Ultrasound

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**Spinal ultrasound** (of infant spine) – see [p. D70 >](http://WWW.NEUROSURGERYRESIDENT.NET/D.%20DIAGNOSTICS%5CD70.%20Spinal%20Imaging/D70.%20Spinal%20Imaging.pdf)

**Doppler** – see [p. D62 >>](http://WWW.NEUROSURGERYRESIDENT.NET/D.%20DIAGNOSTICS%5CD60-68.%20Vascular%20examination/D62.%20Doppler.pdf), [p. Vas7 >>](http://WWW.NEUROSURGERYRESIDENT.NET/Vas.%20Vascular/Vas7.%20Carotid%20Atherosclerotic%20Stenosis.pdf)

Higher beam frequency - better axial resolution, but less tissue penetration.

A mode (amplification) - one of earliest and simplest forms of display: image is displayed as series of spikes; amplitude\* is represented on *y* axis and depth on *x* axis.

* was used to identify *midline head structures* (*echoencephalography*),

\*stronger echo → higher spike.

Static B mode (brightness) - repre­sents only current line of sight of transducer - each echo is displayed as dot (static 2D image); dot brightness is proportional to echo intensity.

TM mode (time-motion) - used primarily in *echocardiology*: image displays movements of various parts of heart.

Real-time ultrasound - rapid, sequential genera­tion of 2D B-scan images - images change almost instantaneously on screen with shifts in transducer posi­tion.

* may be used in conjunction with Doppler (e.g. to diagnose carotid stenosis).

Brain ultrasound (of infants)

See also D45 p.!!!

Advantages - portable, safe, noninvasive, low cost and highly effective.

Disadvantages - findings may be relatively unspecific and difficult to interpret (even for experienced sonologists).

* grey and white matter cannot be differentiated.

Sonographic "window" (not blocked by intervening bone or air) - anterior fontanelle – allows ***coronal*** and ***sagittal*** images:

* 1. cerebral hemispheres
	2. deep ganglionic structures
	3. thalami
	4. ventricles
	5. posterior fossa.
* posterior fontanelle - better views of posterior fossa.
* temporal fontanelles - ***axial*** views in very young.

What can be detected:

* 1. congenital anomalies in central (periventricular) position (Chiari malformations, Dandy-Walker syn­drome, agenesis of corpus callosum, anencephaly, aqueductal stenosis, holoprosencephaly, encephaloceles)
	2. hydrocephalus
	3. neoplasms
	4. cysts
	5. periventricular hemorrhage (subarachnoid / subdural blood that is nearer transducer are harder to identify - may be confirmed by CT).
	6. vascular malformations (e.g. vein of Galen malformation).
* sensitivity for hypoxic–ischemic lesions is poor (normal sonogram does *not* exclude this pathology);
	+ - *cerebral edema* is **hyperechoic** - very difficult to diagnose since there is no adjacent parenchymal organ that can provide reference in echogenicity.
		- definite *infarction* is **hypoechoic** and well demarcated.

Normal brain US:

**A.** Coronal section at level of internal capsule: interhemispheric fissure (*long arrow*), cingulate sulcus (*two short arrows*); callosal sulcus (*short arrow*), sylvian fissure (*arrowhead*), corpus callosum (cc), frontal horn (1), 3rd ventricle (2), caudate nucleus (3), thalamus (4), internal capsule (5), putamen and globus pallidus (6), insula (I), temporal lobe (T).

**B.** Coronal section at level of ventricular atria: lambdoid suture (LS), glomus of choroid plexus (*white arrow*), slightly hyperechogenic periventricular white matter (7).



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| Normal brain US: sagittal section on lateral ventricle: frontal horn (1), body (2), atrium (3), glomus of choroid plexus (4), choroid plexus in temporal horn (5), caudate nucleus (6), thalamus (7), caudothalamic groove (*arrow*):D:\Viktoro\Neuroscience\D. Diagnostics\D45-59. Neuroimaging (X-ray, CT, MRI, PET, MRS)\00. Pictures\Normal brain US 2.jpg | Normal brain US: medial sagittal section:Corpus callosum: genu (*curved arrow*), body (*straight arrow*), splenium (*arrowhead*), 3rd ventricle (3), 4th ventricle (4), cerebellar vermis (V), brainstem (BS) choroid plexus (CP):D:\Viktoro\Neuroscience\D. Diagnostics\D45-59. Neuroimaging (X-ray, CT, MRI, PET, MRS)\00. Pictures\Normal brain US 3.jpg |

Normal neonatal brain - coronal midline scan:



Normal neonatal brain - coronal midline scan:



Normal neonatal brain – midline sagittal scan:



Bibliography for ch. “Diagnostics” → follow this [link >>](http://www.neurosurgeryresident.net/D.%20Diagnostics/D.%20Bibliography.pdf)

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