Diagnostic Imaging Pathways - Seizure (Investigation)

Population Covered By The Guidance

This pathway provides guidance on the imaging of patients presenting with their first episode of seizure. A protocol for imaging patients with recalcitrant seizures is also included.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

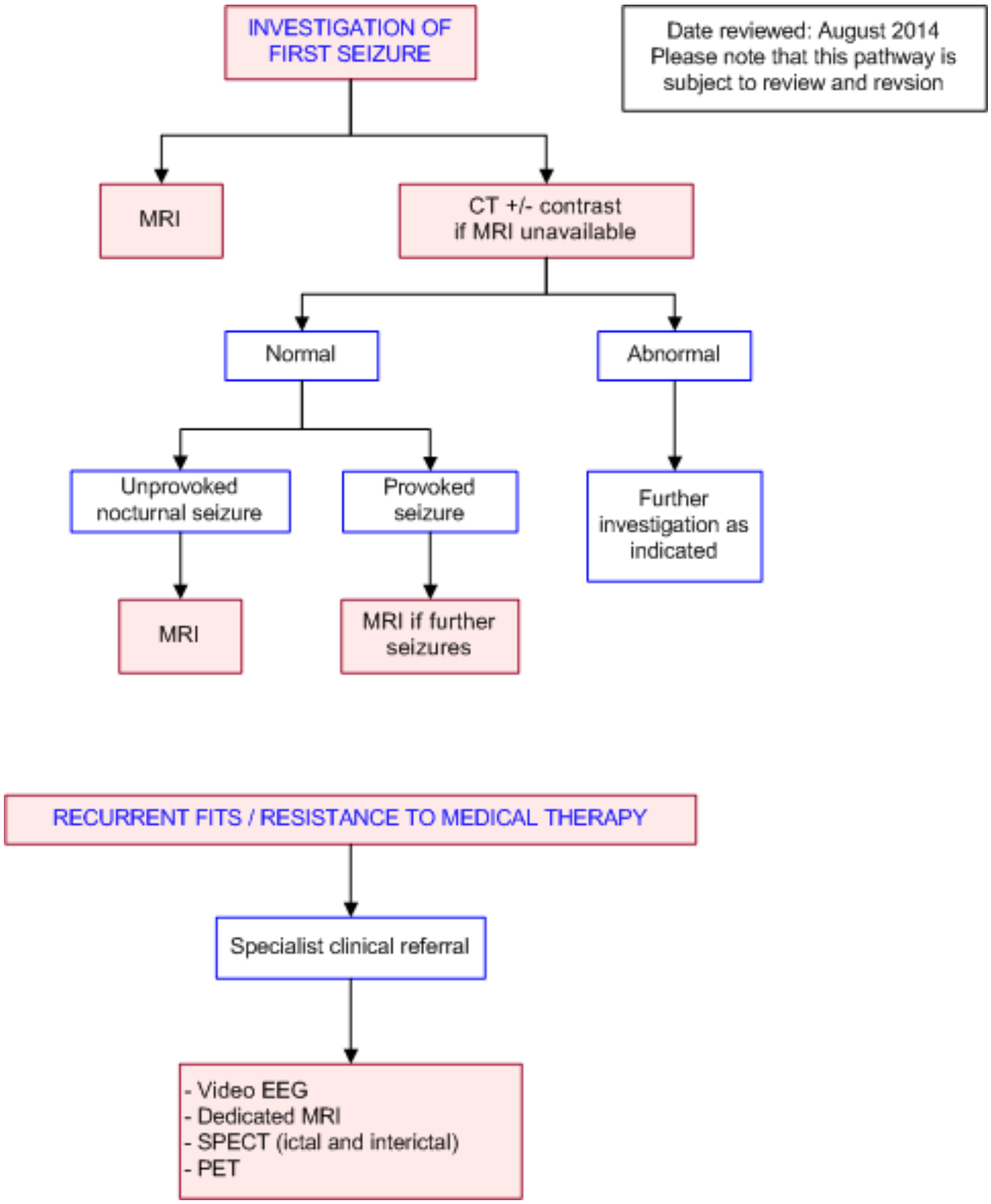
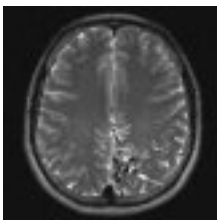


Image Gallery

Note: These images open in a new page

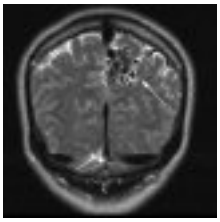
1a **Arterio-Venous Malformation**

Image 1a and 1b (Magnetic Resonance Imaging): Axial and coronal images



demonstrating a large left parieto-occipital arterio-venous malformation (arrows).

