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The Buzz on Zika: and Ultrasound of the CNS

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The Buzz on Zika: and Ultrasound of the CNS



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Aedes aegypti



- An important vector in urban areas.
- Closely associated with humans and their homes.
- Adult mosquitoes are commonly found indoors.
- Larval habitats are typically containers on the household premises.

Approximate distribution of *Aedes aegypti* in the United States*



Aedes albopictus



- More likely to play a larger role in transmission in the United States due to its wide distribution.
- Biting adults are found both indoors and outdoors, but are most commonly found outdoors.
- Larvae occur in peridomestic habitats as well as surrounding natural habitats.

Approximate distribution of *Aedes albopictus* in the United States*



Aedes mosquitoes farther north?

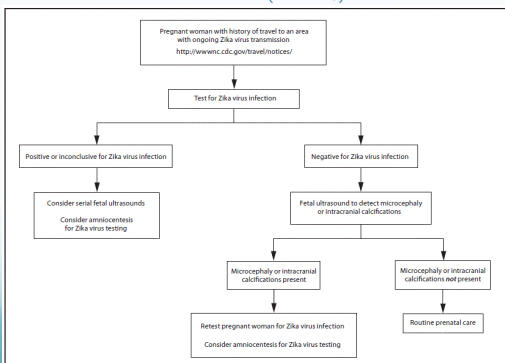
- Recent report demonstrated population persistence of *Aedes aegypti* mosquitoes in Capitol Hill region of Washington, DC
 - Typically thrives no farther north than Alabama
- Authors suggest a resident DC mosquito population, likely maintained during winter months in subterranean habitat that facilitates year-round survival (subways, etc.)
 - Small population, chances of human transmission low
 - Still, DC has high concentration of global travelers so potential exists for native transmission

Lima A, et al. *Am J Trop Med Hygiene* 2016; 94: 231-5

Ultrasound surveillance

- Microcephaly difficult to diagnose before 22 weeks
 - If exposure early (esp. if symptomatic), could potentially see intracranial findings short of microcephaly before 20-22 weeks: *evolving spectrum of disease*
 - Using CMV as model, likely need at least 6 weeks post exposure to see possible impact on u/s
- Current guidelines not prescriptive
- If Zika serology negative and reasonably-timed post-exposure ultrasound is normal, then routine surveillance is appropriate

Updated Interim guidance: Testing algorithm for a pregnant woman with history of travel to an area with ongoing Zika virus transmission (2/12/16)



Congenital Zika Virus Syndrome

Brain Involvement

- **Cerebral volume reduction / Brain atrophy**
Microcephaly/ Small HC - Large subarachnoid spaces
- Calcifications
Subcortical, cortical, periventricular, cerebellar, ocular
- Abnormal gyration / sulcation
- Ventriculomegaly
- Callosal dysgenesis
- Destructive lesions
- Cerebellar and midbrain involvement
- Basal ganglia involvement
- Medullar involvement

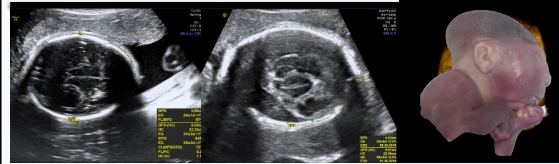
What are the correct planes to evaluate the CNS ?

1. " I am not sure that I can answer This question due to the perceived difficulty in performing the US examinations in these patients due to the small size of the fontanel/sutures."
2. "Ideally you need to obtain the 3 axial planes as described in the ISUOG guidelines plus 4 coronals and 3-5 sagittals. It will be extremely difficult but not impossible to miss a significant finding this way."

- "Personally and according to my own experience and after observing my own team missing findings in patients with CMV, I think that more important that the planes is to know exactly what to look for and where to find it."

