The Normal Fetal Brain

• 3 classic TAS views using the axial
  • Transventricular
  • Transthalamic
  • Transcerebellar
• Beyond the basics → coronal and median views using TAS and/or TVS
  • Mid-Coronal
  • Median

The Normal Fetal Brain - Outline

Measuring the lateral ventricle

• Normal < 10mm
• What are the landmarks?

Transventricular plane

• Landmarks
  – Frontal horns
  – Cavum septi pellucidi
  – Posterior horn
    • Atrium
    • Choroid plexus
  – Lateral ventricle measurement

Guibaud L. Opinion. Fetal cerebral ventricular measurement and ventriculomegaly: time for procedure standardization. UOG 2009:34: 127-30
Correct Plane and Placement of Calipers

<table>
<thead>
<tr>
<th>Table 1 Image-scoring method</th>
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<tbody>
<tr>
<td>Criterion</td>
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<tr>
<td>Primary criteria</td>
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<tr>
<td>1. Strict axial plane</td>
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<td>2. Adequate anatomical level</td>
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<td>3. Location of the structure</td>
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<td>Secondary criteria</td>
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<td>4. Caliper placement</td>
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<tr>
<td>5. Adequate image size</td>
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<td>Maximum total score is 7</td>
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At 20 weeks

At 28 weeks

Transthalamic plane

- **Landmarks**
  - Frontal horns
  - Cavum septi pellucidi
  - Thalami
  - Hippocampal gyrus
  - Measurement of the BPD, HC, OFD

BPD

- The transducer must be perpendicular & hemispheres and head should be symmetric.
- The calipers should be placed at the: outer edge of the near calvarial wall
- inner edge of the far calvarial wall
- The cerebellar hemispheres should not be in the plane

HC

- The transducer must be perpendicular & hemispheres and head should be symmetric.
- The calipers should be placed at the: around the outer table of the calvarium
- The cerebellar hemispheres should not be in the plane

Cortical surface: Insula

Guibaud L. Opinion. Fetal cerebral ventricular measurement and ventriculomegaly: time for procedure standardization. UOG 2009:34: 127-30
**Transcerebellar plane**

- Landmarks
  - Frontal horns
  - Cavum septi pellucidi
  - Thalami
  - Cerebellum
  - Cisterna magna
  - Measure of the cerebellar diameter and cisterna magna

**Cisterna Magna Septa**

- Seen in 84-92% of fetuses (2nd 3rd Δ)
- Usually 2 septae are seen
- Found inferior & posterior from the vermis
- Straight & parallel with the AP diameter
- These are NL anatomic structures a result of NL embryologic development of the posterior fossa

* Represent the walls of Blake’s pouch

**Blake’s Pouch a.k.a. Cisterna Magna Septa: Quick Facts**

- The cisterna magna septa are the walls of Blake’s pouch
- Blake’s pouch is a normal fingerlike appendage of the 4th ventricle
- ‘Potential marker’ for normal development

**The cavum septi pellucidi on the axial planes**

- Anechoic, rectangular
- Fluid filled space
- Consistently seen after 18-20th week
- Its boundaries are the lateral walls of the cavum

**Warning!!!!**

Do not confuse the CSP with the fornices!!

The fornices are seen several mm below the plane of the CSP and unlike the CSP have a linear echo in the center.
Can you tell which one of these 2 is a normal CSP?

Basic Brain Scan: TAS & Axial

- Biometry:
  - Biparietal diameter
  - Head circumference
  - Occipitofrontal diameter
  - Lateral ventricle
  - Transcerebellar diameter
  - Depth of the cisterna magna

- The brain structures:
  - Head shape
  - Lateral ventricles
  - Cavum septi pellucidi
  - Thalami
  - Cerebellum
  - Cisterna magna
  - Spine


Beyond the basics

- Coronal and median views using TAS and/or TVS
  - 2D or 3D scanning
  - Multiples sections that can be obtained will r
    - Mid-Coronal
    - Median