1b



Teaching Points

- Patients without a provoked cause of first seizure require further evaluation through imaging
- In the emergency setting, contrast enhanced CT of the brain is a useful initial investigation
- MRI can depict subtle abnormalities that may go unrecognised on CT. Specific seizure protocols may be utilised in order to identify the epileptogenic focus
- Refractory epilepsy requires specialist referral. Video EEG, SPECT and PET have a role in this sub-group of patients

Computed Tomography (CT)

- When MRI is unavailable, CT is the next best imaging modality for establishing the cause of seizures and is able to detect early surgical lesions in the acute setting 11,12
- Can identify large structural abnormalities and remains adequate in the emergency or perioperative setting 1,13,14
- The role of contrast administration for both CT as well as MRI needs to be assessed 19
- CT head with contrast enhancement may be useful in the setting of a focal seizure, neurological deficit, possible trauma, or absence of history of alcohol misuse
- Limitations: less sensitive than MRI at detecting the nature of the abnormality and demonstrating more subtle lesions such as encephalitis, hyperacute infarction, small mass lesions including tumours and vascular malformations, hippocampal sclerosis and developmental cortical malformations 7-10

Magnetic Resonance Imaging (MRI)

- Imaging modality of choice for evaluation of epilepsy 1,2
- Usually recommended in all patients with first seizure 3,4
- Imaging technique used depends on the specific type of seizures suspected on clinical assessment and EEG eg a dedicated temporal lobe protocol for clinically suspected temporal lobe epilepsy or high resolution imaging through a possible epileptogenic region in those with clinically suspected extratemporal epilepsy 2
- The identification of a lesion in extratemporal areas or of atrophy/increase signal in temporal lobe by qualitative or quantitative MRI, has a high correlation with the site of epileptogenesis 5
- Allows diagnosis and provides prognostic information which can alter management for the

individual patient with newly diagnosed partial seizures 6

- Superior to CT in detection of cerebral lesions related to epilepsy, especially gliomas and cavernous malformations. Therefore, MRI may be needed to image patients with normal or inconclusive CT 3,7-10
- MRI will be needed to detect and assess epileptogenic lesions unless there is an established provocative event
- Limitations
    - Limited availability and expense
    - Patients with contraindications to MRI

Magnetic Resonance Imaging (MRI) in Refractory Epilepsy

- Essential for pre-surgical evaluation of patients with uncontrolled epilepsy considered for surgery 15,16
- MRI can provide quantitative and qualitative assessment and information and should be targeted to the area of clinical and EEG abnormalities (e.g. temporal or frontal lobe epilepsy) 1,5
- Provides the anatomical resolution necessary for more accurate interpretation of functional imaging studies such as, SPECT and FDG-PET

Positron Emission Tomography (PET)

- Functional imaging technique allows presurgical localisation of seizure focus in patients with medically refractory partial seizures 5,18
- During focal seizures, cerebral metabolic activity increases in the epileptogenic area, and PET reveals localised hypermetabolism. Interictal FDG-PET is useful for localisation of the epileptogenic region in patients with clinical syndrome of refractory mesial temporal lobe epilepsy or with suspected neocortical temporal lobe epilepsy 18
- Interictal FDG-PET has sensitivity of 84% and specificity of 86% for temporal lobe epilepsy and 33% sensitivity and 95% specificity for extratemporal epilepsy 5
- Useful in cases where there is discordant information eg EEG shows right temporal focus and MRI shows left mesial temporal sclerosis, or if MRI is normal in a patient with clinical/electrographic evidence of temporal epilepsy or if there is bilateral mesial temporal sclerosis. Also may be of value where there is "dual pathology" eg temporal sclerosis and a structural abnormality of uncertain significance elsewhere
- Limitations: expensive and limited availability

Single Photon Emission Computed Tomography (SPECT)

- Functional imaging technique useful in localisation of the seizure focus in the presurgical evaluation of patients with medically refractory epilepsy 5,17
- Useful in cases where there is discordant data in temporal lobe epilepsy, non-lesional temporal or extratemporal epilepsy
- A seizure focus typically manifests as a focus of hypoperfusion on interictal examinations and as a focus of increased perfusion on ictal examinations 17
- Ictal scans are compared with interictal baseline examination to detect subtle changes 17
- Usually concurrent video EEG is required to allow correlation of the blood flow changes with clinical and electrophysiological changes

- Limitations: difficult interpretation requiring knowledge of seizure type, clinical activity, time of ictal injection in relation to seizure onset, and MRI findings 5

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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