Gustavo Malinger MD Sept 28 2016

Microcephaly / Small HC



Large subarachnoid space



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Congenital Zika Virus Syndrome Brain Involvement



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Congenital Zika Virus Syndrome Brain Involvement



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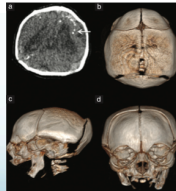


Congenital Zika Virus Syndrome Brain Involvement

Picture of the Month

Intrauterine Zika virus infection and microcephaly: correlation of perinatal imaging and three-dimensional virtual physical models

H. WERNER*, T. FAZECAS*, B. GUEDES*, J. LOPES DOS SANTOS†, P. DALTRO*, G. TONNI‡, S. CAMPBELL§ and E. ARAUJO JÚNIOR¶



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Congenital Zika Virus Syndrome Brain Involvement

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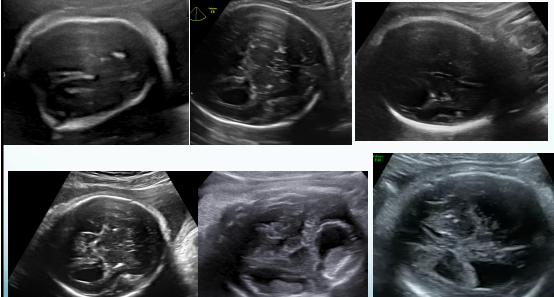

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Congenital Zika Virus Syndrome
Brain Involvement

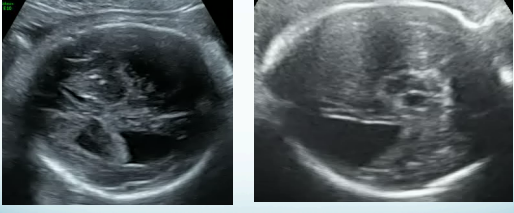

- Cerebral volume reduction / Brain atrophy
Microcephaly/ Small HC - Large subarachnoid space
- Calcifications**
Subcortical, cortical, periventricular, cerebellar, collic
- Abnormal gyration / sulcation
- Ventriculomegaly
- Collic dygenesis
- Destructive lesions.
- Cerebellar and midbrain involvement
- Basal ganglia involvement
- Medullar involvement



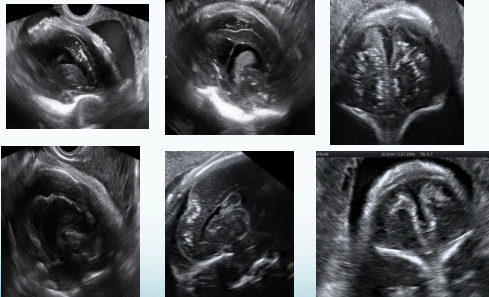

Congenital Zika Virus Syndrome
Calcifications - Trans abdominal Us



Congenital Zika Virus Syndrome
Calcifications - Trans abdominal Ultrasound

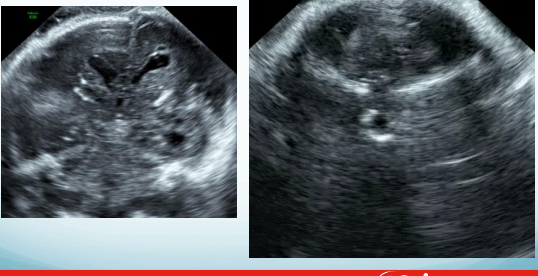

Congenital Zika Virus Syndrome
Calcifications - Trans vaginal Us

Congenital Zika Virus Syndrome
Calcifications - Trans vaginal Us

Congenital Zika Virus Syndrome
Vasculitis - Trans vaginal Us

Congenital Zika Virus Syndrome

Calcifications - Trans vaginal US

CMV Zika Toxo

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Congenital Zika Virus Syndrome

Calcifications - Vasculitis - (hematoxylin and eosin staining)

shows higher magnification of calcifications with filamentous structures

L.Espinosa - A.Salazar- Colombia

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Congenital Zika Virus Syndrome

Calcifications - Vasculitis - Medullar calcifications

L.Espinosa - A.Salazar- Colombia

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Congenital Zika Virus Syndrome

Cysts

Zika - Bogotá Zika - Ibagué

Zika - Bogotá CMV - Tel-Aviv

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Congenital Zika Virus Syndrome

