

ILAE Commission Report

Recommendations for Neuroimaging of Patients with Epilepsy

Commission on Neuroimaging of the International League Against Epilepsy

1. PREAMBLE

These guidelines are intended to apply to patients with a clear diagnosis of epilepsy. They have been specifically formulated for the management of newly diagnosed patients and those with chronic epilepsy who have not been fully evaluated. They are not designed for full investigation of patients for possible surgical treatment.

2. AIMS AND RATIONALE OF NEUROIMAGING

- 2.1 To identify underlying pathologies such as tumors, granulomas, vascular malformations, traumatic lesions, or strokes that merit specific treatment.
- 2.2 To aid the formulation of syndromic and etiological diagnoses and to give patients, their relatives, and physicians an accurate prognosis.

3. TECHNIQUES

- 3.1 Magnetic resonance imaging (MRI) is clearly the structural imaging modality of choice for investigating patients with epilepsy and is superior to radiographic CT in terms of both sensitivity and specificity for identification of small lesions and abnormalities of the cerebral cortex. Occasionally, CT may be useful as a complementary imaging technique in the detection of cortical calcifications, particularly in patients with congenital or acquired infections.
- 3.2 In nonacute circumstances, MRI is preferable to CT as the first imaging investigation. Imaging should include T₁- and T₂-weighted sequences to cover the whole brain in a minimum of two orthogonal planes, with the minimum slice thickness obtainable on the scanner used. Gadolinium contrast enhancement is not necessary in routine cases but may be helpful in selected cases if the

noncontrast-enhanced MRI scan is not definitive. Ideally, particularly in patients with partial epilepsy or fixed deficit evident on neurological or neuropsychological examination, sequences should include volume acquisition with thin partition size (≤ 1.5 mm) to allow reformatting in any orientation; three-dimensional reconstruction may be appropriate. In the first 2 years of life, myelination is incomplete, resulting in a poor contrast between white and gray matter and thus in difficulties in detecting cortical abnormalities. In contrast, white matter disorders are better recognized since the normal signal of myelin (which varies according to age) and the topography of the brain are well known. In such young patients, MRI scans may not reveal lesions and scans may have to be repeated again after 1-2 years.

- 3.3 Radiographic CT scans are usually initially obtained without use of intravenous contrast material. If such a scan is unclear, further clarification may be achieved by obtaining a second scan with use of intravenous contrast. If available, however, an MRI scan is likely to provide more information.
- 3.4 Scans must be interpreted in the context of the entire clinical situation. Images must be reviewed by a specialist in neuroimaging who has training and expertise in the neuroimaging of epilepsy. This person usually is either a radiologist with particular training and experience in neuroradiology or an appropriately experienced clinician.
- 3.5 Conventional isotope brain scans do not provide sufficient information about brain structure to identify many lesions associated with seizures, and their use is not recommended. The functional imaging modalities single photon emission computed tomography (SPECT) and positron emission tomography (PET) are also inadequate for assessment of brain structure.

4. THE ACUTE SITUATION

In the acute situation of seizures developing in the context of a neurological insult such as head injury, intracranial hemorrhage, or encephalitis, radiographic CT scan is an appropriate initial investigation if MRI is not

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readily available or cannot be performed for technical reasons (e.g., a patient who has a cardiac pacemaker or who is dependent on a respirator) or if there is a need to have ready access to the patient during scanning.

5. THE NONACUTE SITUATION: IDEAL PRACTICE

In the nonacute situation, the ideal practice is to obtain structural neuroimaging with MRI in all patients with epilepsy, except in patients with a definite electroclinical diagnosis of idiopathic generalized epilepsy (benign myoclonic epilepsy of infancy, childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy), or benign epilepsy of childhood with centrotemporal spikes.

MRI is particularly indicated in patients with one or more of the following:

- a. Onset of seizures at any age with evidence of a partial onset on history or EEG
- b. Onset of unclassified or apparently generalized seizures in the first year of life or in adulthood
- c. Evidence of a focal fixed deficit on neurological or neuropsychological examination
- d. Difficulty in obtaining control of seizures with first-line antiepileptic drug treatment
- e. Loss of control of seizures with antiepileptic drugs

or a change in the seizure pattern that may imply a progressive underlying lesion

6. THE NONACUTE SITUATION: MINIMUM-STANDARDS

- 6.1** Appropriate minimum standards vary between different countries and societies, according to economic and geographical factors and the system for providing health care.
- 6.2** Radiographic CT scanning is an alternative procedure if MRI is not available or cannot be performed for technical reasons. Radiographic CT scans will usually identify large structural abnormalities. However, hippocampal sclerosis and small lesions such as low-grade tumors, cavernomas, developmental abnormalities, and hamartomas may be missed, particularly in the temporal lobe.
- 6.3** The following are regarded as essential indications for the performance of MRI scans:
 - a. Partial or secondarily generalized seizures, and apparently generalized seizures, that do not remit with antiepileptic drug treatment.
 - b. Development of progressive neurological or neuropsychological deficits.