Seizure: acute investigation and management

A seizure is a common presentation to the accident and emergency department, with approximately 10% of the population suffering a single seizure at some point in their life with a 3% chance of having epilepsy (Hauser et al, 1990). This article focuses on adult seizure only.

When a patient presents with a seizure there are six important things which the clinician must consider:

1. Is it really a seizure?
2. Was the seizure provoked?
3. Is this the first seizure or has the patient got a history of previous seizures?
4. Are there any special circumstances in this case?
5. Does the patient need treatment?
6. What needs to happen next?

1. Is it really a seizure?

A single seizure can be a diagnostic dilemma as there is a wide differential for altered consciousness from a first presentation of epilepsy to syncope, psychogenic non-epileptic seizures, vascular events, hypoglycaemia, movement disorders and drop attacks (Smith, 2012).

A good clinical history is really important at the first presentation from both the patient and, crucially, a witness if at all possible. Include a list of witnesses and mobile phone numbers in the patient's notes or discharge letter if possible.

Try to determine if there was a prodrome, a change in the mood or behaviour in the patient which may precede the seizure by a few hours.

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The patient may describe an aura which occurs immediately before the seizure and can be used to localize a focal lesion, as would the onset of abnormal movements in one limb.

A description of abrupt onset unresponsiveness followed by stiffness and jerking with cyanosis and grunting then confusion is convincing for a tonic-clonic seizure, whereas a patient lying flat and mainly still with pallor (suggestive of a cardiovascular cause), loose body tone and rare twitching movements is not.

There may be a post-ictal period in which the patient is disorientated and confused. A prolonged post-ictal period would be unusual in a syncopal event.

Review birth and development history, history of febrile seizures, previous head injury, stroke or intracranial infection and family history of epilepsy.

Document any event you see: focal onset *vs* generalized (*Table 1*), body tone at the time of the seizure, and degree of responsiveness during and after the event.

In accordance with the National Institute for Health and Care Excellence (2012) guidelines after an event suspicious for a seizure a patient should undergo a thorough physical examination including neurological and cardiac examination. The neurological examination should identify whether there are focal signs, especially if there is a suggestion that the seizure was focal in onset, and whether there is evidence of raised intracranial pressure.

There are no investigations available in the accident and emergency department that will definitively provide a diagnosis of epilepsy, but it is important to do some investigations to see whether there are any provoking factors for a seizure, or whether there may be another cause for the loss of consciousness. In the first instance this will include:

- Bloods, looking particularly at electrolyte disturbances, infective markers and glucose level. Prolactin and lactate levels are not sensitive for seizure activity and normal levels do not exclude a seizure
- Drug levels can be useful if non-compliance or drug toxicity is suspected (Stepanova and Beran, 2015)
- 12-lead electrocardiogram is essential to look for a cardiac cause for the presentation
- Urinalysis and chest X-ray if there is a suspicion of infection
- If there is a suspicion of raised intracranial pressure or focal signs on examination neuroimaging should be performed (National Institute for Health and Care Excellence, 2012).

A patient who has a single, unwitnessed event with full recovery and normal examination should be given advice about lifestyle and driving (*Table 2*) and referred to 'first-fit' neurology clinic for review to make a decision on diagnosis (Dunn et al, 2005).

2. Was the seizure provoked?

Approximately 25–30% of first seizures are 'provoked' and are called acute symptomatic

Table 1. Features of focal and generalized seizures

Partial (focal/local) seizures	Originate within a single hemisphere and imply focal cerebral disease with seizure arising from the cortex Motor, sensory or autonomic signs/symptoms Simple partial seizures are those in which consciousness is not impaired Complex partial seizures have impaired consciousness Partial seizures can evolve into generalized seizures
Generalized seizures	Bilateral cortical and subcortical involvement with impaired consciousness from the outset Forms: Absence, myoclonic, clonic, tonic, tonic-clonic, atonic

Adapted from Berg et al (2010)

