The prevalence of epilepsy in the UK is one in 103, meaning there are about 610,000 people with the condition (Joint Epilepsy Council, 2011). Although 70-80% of people can have their seizures completely controlled, usually by anti-epileptic drugs (AEDs), the condition carries a significant physical and emotional burden. In addition, optimal treatment is not available to everyone, and estimates indicate that only 52% of people with epilepsy in the UK are seizure-free (Moran et al, 2004).

Knowledge of epilepsy among medical and nursing professionals is often poor. Providing more education to health professionals in generalist roles would improve the quality and consistency of advice given to patients and in turn make an important difference to how the condition is managed. This article provides an overview of epilepsy, from classification and diagnosis to acute treatment and long-term management.
called partial seizures;
- Generalised-onset;
- Unknown-onset.

**Focal-onset seizures**
Focal-onset seizures are defined as “originating within networks limited to one hemisphere” (Berg et al, 2010). They can occur with or without impairment of awareness (previously termed ‘simple partial seizure’ and ‘complex partial seizure’, respectively).

Focal seizures without impaired awareness can simply involve an odd sensation such as déjà vu or memory flashback, or motor manifestations such as clonic jerking in one side of the body (typically the face). These symptoms can evolve so that consciousness becomes impaired; at that point, automatisms such as lip smacking, fiddling with objects or even removing clothing can occur. Seizures originating from the frontal lobe can produce relatively brief hyperkinetic – sudden, often frenetic and violent – movements (hyper-motor seizures), usually during sleep, and are often confused with psychological conditions.

A focal seizure can evolve to a generalised seizure (usually tonic-clonic) with complete loss of awareness, open eyes and stiffening and jerking on both sides of the body, typically lasting 1-3 minutes, after which the person will be deeply unresponsive for a few minutes. An electroencephalogram (EEG) will show minimal brain wave activity, and this seems to be the time when they are most at risk of sudden unexpected death in epilepsy (SUDEP). When beginning to respond, they will be confused, tired, possibly nauseous or headachy, and may have bitten their tongue. Some recover quickly while others take several days to return to their usual selves.

These post-ictal (after seizure) symptoms are caused by a release of gamma-aminobutyric acid (GABA), which acts almost like the brain’s natural anaesthetic. When the symptoms are thought of in these terms, it becomes clearer why they occur. Their absence after a tonic-clonic seizure should arouse suspicion as to the nature of the episode.

**Generalised-onset seizures**
Generalised-onset seizures are defined as “originating at some point within, and rapidly engaging, bilaterally distributed networks” (Berg et al, 2010); they occur without warning and do not evolve like focal-onset seizures. However, a generalised tonic-clonic seizure can be preceded by a series of absences or myoclonic jerks.

Absences are often confused with the impaired awareness seen in focal seizures. They happen without warning; the person will usually stop what they are doing and stare blankly for between five and 15 seconds, and then return to their usual self without any post-ictal symptoms.

Myoclonic jerks consist of a bilateral twitch occurring on its own, or a series of discrete jerks occurring over several minutes (rarely for longer). The jerks often occur soon after waking and can be sufficient for the person to drop objects. They typically start in the teenage years and are often ignored until a tonic-clonic seizure occurs. Patients presenting with new-onset tonic-clonic seizures in late childhood, adolescence or early adulthood should be asked about this. Placing the question into a scenario can be helpful – asking, for example, “Are you clumsy at the breakfast table? For example, do you drop drinks?”

Generalised tonic-clonic seizures are similar to focal seizures except there is no warning and, usually, no lateralising signs (symptoms occurring only on one side of the body). Other types of generalised seizures are rarer and usually occur in the more severe epilepsy syndromes, which often coexist with ID.

Tonic seizures involve a stiffening of the body and the person often falls backwards, sustaining an occipital head injury. Atonic seizures involve a complete loss of muscle tone, the person reacting almost like a puppet having its strings cut, so frontal head and facial injuries are common. These two seizure types are often called ‘drop attacks’.

