Schizencephaly in a Dysgenetic Fetal Brain

Prenatal Sonographic, Magnetic Resonance Imaging, and Postmortem Correlation

William M. Huang, MD, Ana Monteagudo, MD, RDMS, Genevieve L. Bennett, MD, Mary E. Fowkes, MD, Ilan E. Timor-Tritsch, MD, RDMS

We report a case of schizencephaly in a dysgenetic fetal brain diagnosed antenatally by the combined use of 2-dimensional (2D) and 3-dimensional (3D) sonography and magnetic resonance imaging (MRI) and then confirmed by postmortem pathologic examination. Schizencephaly is a rare disorder, resulting in mild to devastating effects on fetal neurodevelopment. The term describes a full-thickness cortical defect from the lateral ventricle to the subarachnoid space lined with pia-ependyma. Schizencephaly can be described as unilateral or bilateral and as closed or open (Figure 1). Unilateral closed cases are occasionally found incidentally on adult head imaging with little or no symptoms, whereas open bilateral cases are generally associated with seizures and very limited cerebral function. Its etiology is uncertain but may be an early destructive event before completion of neuronal migration at 16 to 20 weeks or a primary neuronal migrational disorder, sometimes associated with a mutation of the EMX2 (empty spiracles homolog 2) gene.

Case Description

A 28-year-old woman, gravida 2, para 0010, was referred at 36 weeks for a fetal intracranial cyst and macrocephaly. Second-trimester quad screen and office anatomy scan results were reported as normal. Subsequent abdominal sonography confirmed the macrocephaly (biparietal diameter, 122 mm; head circumference, 432 mm). A supratentorial, fluid-filled lesion and a disorganized, centrally located brain tissue mass were seen but could not be well characterized because of the cephalic presentation. A transvaginal neurologic scan revealed a shortened falx cerebri with a normal posterior fossa and cerebellum. Two-dimensional and 3D sonography revealed large bilat-
eral clefts (Figure 2). Pachygyria and a disorganized midline brain structure were noted (Figure 3). On 2D and 3D power Doppler sonography, the intracranial vessels appeared disorganized, and normal major arteries could not be identified (Figure 4).

Fetal MRI confirmed the anatomic abnormalities seen on sonography. In addition, gray matter heterotopia and gray matter lining the clefts could be seen (Figure 5). We used Voluson 730 Expert system Virtual Organ Computer-Aided Analysis software (GE Healthcare, Milwaukee, WI) to reconstruct the 3D sonographic brain volume. The obtained shape (Figure 6) was consistent with the MRI findings and the later pathologic specimen (Figure 7). Results of TORCH (toxoplasmosis, other infections, rubella, cytomegalovirus, and herpes simplex) titers were negative for acute infection.

Bilateral open schizencephaly was suspected, and the patient and husband were counseled about the high probability of spastic quadriplegia, profound mental retardation, and seizures.5 In addition, because of the macrocephaly, cephalopelvic disproportion was expected, and a cesarean delivery would be necessary. Cephalocentesis, with 90% fetal mortality,6 was offered to allow vaginal delivery. Despite draining of 120 mL of fluid by cephalocentesis, the patient underwent a cesarean delivery for arrest of dilatation. A macrocephalic 4360-g male neonate without other apparent abnormalities was delivered with Apgar scores of 2, 2, and 2 at 1, 5, and 10 minutes, respectively. No resuscitation was performed, as per parental wishes. The neonate died at 15 minutes.

Figure 1. Unilateral and bilateral schizencephaly (left and right) and closed and open schizencephaly (top and bottom).

Figure 2. Transvaginal 3D sonogram shows asymmetric left and right hemispheres with communication of the subarachnoid space to the lateral ventricles (stars). The cerebral cortex was present anteriorly and inferiorly, ending abruptly but smoothly, consistent with large bilateral clefts (arrows).

Figure 3. The midbrain structures in the midline appear disorganized with no demonstrable visible thalamus, cavum septi pellucidi, or corpus callosum.
Figure 4. On both 2D (A and B) and 3D power Doppler (C) sonography, the intracranial vessels appear disorganized. The middle cerebral artery, anterior cerebral artery, and pericallosal vessels could not be identified.

Figure 5. Gray matter heterotopia and gray matter lining the clefts (arrows) are shown on enlargement.
On autopsy, a complex schizencephaly/porencephaly developmental malformation with megalencephaly (895 g), absence of parietal and occipital lobes, a large central mass consisting of dysplastic cortex, and white matter with gray matter heterotopias were seen. The nature of this central mass remains obscure (Figure 8). The fetus had no other abnormalities except for a Meckel diverticulum. The karyotype was 46,XY.

References