Table 2. Advice to patients after first seizure

Driving	Cannot legally drive without informing the DVLA and following their advice (dvla.gov.uk/drivers). They should be aware that they would be breaking the law if they drive without DVLA guidance and their motor insurance would be void in the event of an accident, even if they did not have a seizure
Bathing	Avoid taking a bath (take a shower instead) and leave the bathroom door unlocked
Sports	Let an attendant know if swimming. Safety consideration before activities like cycling or rock climbing
Cooking	Turn handles inwards when cooking to avoid knocking them over and causing burns if they have a seizure
What to do	Lie down somewhere safe if there is time, carer should not try and move the patient, put them in the recovery position on the left side. Take a video on smart phone if possible. Call an ambulance if fitting for more than 5 minutes or ongoing without recovery

From Dvla.gov.uk and www.epilepsysociety.org.uk

Table 3. Provoking factors for seizures

Cerebrovascular disease	Arterial or venous infarction Intracranial haemorrhage
Infection	Meningitis Encephalitis Cerebral abscess Tuberculosis Neurocysticercosis HIV
Head injury	
Inflammatory	Multiple sclerosis Neurosarcoid Cerebral vasculitis Immune-mediated encephalitis
Metabolic	Hypo- or hyperglycaemia Hypo- or hypernatraemia Hypo- or hypercalcaemia Hypomagnesaemia Liver failure Eclampsia
Toxins	Recreational drugs Animal, fungal and plant toxins
Space-occupying lesion	
Cerebral atrophy in the elderly	

Adapted from Powell and McLauchlan (2012)

seizures. They are defined as occurring at the time of, or in close temporal relationship with, a documented CNS or systemic insult (Beghi et al, 2010). This insult may be structural, toxic, infective, inflammatory or metabolic. In contrast, sleep deprivation, alcohol or recreational drug use, and strobing lights are considered 'triggers' in susceptible individuals with an underlying epilepsy disorder (Pohlmann-Eden et al, 2006).

It is important to determine whether a seizure was unprovoked or provoked because of the long-term prognosis for the patient. There is a 64.8% 10-year risk of seizure recurrence after an unprovoked seizure, compared with an 18.7% risk of unprovoked seizure after a provoked seizure (Hesdorffer et al, 2009). In acute symptomatic seizures the management priority is treating the underlying aetiology with possible temporary use of antiepileptic drugs to manage seizures during the acute phase, but commencing prophylactic antiepileptic drugs is controversial (Beghi et al, 2010).

3. Is this the first seizure or has the patient got a history of previous seizures?

In the case of a first seizure, National Institute for Health and Care Excellence guidelines (2012) recommend onward referral to a neurologist (or other specialist in the management of epilepsies) when either a first epileptic seizure is suspected or there is diagnostic doubt. This should happen within 2 weeks of the event in order to ensure precise and early diagnosis.

Patients may present to accident and emergency following a second generalized seizure before they have been seen in the first fit clinic. In addition, patients may have had previous undiagnosed simple or complex partial seizures without realizing they were seizures. It is therefore worth asking specifically about episodes of déjà vu, abnormal smells or tastes or feelings of fear in the pit of their stomach. Two seizures within a 24-hour period are considered a single seizure event (Kho et al, 2006).

If a patient already has a diagnosis of epilepsy it is important to do a bit more detective work to find out more about the patient's seizures. This information may be available through the patient's GP, through old discharge letters or through the epilepsy specialist nurse if there is one available locally.

- Is this the patient's normal seizure type and frequency? If not, why not?
- What medication is the patient normally on and at what dosage? Is the patient compliant?
- Has the patient started any new medications that may interact with their antiepileptic drugs? Common drugs which can interact with antiepileptic drugs and increase seizure frequency include antimicrobials, cardiovascular drugs, gastrointestinal drugs, certain herbal remedies, immunosuppressants, psychotropic drugs, steroids and analgesics (see Patsalos and Perucca, 2003 for more information)
- Does the patient have any triggering factors?

