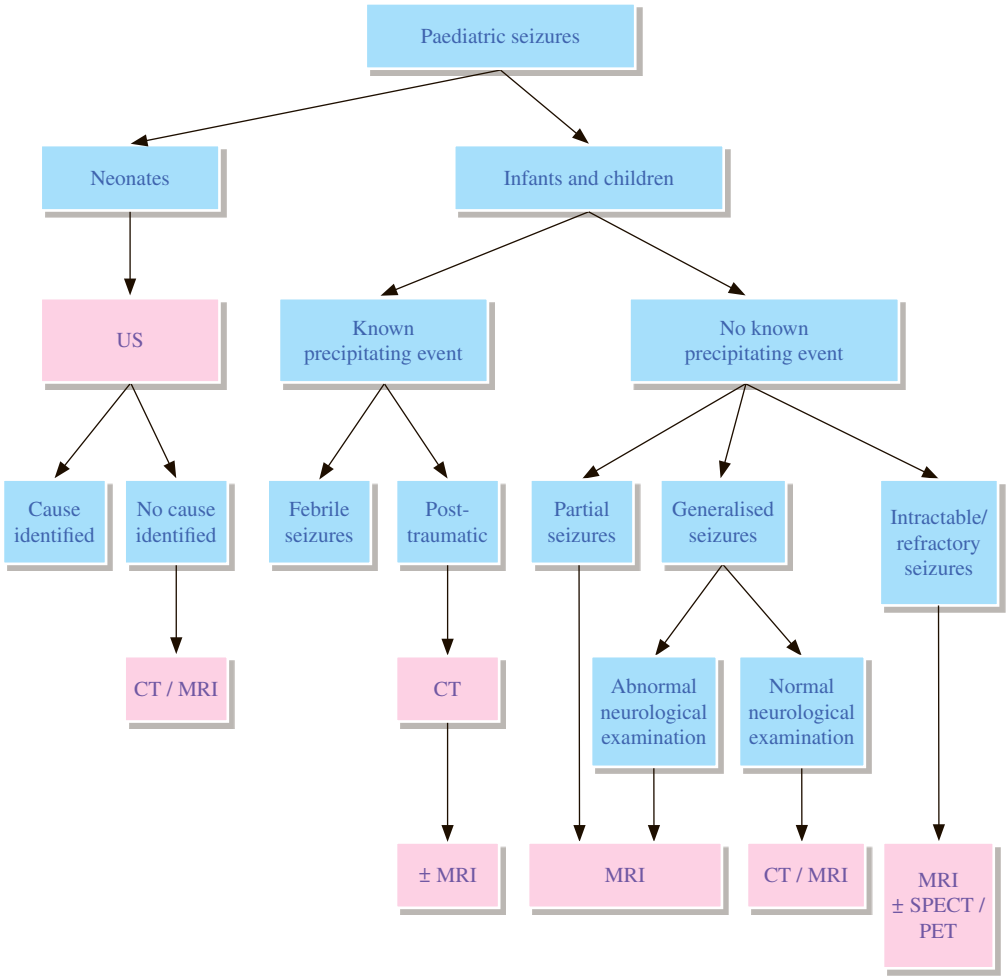
PD 2 Paediatric seizures



REMARKS

1 Indications

1.1 Structural neuroimaging is recommended for all children with recently diagnosed localization-related or generalized epilepsy who do not have the clinical and electroencepalogram (EEG) features characteristic of classical idiopathic focal or generalized epilepsy (benign epilepsy with centrotemporal spikes (BECTS), childhood absence epilepsy (CAE), juvenile absence epilepsy (JAE), or juvenile myoclonic epilepsy (JME)) and for any child younger than 2 years of age.

1.2 Imaging early in the course of epilepsy is directed at identifying an etiology for seizure that requires other medical or surgical attention[1]:

1.2.1 If there is any evidence to suggest the epilepsy is localization-related (e.g. focal), with the exception of typical benign idiopathic partial epilepsy.

1.2.2 Abnormal neurologic examination, including focal deficits, stigmata of neurocutaneous syndrome, cerebral malformation syndrome, or a history of significant developmental delay, arrest, or regression.

1.2.3 Children younger than 2 years, excluding those with simple febrile seizures.

1.2.4 Children with characteristics of a symptomatic generalized epilepsy syndrome, including infantile spasms or early Lennox-Gastaut syndrome.

1.2.5 Failure to control seizures, worsening seizures, changes in seizure manifestations, or developmental regression also merit neuroimaging if not previously performed.

1.2.6 New-onset seizure/epilepsy presenting with evidence for a medical emergency such as increased intracranial pressure or status epilepticus always merit emergency imaging.

