Fetal and Postnatal Brain Imaging for the Detection of ZIKV Encephalopathy in the Fetus/Newborn

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Background: Up to 15% of pregnancies complicated by maternal ZIKV infection result in Zika-virus associated brain abnormalities in the fetus/newborn. Fetal ultrasound (feUS) is the standard imaging modality for the evaluation of fetal anatomy and for brain changes from congenital infection. Fetal MRI (feMRI) may be a useful adjunct.

Objectives: Evaluate feUS, feMRI, and postnatal head US and brain MRI in fetuses exposed to ZIKV.

Design/Methods: We performed a prospective longitudinal neuroimaging study of fetuses/newborns of pregnant women with clinical and/or lab confirmed (RT-PCR and/or IgM/PRNT) diagnosis of Zika infection in Barranquilla, Colombia (endemic) and in Washington, DC, USA (travel-related). Gestational age (GA) at exposure and timing between ZIKV exposure/symptoms and imaging was documented. Subjects had 1 to 2 feMRIs and feUS, depending upon GA at enrollment. The feMRI and feUS protocols were standardized between sites and studies were centrally interpreted at Children’s National. Postnatally, infants received an unsedated brain MRI and head US.

Results: Forty-eight, ZIKV exposed/infected in first or second trimester pregnant women were enrolled (46 Colombia, 2 USA). Subjects had symptoms of ZIKV infection at mean of 8.4 ± 5.7 wks GA. The first feMRI and feUS were performed at 25.1 ± 6.3 wks GA. Thirty-six infants had a second feMRI and feUS at 31.1 ± 4.2 wks GA. Three of 48 (6%) cases had an abnormal feMRI: (1) heterotopias and abnormal cortical indent, (2) parietal encephalocele and Chiari II, (3) thin corpus callosum, dysplastic brainstem, temporal cysts, subependymal heterotopias, and generalized cerebral/cerebellar atrophy. FeUS in these 3 cases found (1) normal study, (2) parietal encephalocele and Chiari II, (3) significant ventriculomegaly with decreasing percentiles of head circumference from 32 to 36 wks GA (38% to 3.6%). One fetus had borderline ventriculomegaly (10mm) on feMRI and feUS at 28 wks GA and had a normal postnatal MRI and US. Postnatal head US revealed findings not seen on feUS: choroid plexus or germinal matrix cysts in 9 infants, lenticulostriate vasculopathy in 1 infant, and thin corpus callosum in 1 infant.

Conclusions: FeMRI and feUS provide complimentary information in the assessment of fetal brain changes in ZIKV. In cases of abnormal brain structure, feMRI reveals more extensive areas of brain damage than is seen by US. It is not known if encephalocele is related to ZIKV. Further study is needed to determine if cystic changes on postnatal head US are related to ZIKV infection, or are incidental findings.