**Diagnosis**
It is estimated that 20-31% of people diagnosed with epilepsy do not actually have the condition; this could equate to 137,000 misdiagnoses in the UK every year (Joint Epilepsy Council, 2011).

The diagnosis of epilepsy is primarily one of clinical judgement. The video-recording capabilities of mobile phones now allow epilepsy specialists to view seizures almost at first hand. However, it remains vital to be able to describe them accurately. The ILAE classification (Fisher et al, 2017) emphasises the significance of what happens at the onset of a seizure, which usually gives more clues than subsequent symptoms but is often missing on mobile phone videos. Health professionals should, therefore, always try to obtain an eyewitness account of the seizure; this is one of the parameters used to measure the quality of secondary care intervention after a seizure (Dixon et al, 2015).

There are certain ‘red flags’ in seizure histories that should prompt health
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Capturing a seizure on EEG is usually diagnostic, but is difficult to do in practice.

Professionals to question a diagnosis of epilepsy:
- Seizures in the same person are stereotyped, so symptoms change over time should arouse suspicion;
- Eyes are almost always open in seizures and there should be no resistance to the eye being manually opened;
- Violence in seizures is unusual and is not directed at a specific person or object;
- Convulsive (tonic-clonic) seizures follow the pattern described above – convulsions with sudden onset or offset that sometimes occur on the right and sometimes on the left or bilaterally, and may start and stop several times in the space of a single episode, should arouse suspicion;
- The absence of post-ictal symptoms after a convulsive seizure or, conversely, long recovery times, are unusual in epileptic events.

There are no easily accessible tests that can definitively differentiate between epilepsy and other events resembling seizures, which can be physical (such as vasovagal syncope) or psychological (such as non-epileptic attack disorder).

Interictal (between seizure) EEG is useful for classifying epilepsy but not for diagnosing it. Frustratingly, it can reveal non-specific abnormalities, or even be completely normal, in people who have clearly experienced an epileptic seizure; conversely, abnormalities can be found in people who do not have epilepsy. An older study in pilot cadets suggest that around 3% of the general population will have an epileptiform EEG but never experience a seizure (Trojaborg, 1992).

Capturing a seizure on EEG is usually diagnostic, but is difficult to do in practice. Few centres have inpatient monitoring (video telemetry), and while ambulatory EEG services are becoming increasingly common they are not universal.

Intercranial imaging (with magnetic resonance imaging unless contra-indicated) can help identify the aetiology of seizures. Other clues come from electrocardiogram (ECG), which is mandatory for all events involving a loss of consciousness and collapse, and a routine biochemical screen.

Medication

The treatment of focal epilepsies differs from that of generalised epilepsies, so first-line medication should be chosen accordingly. Both the National Institute for Health and Care Excellence (2012) and the Scottish Intercollegiate Guidelines Network (2015) guidelines reach similar broad conclusions, stating that:
- Focal epilepsies should be treated with lamotrigine or carbamazepine;
- Sodium valproate (unless contra-indicated) is the most effective option for generalised epilepsies.

However, this oversimplifies the treatment of epilepsy. Some drugs can exacerbate certain seizure types. Carbamazepine, gabapentin, oxcarbazepine, phenytoin, pregabalin, tiagabine and vigabatrin should be avoided when treating absence or myoclonic jerks. AEDs should be used with caution in people with psychiatric comorbidities or IDs and in older people.

All AEDs have teratogenic potential (that is, can be harmful to a foetus), although there are significant differences in the level of risk, both between drugs and with increasing doses of the same drug. While sodium valproate remains a first-choice treatment for men with generalised epilepsy, the harm it can do to an unborn child means it must be avoided for women of childbearing age. Warnings about the drug’s teratogenic effects now clearly

### Treatment

Anti-epileptic drugs are the mainstay of treatment. There are now over 20 medications licensed for epilepsy in the UK, most of which have appeared in the last 30 years (Fig 2). Compounds – some novel and others that modify previously proven modes of action – continue to be launched. Despite these new drugs, overall seizure-freedom rates have remained static for over 50 years. However, there have been significant improvements in side-effect profiles, particularly around sedation, and some compounds have advantages over others in specific types of epilepsy. A recent meta-analysis of available treatment options tends to corroborate that new drugs are better tolerated than older ones (Nevitt et al, 2017).