Cysts

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Congenital Zika Virus Syndrome

Brain Involvement

- Cerebral volume reduction / Brain atrophy
 - Microcephaly/ Small HC - Large subarachnoid space
- Calcifications
 - Subcortical, cortical, periventricular, cerebellar, ocular
- Abnormal gestation / edoation
- Ventriculomegaly
- Cealost dysgenesis
- Destructive lesions.
- Cerebellar and midbrain involvement
- Basal ganglia involvement
- Medullar involvement

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Congenital Zika Virus Syndrome
Cortical Abnormal Development

31w6d

Colombia

Delayed sulcation

Licencephaly

Brazil

Irregular LV wall

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Congenital Zika Virus Syndrome
Abnormal Cortical Development

BDP	8.11cm
SD	2.00cm
AD	8.20cm
HC	27.41cm
CC	23.02cm
OCIP/PC	3.22cm
HC	31.00cm

Schizencephaly

M. Rebolledo - Colombia

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Congenital Zika Virus Syndrome
Abnormal Cortical Development

L.Espinosa - A.Salazar - Colombia

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Congenital Zika Virus Syndrome
Brain Involvement

- Cerebral volume reduction / Brain atrophy
Microcephaly/ Small HC - Large subarachnoid space
- Calcifications
Subcortical, cortical, periventricular, cerebellar, ocular
- Abnormal gyration / sulcation
- **Ventriculomegaly**
- Corpus callosum dysgenesis
- Destructive lesions
- Cerebellar and midbrain involvement
- Basal ganglia involvement
- Modular involvement

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Congenital Zika Virus Syndrome
Ventriculomegaly

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Congenital Zika Virus Syndrome
Ventriculomegaly

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Congenital Zika Virus Syndrome
Ventriculomegaly

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Congenital Zika Virus Syndrome
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Microcephaly/ Small HC - Large subarachnoid space
- Calcifications
Subcortical, cortical, periventricular, cerebellar, ocular
- Abnormal gyration / sulcation
- Ventriculomegaly
- **Callosal dysgenesis**
- Destructive lesions.
- Cerebellar and midbrain Involvement
- Basal ganglia Involvement
- Medullar Involvement

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Congenital Zika Virus Syndrome
Callosal Dysgenesis

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- **Callosal dysgenesis**
- **Destructive lesions.**
- Cerebellar and midbrain Involvement
- Basal ganglia Involvement
- Medullar Involvement

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Congenital Zika Virus Syndrome
Destructive Lesions

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Congenital Zika Virus Syndrome
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- **Destructive lesions.**
- **Cerebellar and midbrain Involvement**
- Basal ganglia Involvement
- Medullar Involvement

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Congenital Zika Virus Syndrome
Cerebellar Involvement

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Congenital Zika Virus Syndrome
Cerebellar Involvement

Courtesy Prof. Pedro Piris, Recife

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Congenital Zika Virus Syndrome
Cerebellar Involvement

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Congenital Zika Virus Syndrome
Extra CNS Involvement
Eyes

