

Neuroimaging of neonatal seizures

Neonatal seizures are defined as seizures within the first 28 days of life and may be the first clinical manifestation of central nervous system pathology. Neonatal seizures are frequent and have been reported to occur in 2.5-3.5 per 1000 full term newborns. Moreover, seizure activity has also been reported during the prenatal, fetal period.

Neonatal seizures may be a diagnostic challenge because there is a long list of etiologies including hypoxic ischemic injury, neonatal focal stroke or hemorrhage, infection, malformation as well as multiple inborn errors of metabolism. Furthermore neonatal seizures may result from the intrauterine exposure to recreational drugs used by the mother. An early and specific diagnosis is essential to treat etiologies that may result in irreversible brain damage if not treated adequately. Especially, the early recognition of metabolic disorders is essential in order to limit brain injury.

A detailed physical and neurological evaluation including collection of the prenatal history, identification of possible perinatal complications as well as review of the family history is essential for correct diagnosis. Next to a metabolic screening and electro-encephalography (EEG) studies, high end anatomical and functional neuroimaging may narrow differential diagnosis. Transfontanellar ultrasound is typically the first imaging modality used to rule out findings suggestive of hypoxic ischemic injury, focal hemorrhage or stroke. Magnetic resonance imaging (MRI) is typically used as a second line imaging tool in which the high spatial resolution in combination with the functional imaging, especially diffusion weighted or diffusion tensor imaging and ^1H magnetic resonance spectroscopy (^1H MRS), may render a more detailed and specific diagnosis. Imaging should always be optimized for the young age of the child and consequent immaturity of the neonatal brain. Injection of contrast media should be avoided and is rarely indicated. Computer tomography (CT) can be considered as a fast alternative imaging modality. CT is however less sensitive for subtle lesions and should be avoided because of the vulnerability of the pediatric brain for ionizing radiation.

In the current presentation, the various imaging modalities relevant for the neonate with seizures will be discussed, in particular how they can be optimized for the evaluation of the neonatal brain. In addition, didactic examples of the various focal or diffuse brain pathologies that may present with neonatal seizures will be discussed.

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