![Fig 2. Development of anti-epileptic drugs](image-url)

**Fig 2. Development of anti-epileptic drugs**

<table>
<thead>
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<th>Medication</th>
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<tr>
<td>Brivaracetam</td>
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Review

feature on its packaging, and health professionals have been issued with patient information leaflets (Medicines and Healthcare products Regulatory Agency, 2016). Many generalised epilepsies that begin in childhood persist into adulthood and may indeed be lifelong, so paediatric colleagues need to be mindful of these risks when considering treatment for younger girls. Women of childbearing age must receive careful pre-conceptual counselling (Kinney and Morrow, 2016).

Surgery
Patients who are not seizure-free after adequate trials of two AEDs suitable for their type of epilepsy should be referred to a tertiary centre, where surgical options can be considered. The surgical resection of the epileptogenic focus can be highly effective in some types of epilepsy, obtaining freedom from seizures in 66% of patients with epilepsy arising from the temporal lobe (Tellez-Zenteno et al, 2005).

Discoitive procedures, such as corpus callosotomy or multiple subpial transaction, are sometimes considered in severe epilepsies, when resection is not possible, as is vagal nerve stimulation (VNS). In VNS, electrical impulses are sent through the left vagus nerve, which has direct connections to the brain’s limbic system. Over time, this appears to reduce seizures in about half of patients who undergo treatment, although only a relatively small number actually become seizure-free.

Alternative therapies
Some alternative therapies have been suggested for people with epilepsy. In general, relaxation can be helpful, using techniques such as yoga, meditation, aromatherapy, hypnosis or biofeedback.

There is robust evidence supporting dietary treatment for epilepsy, particularly in children. Traditionally, a ketogenic diet, which severely restricts carbohydrates and fuels the body with fat and protein, has been used. There is currently one centre in the UK offering a dietary treatment approach to adults with epilepsy, and a handful of specialist centres offering it to children. Ketogenic diets, or variations such as the modified Atkins diet, need to be carefully monitored. More information can be found through the charity Matthew’s Friends (www.matthewsfriends.org).

Herbal preparations have been used for centuries to treat seizures, but there is no robust evidence of their efficacy. Randomised clinical trials of cannabinoids are underway (Rosenberg et al, 2015). Patients who wish to try herbal remedies must be advised that:

- Most tinctures contain alcohol, which can trigger seizures, as can the oil of evening primrose;
- Some herbal treatments, notably St John’s Wort, interact with anti-epileptic drugs (Bit.ly/NICEStJohnsWort).

Alternative therapy needs to be carefully tailored to the individual. There is no ‘one size fits all’ approach. Complementary treatments should be used alongside conventional treatments, rather than as a substitute for them.

Treating status epilepticus
Some seizures can be life-threatening. Prolonged or repeated seizures can progress to status epilepticus (SE). In the past, this was defined as one or multiple seizures lasting for more than 30 minutes, but the definition has recently been revised by the ILAE, which now states that: “Status epilepticus is a condition resulting either from the failure of the mechanisms responsible for seizure termination or from the initiation of mechanisms that lead to abnormally prolonged seizures (after time point t1). It is a condition that can have long-term consequences (after time point t2), including neuronal death, neuronal injury, and alteration of neuronal networks, depending on the type and duration of seizures.”

“This definition is conceptual, with two operational dimensions: the first is the length of the seizure and the time point (t1) by which the seizure should be regarded as ‘continuous seizure activity’” (Trinka et al, 2015).

In the case of convulsive (tonic-clonic) SE, the two time points have been estimated to be five minutes for t1 and 30 minutes for t2, based on animal experiments and clinical research. In the case of other forms of SE, the evidence is not sufficient to offer sound estimates of t1 and t2 (Trinka et al, 2015).

