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Mild Cerebral Ventriculomegaly in Fetuses: Characteristics and Outcome

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Key Words
Fetal ventriculomegaly · Cerebral lateral ventricle · Hydrocephalus

Abstract
Background: A fetal ultrasonographic (US) finding of mild ventriculomegaly (MVM) is not uncommon, but its prognostic significance is not clearly defined. ***Objective:*** To evaluate the clinical and US characteristics and outcome of fetuses with mild dilatation of the cerebral lateral ventricles. ***Patients and Methods:*** We reviewed the medical records of 34 consecutive fetuses with US evidence of MVM (atrial width of the lateral ventricles = 10–15 mm) at 18–35 weeks of gestation. ***Results:*** Of the 34 fetuses with MVM, 7 underwent karyotype examination and were normal. In 4 of the 34 fetuses the pregnancy was terminated (at autopsy: 1 was normal, 2 had hydrocephalus and for 1 the parents refused autopsy). Eight fetuses that were delivered had congenital malformations; 3 of them died during the early neonatal period. In 6 of the 8 fetuses with malformations, karyotypes were available and 3 had chromosomal aberrations (trisomy 18, 45XO, and triploidy 69XXX). Spontaneous in utero resolution of the MVM occurred in 10/30 (33.3%) of the cases. Of the 26 infants that remained in follow-up, 16 (61.1%) were normal at 1 month and at 2 years of age. ***Conclusions:*** Our data confirm those of previous reports as to the characteristics and outcome of MVM. In the setting of mild fetal ventriculomegaly with a normal karyotype and an absence of malformations, the outcome appears to be favorable.

Introduction

Many investigators have addressed the issue of the ultrasonographic (US) evaluation of the size of the lateral ventricles in the fetus, including the detection of mild ventricular dilatation and hydrocephalus [1–3]. We showed in a previous report that the atrial width (AW) of the lateral ventricles in normal fetuses remains fairly constant throughout gestation, with a mean diameter of 0.69 ± 0.13 cm [3]. AW values exceeding 10 mm (greater than 4 standard deviations above the mean) were suggested as being an evidence of ventriculomegaly (MVM; AW = 10–15 mm, and severe MVM; AW >15 mm) [2–4]. This definition of MVM (AW = 10–15 mm) was further supported by recently reported MRI measurements of the cerebral lateral ventricles in fetuses [5].

Characteristics, natural history and outcome of MVM in the fetus have previously been investigated and the topic has been recently summarized by Kelly et al. [4]. The objective of the present study was to evaluate the clinical and US characteristics and the outcome of fetuses with MVM, and to compare our data with those of previous reports in the literature.

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Table 1. Demographic, clinical and US characteristics of the 34 fetuses studied

Variable		Details (n)
Maternal age, years, mean ± SD	28.5 ± 5	
Range	17 – 37	
Gestational age at examination, weeks		
Mean ± SD	25.1 ± 4.6	
Range	18 – 35	
Termination of pregnancy	4/34 (11.8%)	hydrocephalus at autopsy (2) declined autopsy (1) normal autopsy (1)
Mortality	3/30 (10%)	neonatal deaths (3): pulmonary atresia, atrioventricular septal defect, oesophageal atresia
Associated anomalies[1]	12/34 (35.3%)	pulmonary atresia (1) coarctation of aorta (1) hydrocephalus (2) choroid plexus cyst (2) cleft lip and palate (1) ventricular septal defect (1) oesophageal atresia (1) complete atrioventricular septal defect (1) omphalocele (1) bilateral hydronephrosis (1) chromosomal aberrations with associated anomalies (3)
Abnormal karyotype	3/13 (23%)	47XY+18, 45XO, 69XXX
Spontaneous resolution of fetal ventriculomegaly	10/30 (33.3%)	
Seizure disorder	2/26 (7.7%)	
Normal development at 2 years of age	16/26 (61.6%)	

[1] Some fetuses had more than 1 malformation.

Patients and Methods

We reviewed the Yale Perinatal Unit hospital records of 34 consecutive fetuses with MVM during a 2.5-year period. We collected data regarding US findings, chromosomal studies, associated anomalies, autopsy findings and outcome. MVM was defined as an AW of the lateral ventricles of 10–15 mm, as measured on the screen of the US machine with the electronic calipers [5, 6].

In each case, routine biometric measurements and fetal anatomical survey were also obtained. Each patient had serial sonographic evaluations until delivery. The ultrasound equipment used during the study period included Ultramark 9 (Advanced Technology Laboratories, Bothell, Wash., USA) and Acuson XP (Acuson, Mountain View, Calif., USA) machines with 5- or 3.5-MHz transducers.

