Riccabona, M. Neonatal Brain Ultrasound: A Powerful Imaging Tool A Brief Overview of the Present State and Value. *Journal of the Belgian Society of Radiology*. 2017; 101(S1): 5, pp. 1–2. DOI: https://doi.org/10.5334/jbr-btr.1408

SHORT ABSTRACT

Neonatal Brain Ultrasound: A Powerful Imaging Tool A Brief Overview of the Present State and Value

Michael Riccabona

Keywords: ultrasound; neonate; brain

Extended Abstract

Neonatal brain ultrasound (US) has been one of the first applications of sonography in paediatrics. For a long time it was the one and only method for diagnosing and following up brain haemorrhages in neonates and preterm babies, and even today it is the most frequently used bedside imaging tool in these children. Some also advocate US screening of the brain particularly in at-risk patients. Nevertheless, with the increasing use of Computed Tomography (CT) and, moreover, Magnetic Resonance (MR), US has lost importance. Often today US is seen as an orienting imaging tool for screening or quick bedside checks, and everything else should be diverted to MR. This recent development is partially based on poor performance of US examinations, and often US results are compared with MRI results from studies that were done considerably later, making the depiction of various changes much easier. However, some recent reports show that if high-end US is performed within hours of the respective MR investigation, it reveals all the therapeutically relevant information. Thus the number of MRs can be reduced or the investigations postponed to a time when US has lost its good access and possibilities.

The following aspects will be addressed:

1) How to perform brain US
   - A comprehensive knowledge of the brain anatomy and the various changes during maturation and growth as well as the development of the brain is mandatory, particularly when investigating also preterm babies.
   - A sector or vector transducer is necessary; however, in many conditions a high-resolution linear array with the option of phasing to trapezoid mode can be helpful, particularly for the near field and the brain surface.
   - Besides the typical transfontanellar access, all other possible approaches from various other fontanelles (mastoid, occipital, lesser fontanella) and even transcranially (using non-ossified parts of the skull for access) should be explored to get a proper and reliable overview of all brain sections; these additional views are particularly helpful for basal structures, the structures of the posterior fossa, and the peripheral extra-axial cerebrospinal fluid (CSF) spaces.
   - Image compounding is less often necessary and in some, particularly sector transducers, not available. Harmonic imaging can be useful, though it must be considered that this comes with a slight loss of penetration and a higher energy burden to the neonatal brain.
   - The investigation should be short but not rushed, so as not to miss important information, and transducer pressure should be minimised (particularly in micro-curved arrays, where it easily happens that one compresses the brain and the superior sinus); also the mechanical and thermal burden from the US energy should be considered and MI/TI should be kept at least below/around 1 to be on the safe side for the duration of a longer investigation. Note that particularly colour and spectral Doppler (as well as harmonic imaging) use higher sound energy.
   - These available tools should be applied as needed, and particularly with Doppler this should be kept short and focused to the area of interest. Nevertheless, Doppler US has become an indispensable requisite for various conditions.
   - Don't forget – even at bedside investigations – to properly document (with representative good images at standardised and repeatable sections) the entire investigation and to file a standardised report for each and every examination.
2) What are the typical applications?
   - The assessment of intracranial (and extracranial) haemorrhages, particularly the intraventricular haemorrhages of the preterm, not only for a diagnosis and follow-up but also as a screening tool in critically ill patients.
   - The assessment of often prenatally diagnosed brain malformations and hydrocephalus; the latter can also arise after haemorrhage or infection.

Universitätsklinikum LKH Graz, AT
michael.riccabona@klinikum-graz.at

- The assessment of neonates after birth asphyxia.
- The assessment of various inflammations and (intra-uterine) infections, and there additionally are some other conditions where US can be useful (such as in battered child, skull fractures, cerebrovascular malformations, or even tumours).

3) What are the typical queries?
   Respective imaging examples of typical conditions and findings will be presented and discussed, with special focus on modern US providing good image quality that allows for reaching a reliable diagnosis. A very simple additional trick for improving the reading of neonatal brain US is to use all the knowledge one has gained from CT and MR, applying the various comparable criteria.
4) What are the restrictions for brain US?
   There are areas where US has inferior capabilities and cannot compete with MR – particularly concerning areas poorly accessible by US, small (remnants of) haemorrhages, or parenchymal changes such as heterotopia, migration disorders, or early infarction. These restrictions need to be recognized and thus, whenever such a clinical query arises and there is an indication, the necessary MRI investigation should be performed.

In summary, modern US applying modern high-resolution transducers and equipment operated by a skilled and knowledgeable investigator offers a powerful imaging tool for imaging particularly the neonatal brain. Providing this service in a constant fashion and teaching the techniques and the details to all those who regularly have to perform brain US will improve patient care and outcomes, and probably will help reduce the need for MR.

Competing Interests

The author has no competing interests to declare.

How to cite this article: Riccabona, M. Neonatal Brain Ultrasound: A Powerful Imaging Tool A Brief Overview of the Present State and Value. *Journal of the Belgian Society of Radiology*. 2017; 101(S1): 5, pp. 1–2. DOI: https://doi.org/10.5334/jbr-btr.1408

Published: 18 November 2017

]u[*Journal of the Belgian Society of Radiology* is a peer-reviewed open access journal published by Ubiquity Press.

OPEN ACCESS