1.3 Imaging studies in CAE, JAE, JME, and BECTS do not identify significant structural abnormalities[1].

2 Plain radiograph

2.1 Skull radiographs are not routinely indicated in evaluation of seizures in children as it lacks both sensitivity and specificity.[2]

3. US

3.1 US is effective in evaluation of seizures in neonatal period and may adequately define treatable pathology to allow management in some cases.

3.2 An open fontanelle is necessary for US.

3.3 US Doppler evaluation of intracranial arteries is effective in assessing regional cerebral blood flow but its clinical value remains unclear.

4. Nuclear medicine

4.1 Single photon emission computed tomography (SPECT).

4.1.1 Ictal SPECT has been useful in differentiating temporal lobe epilepsy from extra-temporal lobe foci and provides non-invasive imaging information used in planning treatment strategies.[3]

4.1.2 Ictal SPECT optimization requires radiopharmaceutical injection (Tc-99m hexamethylpropyleneamine oxime [HMPAO] or Tc-99m ethyl cysteinate dimer [ECD]) within seconds of a seizure.

4.2 PET

4.2.1 PET offers a direct quantitative correlation with metabolic activities and therefore it is potentially more specific than SPECT.

4.2.2 Both SPECT and Fluorodeoxyglucose (FDG) PET have been used as a part of pre-surgical evaluation and planning.

5. CT

5.1 Non-contrast CT is effective in identifying some treatable causes of seizures or emergencies causing seizures.

5.2 CT confers some advantages with regard to identifying blood and calcification (as found in congenital infection).[1]

5.3 Contrast enhancement in general does not improve the sensitivity in detecting focal intracranial lesions with the exception of brain metastases, which are rare causes of seizures in the paediatric population.

5.4 CT is more widely available than MRI, less expensive, and less likely to require sedation for younger children.

5.5 CT can detect all treatable lesions in the setting of acute mild trauma.[3]

6. MRI

6.1 MRI has the highest sensitivity in detecting focal intracranial lesions. It is considered the imaging modality of choice because of superior anatomic resolution and characterization of pathologic processes.[1]

6.2 Routine administration of gadolinium contrast provides little advantage in children with epilepsy. Administration of gadolinium is of limited value in increasing the sensitivity of MRI examination of brain, although the specificity can be improved.[4] It is reserved for circumstances where tumor, vascular malformations, inflammation, and infectious concerns arise or are suspected based on review of non-contrast studies.

6.3 There is no agreement on specific imaging protocols or MRI sequences, but there is general agreement that the following should be performed[1]:

6.3.1 Anatomic, thin-slice volumetric T1-weighted gradient-recalled-echo sequence,

6.3.2 Axial and coronal T2-weighted sequence,

6.3.3 Fluid attenuated inversion recovery (FLAIR) sequence (axial, and coronal if possible),

6.3.4 High resolution oblique coronal T2-weighted imaging of the hippocampus (fast or turbo spin echo weighted sequence),

6.3.5 There is debate, and there are limited data, about the utility of newer sequences such as magnetization transfer imaging and diffusion tensor imaging,

6.3.6 When metabolic disorders are suspected, magnetic resonance spectroscopy (MRS) may be helpful,

6.3.7 Functional MRI has been used as a part of pre-surgical evaluation and planning.

6.4 Children younger than 2 years require special sequences, as immature myelination affects the ability to identify common causes of epilepsy[1]:

6.4.1 In addition to a 3D dataset, imaging in children younger than 2 years should include sagittal, axial, and coronal T1-weighted sequences.

6.4.2 Volumetric T1-weighted sequences are less useful before one year of age due to incomplete myelination on T1 sequences.

6.4.3 MR imaging (especially high-resolution T2 images) performed early in the first year of life in infants with epilepsy is important to identify areas of cortical or subcortical dysplasia, which can become difficult to identify after myelination.

6.4.4 If MR imaging before the age of 2 years is normal, and seizures persist, then MRI may be repeated at 6-month intervals, and after age 24–30 months when more mature myelination can reveal otherwise unsuspected cortical dysplasia.

7. Angiography

7.1 Angiography should only be performed with prior imaging suggesting a vascular lesion.

REFERENCES

1. Gaillard WD, Chiron C, Cross JH, Harvey AS, Kuzniecky R, Hertz-Pannier, Vezina LG; ILAE, Committee for Neuroimaging, Subcommittee for Pediatric Neuroimaging. Guidelines for imaging infants and children with recent-onset epilepsy. Epilepsia. 2009; 50: 2147–2153.
2. The Royal College of Radiologists. iRefer: Making thebest use of clinical radiology.8th ed. London: The Royal College of Radiologists; 2017. Section P10.
3. Dory CE, Coley BD, Karmazyn B, et al. ACR Appropriateness Criteria® Seizures - Child. Available athttps://acsearch.acr.org/docs/69441/Narrative/. American College of Radiology. Accessed 2017 Jun 2.
4. Lee ST, Lui TN. Early seizures after mild closed head injury. J Neurosurg 1992; 76: 435-439.