Results

US diagnosis of MVM was made in 34 consecutive fetuses at 18–35 weeks of gestation (table 1). The indications for the US examinations were as follows: suspected hydrocephalus (n = 16); fetal anatomical survey (n = 8); routine follow-up examination per mother's request (n = 5); presence of choroid plexus cyst (n = 2); abnormal triple test (n = 1); elevated maternal α-fetoprotein (n = 1), and premature rupture of membranes (n = 1).

Seven of the thirty-four fetuses with MVM underwent chromosomal studies that showed normal karyotypes. In 4 of the 34 fetuses the pregnancy was terminated (at autopsy: 1 was normal, 2 had hydrocephalus and in 1 the

parents refused autopsy). Eight fetuses were delivered and had congenital malformations; 3 of them died during the early neonatal period. Karyotypes were available for 6 of these 8 malformed fetuses and chromosomal aberrations were found in 3 (trisomy 18, 45XO, triploidy 69XXX). Associated malformations included: cardiac malformations (n = 4), esophageal atresia (n = 1), cleft lip and palate (n = 1), omphalocele (n = 1), and bilateral hydronephrosis (n = 1). Two additional neonates developed seizure disorder. Spontaneous in-utero resolution of the MVM occurred in 10/30 (33.3%) of the cases (table 1).

Of the 30 fetuses with MVM who were born, 27 survived beyond 7 days of age. Of these 27, 1 was lost to follow-up; 16 of the remaining 26 infants (61.6%) were normal at 1 month and 2 years of age according to clinical follow-up examination by a pediatrician (table 1). Detailed developmental assessments were not performed.

Discussion

MVM is one of the most common fetal abnormalities detected by US [4]. Its incidence varies from 1.48 to 22 per 1,000 births in low- and high-risk fetuses, respectively [4, 6]. Due to the increasing thickness of the cortex throughout gestation, the relative size of the lateral ventricles decreases from 70% at 18 weeks to 30% at 28 weeks of gestation and remains constant thereafter [3, 7]. Although it appears that MVM does not increase pressure on the developing cortex, this issue is yet to be settled.

A picture of hydrocephalus may result from obstruction of cerebrospinal fluid flow in the central nervous system [8], cerebral atrophy or fetal brain damage, or developmental anomalies such as agenesis of the corpus callosum [9]. However, the etiology of MVM often remains unknown. It is probably multifactorial and frequently associated with CNS anomalies, chromosomal aberrations, fetal infections or intracerebral hemorrhage. In our study, 30.3% (10/33) of MVM cases were associated with other structural anomalies, as compared to a reported incidence of 43% [8–11].

Chromosomal aberrations were reportedly observed in 9% of MVM cases [8, 10–14], as compared to 23% (3/13) with abnormal karyotype among the 13 cases examined in our series. This higher incidence in our series might be attributed to the fact that only 13 of our 34 cases had their karyotype tested, and that our study comprised a relatively high-risk population.

CNS anomalies accompany MVM in up to 50% of cases [8–15]. These include spina bifida, Dandy-Walker malformation and agenesis of corpus callosum [4]. In our series, 4/33 (12%) cases with MVM also had CNS anomalies (2 had hydrocephalus and 2 had choroid plexus cyst).

In our series, US follow-up showed complete sonographic resolution of MVM in 10/30 cases (33.3%). This is in accordance with a reported resolution rate of 29%. In previous reports, MVM remained sonographically stable in 57% of cases, while it progressed in 14% of cases [8–10, 12–16]. The observed regression of ventriculomegaly could be explained by partial or transitory delay in the drainage or temporary overproduction of the spinal fluid.

The reports on developmental outcome of children who displayed MVM in fetal life are unsatisfactory, mainly due to the inadequate standard of developmental assessment in previous studies [4], in which an observed incidence of developmental delay of 0–36% was observed [8, 9, 11–15]. Reports on long-term cognitive follow-up at school age are lacking and this issue should be investigated in order to determine the true natural history of MVM. In our study, we found that 16 of 26 infants (61.6%) had normal physical growth and neurological status at 2 years of age. Two infants developed a convulsive disorder that resolved. Although 2 additional fetuses could have been considered to have relatively good outcomes (the 1 terminated fetus with normal autopsy, and the other with no abnormalities except vesicoureteral reflux), we chose not to include them in the population of fetuses with isolated MVM and normal outcome. There were no deaths among fetuses whose sole abnormality was MVM.

According to our data, every instance of sonographically detected fetal MVM constitutes an indication to perform a comprehensive anatomical survey of the fetus, a fetal echocardiogram and a karyotype. Our observations add to the published reports as to the US characteristics of MVM, the rate of associated anomalies, and US follow-up and outcome. For most of these variables, our results conform to those of previous reports, as summarized by Kelly et al. [4].

From our findings and from published data, we conclude that in the absence of associated malformations and chromosomal aberrations, an isolated MVM holds a favorable short-term neurodevelopmental outcome.

This conclusion may provide a basis for parental counselling when confronted with a case of fetal MVM.

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