

NEONATAL HEAD/BRAIN ULTRASOUND

Patient Prep:

1. None.
2. Age: Newborn – through 8 months

Survey:

Perform a real-time survey of the neonatal head/brain with attention to all intracranial anatomy.

Use Doppler or color flow to distinguish vessels and on any abnormalities.

Image Documentation:

Each image must be labeled with the patient's full name, medical record number, accession number, initials of the imaging technologist, organ/area identification, scanning plane and patient orientation if different from supine.

If an image of a structure is not well seen, take an image of the structure and annotate the purpose of the image (i.e. third ventricle not well seen).

General Procedure description:

1. Coronal images from anterior to posterior to evaluate normal anatomy and for abnormalities. To include frontal horns, frontal lobes, lateral ventricles, interhemispheric fissure, foramina of Monro, choroid plexus, third ventricles, cingulate sulcus, corpus callosum, septum pellucidum, cavum septi pellucidi, caudate nuclei, putamina, globi pallidi, Sylvian fissures, pons, medulla, thalami, caudothalamic grooves, cerebellum, cerebellar vermis cisterna magna, periventricular white mater, and occipital horns.
2. Sagittal images from midline to left and from midline to right. To include insula, Sylvian fissure, deep white matter, lateral ventricles, caudothalamic groove, and choroid plexus.
3. Germinal Matrix is the primary for a hemorrhage, due to this area being highly vascular tissue. A germinal matrix hemorrhage is graded from 1 – 4 depending on the size of the hemorrhage and what areas of the brain it extends into.
4. Any mass or abnormality is to be imaged in two planes with measurements in three orthogonal planes. Color flow images are to be documented of any mass or abnormality.

Guidelines for Head/Brain ultrasound:

CORONAL IMAGES:

1. Image at the periventricular region anterior to the frontal horns.
2. Image at the frontal horns anterior to the Foramen of Monro. This image will also demonstrate the germinal matrix, corpus callosum, lateral ventricles, Sylvain fissure, cavum septi pellucidum, caudate nucleus and temporal lobe.
3. Image of the lateral ventricles and third ventricle at the Foramen of Monro. This image will also demonstrate the corpus callosum, sylvain fissure, and medulla.
4. Image of the posterior of third ventricle at the thalami. This image will also demonstrate the caudate nucleus, corpus callosum, choroid plexus and anterior aspect of the pons.
5. Image of the quadrigeminal cistern. This image will also demonstrate the thalamus, lateral ventral (temporal horn), cerebellum and cisterna magna.
6. Image of the atria of the lateral ventricles. This image will also demonstrate the choroid plexus, cerebellum and corpus callosum.
7. Image of the posterior periventricular region to include parietal and occipital cortex. This image will also demonstrate the white matter, parietal lobe, occipital lobe and cortical sulcus.
8. Measure the frontal horn width of right and left lateral ventricle at the choroid plexus. Verify image is in the true coronal plane for accurate measurements.
9. Normal frontal horn width (ventricle) measurement is ≤ 3 mm.
10. Provide color images anterior to frontal horns to evaluate the sagittal sinus.
11. If the frontal horn width (ventricle) measurement is > 3 mm, obtain the Frontal and Occipital Horn Ratio (FOHR). Document value on worksheet.
 - a. EQUATION is $(A+B)/2C$.
 - b. A = Frontal horns measurement at the level of the Foramen of Monro. Distance between the lateral walls of the frontal horns.
 - c. B = Occipital horns measurement. Distance between the lateral walls of the occipital horns.
 - d. C = Biparietal diameter. Distance of the width of the skull from inner wall to inner wall.

CINE CLIP IMAGES

1. Coronal image anterior to posterior.
2. Sagittal image midline to left lateral.
3. Sagittal image midline to right lateral

SAGITTAL IMAGES:

1. Image of midline with entire corpus callosum, third ventricle, fourth ventricle, cerebellar vermis and cerebellum. This image will also demonstrate medulla, choroid plexus, and pons.
2. Image of right caudothalamic groove and germinal matrix. This image will also demonstrate the lateral ventricle, choroid plexus, thalamus, cerebellar hemisphere and caudate nucleus.
3. Image of the right Sylvian fissure. This image will also demonstrate the caudate nucleus, thalamus, choroid plexus and caudothalamic groove.
4. Image of the right lateral brain cortex to evaluate periventricular white and gray matter.
5. Image of left caudothalamic groove and germinal matrix. This image will also demonstrate the lateral ventricle, choroid plexus, thalamus, cerebellar hemisphere and caudate nucleus.
6. Image of the left Sylvian fissure. This image will also demonstrate the caudate nucleus, thalamus, choroid plexus and caudothalamic groove.
7. Image of the right lateral brain cortex to evaluate periventricular white and gray matter.

TRANSMASTOID VIEW IMAGES:

1. Label which side of the head is up.
 - a. Ex. Right Side up.
2. Images through the mastoid fontanelle. Provides evaluation of the cerebellum, fourth ventricle, cerebellar vermis, cerebellar hemisphere, cerebellar tentorium and cisterna magna.

