

Visualising the CNS in the first trimester with a high frequency abdominal probe



Women's Health



Dr Marc Althuser, a gynaecologist and sonographer specialising in antenatal diagnostics, discusses the use of high frequency abdominal probes to monitor the CNS during the first trimester. This webinar – hosted by Luca Mastrogirolamo, International Clinical Support Manager at FUJIFILM Healthcare Europe – was recorded for the ISUOG World Congress on Ultrasound in Obstetrics and Gynecology in October 2021, and showcased the improved visualisation achieved with high frequency abdominal ultrasound.

CNS imaging in the first trimester

High resolution ultrasound imaging of a foetus during the first trimester is typically carried out using transvaginal probes, as the image is believed to be clearer. However, a small external 10-megahertz probe is capable of good penetration, and provides clear images of the CNS during this period of gestation, while being more manageable than intra-cavitary probes. Comparison of high frequency and standard probes demonstrates improved visualisation of key CNS features – including the medullary canal, corpus callosum, cerebellum, mesencephalic cavity, cephalic tube – and the dolichocephalic, mesocephalic and rhombo-cephalic vesicles.

Visualising the telencephalon[GP1]

At 12 weeks the telencephalon almost covers the brainstem. Using an external probe, it is possible to view the central ventricular network at this stage, but the visibility is better with high frequency. On a frontal view, two echogenic area correspond to the base of the two choroid plexus. It is also possible to visualise the third ventricle, as well as the future sylvius aqueduct.

Imaging the midbrain

The midbrain evolves rapidly towards the end of the first trimester, and sagittal slices between 11.5 and 12 weeks – centred on the midbrain – show that most of the brain structures are present. The mesencephalon can be seen close to the bpc side, with the cerebellum a little lower. Closer to the base of the skull is the fourth ventricle, limited back by its own choroid plexus, and more vertically the future pons. Behind the fourth ventricle is the cisterna magna, which is separated by a veil too thin to be visible.

Viewing the facial features

High frequency ultrasound can also be used to visualise facial feature in the late first and early second trimesters. At 12 weeks, the maxillary arch is visible, and the mandible has a gothic shape. By 15 weeks, the posterior edge of the palette and the soft palette can be seen. At 17 weeks the maxillary arch and the dental alveoli show, as well as the uvula process and the parotid glands below the mandible, the shape of which is changing.

Improved diagnosis of CNS developmental problems

Foetal imaging in a patient with a high BMI clearly shows anomalies in the CNS, including posterior lift of the choroid plexus, posterior displacement of the midbrain, tilting of the brainstem and a reduced bpd measurement, all of which were clearer with high frequency imaging. Furthermore, deformation of the cerebellar lobe and frontal bones, plus a relatively discrete primary lesion in the sacrum, could be seen, demonstrating the value of this imaging technology in foetal monitoring.

Conclusion

Transcutaneous use of suitable high frequency probes can be particularly useful for visualising the foetal CNS when the vaginal route is limited, either due to an unfavourable foetal position or because a region of interest is too far from the probe. As the abdominal view is not blocked by the vaginal cul-de-sac, more planes of view can be achieved. However, abdominal imaging is limited in cases of obesity, or insufficiently anteverted uterus.

The webinar, including all the supporting images, is available to watch at <https://www.youtube.com/watch?v=MYOL7D6ZTKo>

[GP1]The telecephalon, midbrain, facial features and developmental problems sections will each need to be accompanied by annotated images

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