4. Are there any special circumstances in this case?

Pregnancy

If a pregnant woman presents with a first seizure you must consider whether it could be eclampsia. Eclampsia can occur after the 20th week of pregnancy up to a few days post-partum and is defined as seizures and/or coma in the presence of hypertension and proteinuria. Magnesium is effective in treating eclamptic seizures (National Institute for Health and Care Excellence, 2010) but definitive management is delivery of the baby (Koopmans et al, 2009) so urgent discussion with an obstetrician is required. Pregnant and postpartum women are also at increased risk of cerebral venous sinus thrombosis as a result of the pro-coagulant state of pregnancy (Saposnik et al, 2011) and posterior reversible encephalopathy syndrome, both of which can lead to seizures. These patients require urgent neuroimaging on presentation if they have evidence of raised intracranial pressure or focal neurology (National Institute for Health and Care Excellence, 2012).

If the patient is known to have epilepsy and she is on antiepileptic drugs, ask about

her seizure frequency during the pregnancy and whether seizures are increasing. If there is an increase in frequency then you must check antiepileptic drug levels as these can change with the physiological changes in pregnancy. Please discuss with the on-call neurology team. Remember that pregnant women carry their own maternity notes, and recording relevant information there will make it readily apparent to the obstetric team.

Alcohol

Approximately 40% of emergency seizure presentations are related to alcohol intoxication or withdrawal (McMicken and Liss, 2011). In addition, these patients are more at risk of metabolic derangements, head injuries and vascular events which may provoke a seizure. In the acute environment, treat electrolyte abnormalities, consider computed tomography of the head for intracranial pathology and treat alcohol withdrawal seizures (e.g. benzodiazepines) in combination with thiamine replacement (National Institute for Health and Care Excellence, 2011). Long-term treatment with antiepileptic drugs is not currently recommended in recurrent alcohol-related seizures, but bear in mind that these patients may have underlying epilepsy and if you think this may be a possibility they should be referred for a neurology opinion.

Encephalitis

Infective

In patients presenting with headache, fever and altered mental function combined with seizures, viral encephalitis would be top of the differential. An urgent computed tomography scan of the head must be performed before lumbar puncture, with empirical antiviral and antibiotic treatment given while awaiting the lumbar puncture results (Solomon et al, 2012).

Non-infective

The immune-mediated encephalitides are increasingly being recognized as causes of seizures. NMDA receptor encephalitis usually presents with a subacute history of a combination of neuropsychiatric features, dyskinesias and autonomic features, with seizures in up to 75% of cases (Dalmau et al, 2008). Anti-voltage gated potassium channel antibodies can cause limbic encephalitis with sub-acute cognitive decline, partial-onset seizures and neuropsychiatric features. If the history is suspicious, discuss with neurology (Zuliani et al, 2012).

5. Does the patient need treatment?

In the acute setting seizures which have not spontaneously resolved should be treated with a lorazepam 4 mg bolus and repeated after 10 minutes if necessary to try and prevent the development of status epilepticus (National Institute for Health and Care Excellence, 2012). Status epilepticus is a life-threatening state of ongoing or repetitive seizures without full recovery of motor, sensor and/or cognitive function for at least 30 minutes. Intravenous loading of phenytoin is recommended with cardiac monitoring (because of the risk of arrhythmia) at 15 mg/kg over 20 minutes (National Institute for Health and Care Excellence, 2012). If the patient is known to be on phenytoin and has apparently been compliant, or is known to have a reaction to phenytoin, then sodium valproate (20 mg/kg) (Agarwal et al, 2007) or levetiracetam (20 mg/kg) (Misra et al, 2012) can be used in a loading dose to try and terminate status epilepticus (Brophy et al, 2012). If this is unsuccessful, call the anaesthetic on call team, as they will need to give barbiturates or propofol with respiratory support and the patient will typically be taken to the intensive care unit (National Institute for Health and Care Excellence, 2012).

Once the seizures have been terminated, make sure that the patient's regular antiepileptic drugs are prescribed on the drug chart. If he/she is unconscious or drowsy a nasogastric tube or a change to an intravenous formulation may be needed until the patient is able to take his/her tablets again.