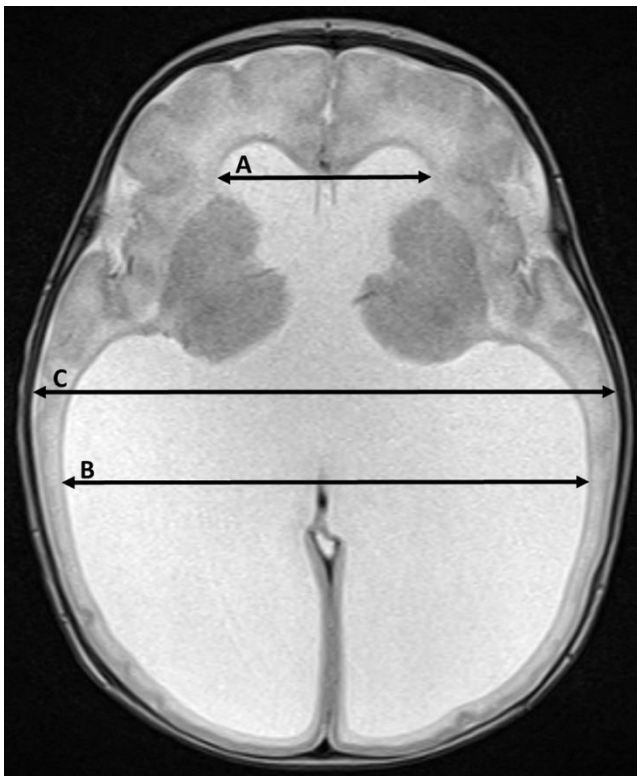
If an area cannot be seen noted on images and worksheet.

All color Doppler images should be with and without color.

All measurement images should be with and without measurement.

Neonatal Hydrocephalus, Measurement of Frontal + Occipital Horn Ratio

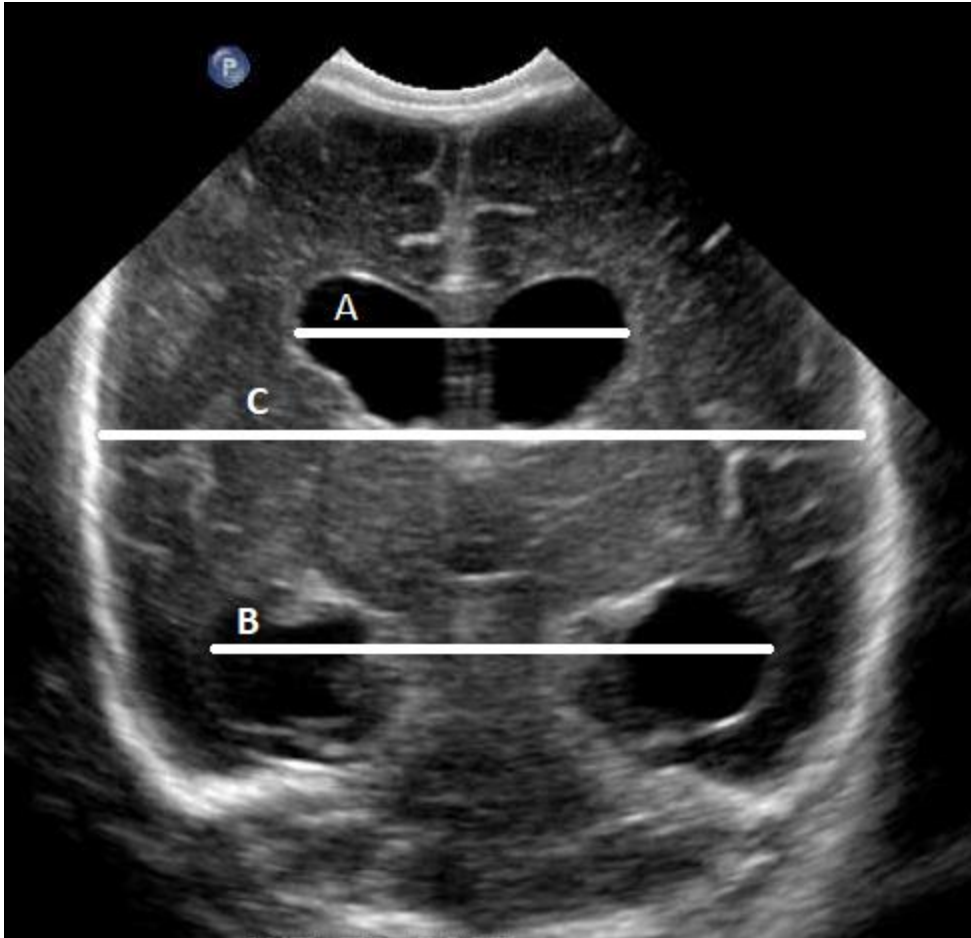
On neonatal head ultrasound studies, we have been routinely reporting the width of the anterior horns of the lateral ventricles. We recently have been asked by the neonatologists to further quantify hydrocephalus in infants whose anterior horn width is greater than 3 mm. Therefore, in those patients with hydrocephalus the technologists will measure the distance between the lateral walls of the frontal horns at the level of the foramen of Monro, the distance between the lateral walls of the occipital horns, and the width of the skull from inner table to inner table, as shown below:



We will report the frontal + occipital horn ratio (FOHR) as calculated below:

$$\text{Frontal + Occipital horn ratio} = (A + B)/2C$$

High values of FOHR, especially those over 0.55, are associated with poor outcomes and may require intervention.



The technologist may not be able to obtain all three measurements on one image as shown above; however, they will obtain all three measurements and document them with images. We will report the FOHR and compare it to the FOHR on previous studies, if available.

A = Frontal horns measurement at the level of the Foramen of Monro.
Distance between the lateral walls of the frontal horns.

B = Occipital horns measurement. Distance between the lateral walls of the occipital horns.

C = Biparietal diameter. Distance of the width of the skull from inner wall to inner wall.

Frontal Occipital Horn Ratio (FOHR): $(A+B)/2C$