Introduction – the Zika virus

• Single-stranded RNA Flavivirus
  • Predominantly transmitted via the Aedes species of mosquitos
  • Crosses the placental barrier resulting in vertical transmission
  • Exhibits neurotropism
• Zika infection usually presents with mild and self-limiting symptoms including headache, fever, and rash
  • ~80% of cases are asymptomatic
• Declared a “public health emergency of international concern” by the WHO in February 2016
Pathophysiology

• The Zika virus attacks neural progenitor cells and mature neural cells causing downregulation of genes involved in cell cycle pathways, dysregulation of cell proliferation and upregulation of genes involved in apoptotic pathways resulting in cell death.

• Vascular phenomena could also be involved in the pathophysiology

• Nonstructural proteins likely play a role in viral immune evasion by modulation of the interferon pathway and by complement antagonism
Manifestations of brain anomalies

• Parenchymal volume loss — Associated with severity. However, normal brain volume does does exclude the infection

• Ventriculomegaly

• Malformations of cortical development — Simplified gyral pattern, polymicrogyria, pachygyria or lissencephaly

• Parenchymal calcifications

• Corpus callosum abnormalities

• Cerebellum hypoplasia

• Brainstem hypoplasia

• Delayed myelination
Parenchymal calcifications

- The most common location is the cortico-subcortical white matter junction of the frontal and parietal lobes.
- The most common morphology is an elongated and curvilinear pattern.
- The pathophysiology of this pattern is still not fully understood.
  - Vasculopathy
  - Direct cellular damage
- Less commonly and particularly in severe cases, calcifications may be present at other sites such as basal ganglia, thalamus, periventricular regions, brain stem and cerebellum.
Findings on US-microcalcifications

2 d/o with microcephaly
Abnormal-ZIKV

Normal
Abnormal-ZIKV

Normal
Abnormal-ZIKV

Normal
Abnormal-ZIKV

Normal
Abnormal-ZIKV

Normal
Abnormal-ZIKV

Normal

CORONAL ANT TO POST
Abnormal-ZIKV

Normal
PATTERN OF CALCIFICATION CAN BE USEFUL IN SUSPECTING ZIKV INFECTION IN UNSUSPECTED CASES

Child born to Cuban mother unknown prenatal history-presents with microcephaly

Based on the pattern of calcifications-ZIKV infection was suggested as possible etiology for microcephaly
Findings on CT

2 day old male: Known ZIKV infection
Sagittal and axial images from a noncontrast CT of the brain demonstrating elongated, curvilinear calcifications (white arrows) at the cortico-subcortical white matter junction in the frontoparietal region
MRI - 2 day old female with known ZIKV infection

T1 and T2 weighted sagittal sequences demonstrating severe microcephaly and thinning of the corpus callosum.

Axial susceptibility weighted images demonstrating numerous punctate foci of calcification (white arrows) at the corticomedullary junction and periventricular regions.

T2 weighted axial sequence demonstrating parenchymal volume loss, ventriculomegaly and a simplified gyral pattern (white arrows)
Take Home points

• Microcephaly (part. when severe) think of Zika as an etiology even if testing in mother and prenatal testing is negative

• Do Stat ultrasound and MR if possible-characteristic pattern of calcifications and other imaging findings might suggest a possible etiology even before lab testing confirms diagnosis

• Absence of microcephaly at birth does not exclude infection by Zika

• Cranial ultrasound should be done in all Zika positive mothers