Starting antiepileptic drugs

There is an argument for initiating treatment after a first seizure if there is a good history of a seizure and an associated structural lesion meaning the risk of recurrence is high, or if there is a risk of severe injury if seizures recur (e.g. with anticoagulant use, severe osteoporosis or cervical spine fracture) (Pohlmann-Eden et al, 2006). However, treatment with antiepileptic drugs is generally recommended only after a second epileptic seizure and should be initiated on the recommendation of a neurologist, as antiepileptic drugs should only be started after a diagnosis of epilepsy has been confirmed (National Institute for Health and Care Excellence, 2012).

Treatment should be fully discussed with the patient and the antiepileptic drug initiated should be chosen according to the seizure type and epilepsy syndrome and after considering the potential side effects (especially teratogenicity in women of childbearing age), interactions with other medications and the patient's cognitive abilities (National Institute for Health and Care Excellence, 2012).

Table 4. Antiepileptic drugs according to epilepsy classification

Epilepsy classification	Antiepileptic drugs (National Institute for Health and Care Excellence, 2012)
Idiopathic generalized epilepsy syndromes	Sodium valproate – most effective (Marson et al, 2007), but avoid in women of childbearing age because of its teratogenic potential
	Lamotrigine – good side-effect profile but can exacerbate myoclonic seizures; slow dosage increase
	Second line: levetiracetam – very few interactions, can lead to mood disturbance or aggression
	Topiramate – can have more side effects
	Carbamazepine – can exacerbate myoclonic or absence seizures
Focal epilepsies	Lamotrigine
	Carbamazepine
	Levetiracetam or sodium valproate second line

6. What needs to happen next?

For patients who have had a first seizure, many accident and emergency and acute medicine units have a referral pathway

TOP TIPS

- Contact the local epilepsy nurse specialist, they have a wealth of experience, know many of the patients really well and may have the most up-to-date management plan at their fingertips.
- Ask the patient's family and friends to record any further events on a mobile phone.
- Don't forget to give advice about informing the Driver and Vehicle Licensing Agency and safety precautions before the patient leaves hospital.

for a 'First Fit Clinic' which should be completed before the patient is discharged from hospital. The history and examination should be clearly documented in both the notes and referral letter to the first fit clinic. Local guidelines will also dictate whether or not magnetic resonance imaging of the brain and an electroencephalogram should be requested before the first appointment.

While awaiting an appointment and diagnosis the patient and his/her family or carer should be provided with information about:

1. How to recognize a seizure
2. First aid
3. The importance of reporting further attacks
4. Stopping driving and informing the DVLA.

Alternatively, if the patient has known epilepsy and has had one of his/her typical seizures and returned to normal, plus the frequency of seizures is as expected and no other factors have been identified, then the patient can be discharged home with his/her usual medication and dosage. If the patient has a consultant neurologist the discharge letter should be copied to him/her, so that he/she is aware of the admission. However, if the patient is having increased seizure frequency to try and identify why – whether there is a trigger that needs to be avoided or whether the patient requires further antiepileptic drugs to control the seizures. If this is the case the authors would recommend checking any letters on the computer system to see if there is a plan from the patient's consultant to increase the medication or discussing with the on-call neurology registrar or consultant at this point.

Conclusions

Seizures are a frequent cause for presentation to accident and emergency and acute medical units. Careful history taking and examination of the patient at the time of the event is important for determining whether or not a seizure was responsible for a loss of consciousness or whether there is another cause. Whether it is a provoked seizure, a first seizure or the patient has a history of epilepsy affects the management in the acute medical setting. **BJHM**

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KEY POINTS

- It is important to identify whether a seizure is unprovoked or an acute symptomatic seizure, as this has implications for prognosis and management of the patient.
- First seizure requires rapid assessment and investigation by a neurologist to make or confirm a diagnosis of epilepsy.
- Consider whether there is any evidence of pregnancy, excess alcohol consumption or encephalitis which will alter your management plan.

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