at birth, and severe sequelae are more often evident.<sup>1,10,11</sup> The child may exhibit neuronal migration disturbances, such as gyral abnormalities or destruction of the brain,<sup>4,6</sup> and disabilities, such as mental retardation, cerebral palsy, and epilepsy, as well as deafness and visual disturbances. It is generally presumed by many health-care professionals that symptomatic congenital CMV infection carries a universally grave prognosis for developmental outcome. However, in one study, 59% of children born with symptomatic CMV infection had a normal IQ, and

preliminary results from a US corroborative study showed 54% of children attaining an IQ of >70 and 29% attaining an IQ of >90.<sup>1</sup> In one prospective study, 1-2% of Swedish women had primary CMV infections during pregnancy, and nearly 50% of their offspring were infected.<sup>8</sup>

A diagnosis of congenital CMV infections include standard serologic tests, such as detection of cytomegalovirus IgG and IgM antibodies, polymerase chain reaction analysis of CMV DNA, or viral culture. Prenatal diagnosis may be made by viral culture or DNA detection of the virus in amniotic fluid or by CMV IgM antibody determination of fetal blood of a symptomatic fetus. False-positive and false-negative serologic results occur, and confirmatory viral culture must be performed.

In our patient there were ventriculomegaly and a severely destructive change of the cerebellum resulting in a large cyst of the posterior fossa; Dandy Walker malformation was suspected in the fetus. Intracranial calcifications were missed during prenatal ultrasound because of low sensitivity of the ultrasound in detecting the calcifications,<sup>12</sup> otherwise congenital CMV infection would have been suspected. The pathogenesis of the CNS abnormalities in our case could be the results of encephalitis, infectious vasculitis, and/or teratogenic effect caused by the CMV infection. Our case illustrated a unique neuroimaging finding of congenital CMV infection.

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