Advantages of 2D ± 3D TVS Multiplanar Scanning

- Transfontanelle scan
- Coronal, & sagittal planes
- All brain sections “radiate” from one point


Coronal Sections

Frontal-2 or transfrontal plane

- Interhemispheric fissure
- Anterior horns

The Midcoronal group

Mid-coronal-1 or transcaudate plane

- Caudate nuclei
- Genu corpus callosum
- CSP
- Frontal horns

Mid-coronal-2 or transthalamic plane

- Thalami
- Interventricular foramina
- Atrium LV

The Midcoronal group

The cavum septi pellucidi on the coronal planes: This plane makes its imaging easier

- Coronal plane allows the visualization of the 2 lateral leaves of the cavum septi pellucidi, which encloses the space of the cavum septi pellucidi
- This is the section to diagnose agenesis of the septi pellucidi

The cavum septi pellucidi on the coronal planes: This plane makes its imaging easier

Q: Are the anterior horns of the lateral ventricles separated by septae on this coronal planes flanking the CSP?

Yes: This is normal
No. This is not!

Think midline anomaly: lobar HPE, SOD, AGS, AGCC

The Occipital group

Occipital-1& 2 or transcerebellar plane

- Occipital horns
- Interhemispheric fissure
- Cerebellar hemispheres
- Vermis

Sagittal Sections
**Oblique-1 or Para-sagittal plane**
- Lateral ventricle
- Choroid plexus
- Periventricular tissue
- Cortex

**Median or mid-sagittal plane**
- Corpus callosum
- Cavum septi pellucidi
- Brain stem
- Pons
- Posterior fossa
- Vermis

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**The Median Plane**
Unfortunately this plane is not mandatory and it is NOT included in the either the AIUM and ISUOG work list. However, we strongly suggest to get and record this plane in order to image the **midbrain** and the **posterior fossa**

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**Corpus callosum & cavum septi pellucidi**
- The development of CSP is closely associated with that of the corpus callosum
  - There cannot be a CSP without a ‘covering’ corpus callosum
  - However, a corpus callosum can be present in the absence of the CSP such as in septo-optic dysplasia

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**Sonographic appearance of the corpus callosum**
- Anechoic
- Inverted “C” shape
- Full developmental shape from 18-20 weeks
- Size extends to quadrigeminal cistern
- Located between the cingulate gyrus and CSP

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**Corpus callosum**
- The corpus callosum has several parts: the rostrum (beak), genu (knee), corpus (trunk) and the splenium (tail)
Corpus callosum

- Continues to grow reaching its final adult-like appearance at around the 28th post-menstrual week.

Sulcus of the corpus callosum (hyperechoic line)

Corpus callosum (hypoechoic line)

Median plane: Best to Image the Vermis

- Allows easy visualization of the vermis
- The vermis is found in the midline between the cerebellar hemispheres

Posterior Fossa

Axial vs. Median Plane

- Cerebellum
- Vermis
- Fastigium
- 4th Ventricle
- Cisterna Magna
- Brainstem

Transcerebellar plane

Median plane

And again......
The Median Plane

Unfortunately this plane is not mandatory and it is NOT included in the either the AIUM and ISUOG work list. However, we strongly suggest to get and record this plane in order to image the midbrain and the posterior fossa.
Pericallosal artery (ies)

- Can be seen superior to the corpus callosum following their inner margin.

Cortical surface: Gyri & Sulci

Gestational Age Matters when scanning the Median plane

Fetal Neuroscan Scan

- The brain structures
  - Anterior horns
  - Posterior horns
  - 3rd and 4th ventricle
  - Interventricular foramina
  - Cavum septi pellucidi
  - Corpus callosum
  - Pericallosal artery
  - Caudate nuclei

- Thalami
- Cerebellum & vermis
- Cisterna magna
- Interhemispheric fissure
- Fissures
- Sphenoidal bone
- Ocular orbits

Sonographic examination of the fetal central nervous system: guidelines for performing the 'basic examination' and the 'fetal neurosonogram'.

Thank you !!!