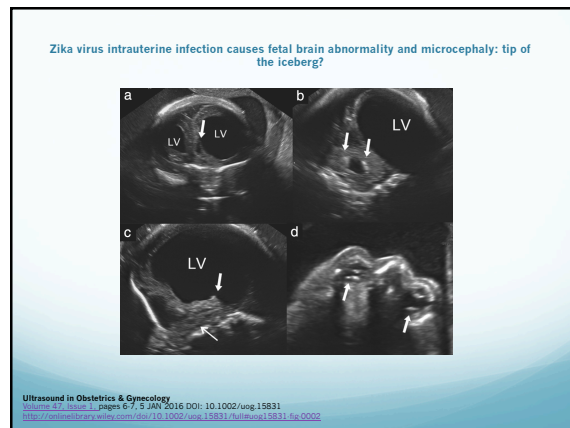
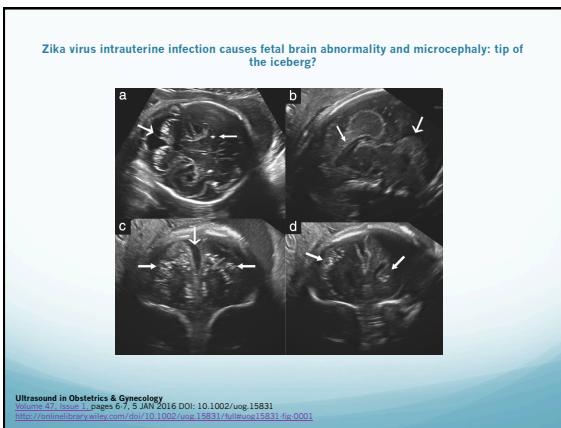
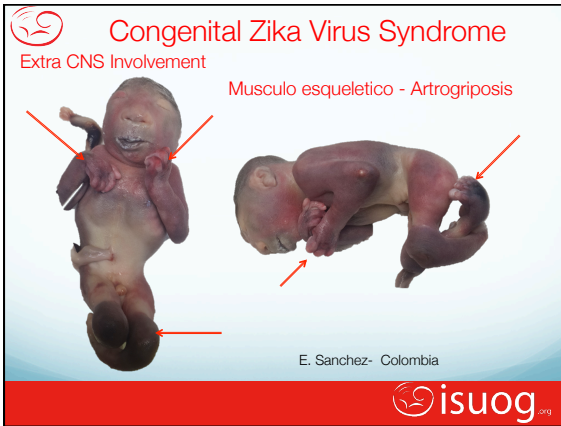
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Congenital Zika Virus Syndrome
Extra CNS Involvement
Heart

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Congenital Zika Virus Syndrome
Extra CNS Involvement
Placenta

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Zika Testing – What Testing can be done?

- Within **first week after onset of symptoms**, testing is for Zika-specific PCR on serum (compare HIV-PCR)
 - **PCR only done on symptomatic patients**
 - **2 tubes for each test (Ab or PCR), + urine if sx**
- All other patients: testing for Zika-specific IgM (2/5)
 - Typically develop toward the end of the first week of illness
 - **Testing in asymptomatic patients no earlier than 2 weeks after exposure (no later than 12 weeks)**
 - If Ab (+), then further neutralization testing done to discriminate between cross-reacting antibodies in primary flavivirus infections.
- Test results are normally available 3-5 weeks after specimen receipt --- **from CDC or county health dept**

Society for Maternal-Fetal Medicine
Society for Maternal-Fetal Medicine (SMFM) Statement
www.smfm.org

Ultrasound screening for fetal microcephaly following Zika virus exposure
Society for Maternal-Fetal Medicine (SMFM) Publications Committee

- If the HC >2SD below the mean, a careful evaluation of the fetal intracranial anatomy is indicated. If the intracranial anatomy is normal, f/u US in 3-4 wks.
- Isolated fetal microcephaly should be defined as "fetal HC >3SD below the mean for GA." Diagnosis of pathologic microcephaly is considered certain when the fetal HC is $\geq 55D$.
- A neurosonographic examination should be performed and f/u US in 3-4 wks.
- If you use a fetal biometry reporting package that provides HC measurements as %tiles, refer to the Table in the Statement to determine the SD, which is necessary in most cases to identify true microcephaly.

Am J Obstet Gynecol (June 2016) <http://dx.doi.org/10.1016/j.ajog.2016.02.043>

New Zika Threat to Infants: Late-Onset Microcephaly

WebMD Health News, Brenda Goodman, August 11, 2016

- CDC researchers reported seeing late-onset microcephaly among 1,200 pregnancies in Brazilian women infected with Zika virus during the third trimester

WHO Emergency Committee on Zika and microcephaly 9/1/2016

- 4th meeting of the Emergency Committee convened on regarding microcephaly, other neurological disorders and Zika virus
 - Briefing on Temporary Recommendations
 - Updated on situation during/after the Olympic Games held in Brazil
 - Update on Zika virus geographic spread
 - Natural history, epidemiology, microcephaly and other neonatal complications associated with Zika virus, Guillain-Barré syndrome
 - Current knowledge on sexual transmission of Zika virus