People with established epilepsy rarely develop SE, which often presents as a first seizure – unless there is a long-term underlying condition, such as a cerebral tumour, or coexistence of ID.

On arrival at the emergency department, patients experiencing prolonged seizures need careful and rapid assessment. Consideration needs to be given to what has caused the seizure; infection, drugs, alcohol or abruptly stopping AEDs are the most likely causes in those with pre-existing epilepsy. In new cases, the cause is almost always acute cerebral events such as infection, trauma, cerebrovascular disease, acute toxic or metabolic disturbances, tumours or childhood febrile illnesses. NICE provides detailed recommendations on how to treat convulsive SE in adults (NICE, 2012).

Any seizure can progress to SE, and treatment depends on seizure type. Non-convulsive forms are often difficult to detect; it is convulsive SE that is life-threatening and requires rapid treatment. NICE provides guidance on emergency AED therapy for convulsive SE (NICE, 2012), but protocols should also be available in every emergency department.

Speed is of essence: by the time patients arrive in hospital, it is likely that they have already been in seizure for more than 30 minutes, so it is possible that long-term cerebral damage may already be occurring (Trinka et al, 2015).

As many as half of patients presenting in emergency departments with presumed convulsive SE do not have epilepsy but non-epileptic attack disorder. It is therefore important that they are assessed by senior members of the medical team (Dixon et al, 2015).

Preventing death
Death from epilepsy does not only result from SE. Accidents, particularly drowning accidents, are not infrequent. Swimming alone (except in lifeguarded areas) and activities that take people near open water need to be carefully considered. There are also obvious risks associated with working at height and with machinery.

However, it is possible to die after a single, usually tonic-clonic, seizure. There

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**Box 1. Situations requiring referral to specialist epilepsy services**

- First suspected seizure
- Acute admission due to severe seizures or status epilepticus
- Increase in seizure frequency and/or severity
- Patient wishing to discuss stopping medication after five years or more of seizure freedom
- Suspected adverse reactions to anti-epileptic drugs
- Suspected misdiagnosis (particularly if actual condition could be non-epileptic attack disorder)
- Female patient wishing to conceive or being pregnant
are perhaps 1,000-1,500 SUDEPs per year in the UK. It is important to counsel people with epilepsy, their families and carers about this, as 50% of deaths could probably be prevented if prompt action was taken (Hanna et al, 2002).

In 2016, the EpSMon app was launched, allowing patients to monitor their individual risk of SUDEP on their mobile phone and to alert their epilepsy team if the risk increases over time. The app, which can be downloaded free of charge for Apple and Android phones (Bit.ly/SUDEPApp), won several patient safety awards.

Nurses’ role
All nurses have a role to play in epilepsy management, whether that is carefully observing and recording seizures in the diagnostic stage, being aware of the importance of giving AEDs in a timely manner when patients are admitted to hospital for other conditions, or knowing when to refer patients for specialist intervention (Box 1).

Both NICE (2012) and SIGN (2015) guidelines state that every patient should have access to an epilepsy specialist nurse. Specialist nurses are increasingly taking the lead in long-term epilepsy management; this trend has accelerated as more nurses have become independent prescribers. Nurses are increasingly leading innovative services (Tittensor, 2013) that bring care closer to patients’ home and improve their access to high-quality treatment; this has accelerated as more nurses have become independent prescribers.

It is likely that there are only 300-400 epilepsy specialist nurses currently practising in the UK. The Epilepsy Nurses Association (ESNA) represents nurses with an interest in epilepsy, whether they are specialist or generalist; it has contributed to the development of the current NICE and SIGN guidelines and produced competency frameworks for nurses working in the specialty (ESNA, 2013). The association is taking the lead in a national project to improve the knowledge of carers, particularly on the use of oromucosal midazolam as a first-line emergency treatment of prolonged seizures (Tittensor et al, 2017).

Future developments
Much current management focuses on the control of seizures using drugs that exert an effect on receptors at the neuronal synapses; some modes of action work better for certain types of seizure. For example, sodium channel blockers are generally the first-line treatment for focal seizures; however, not everyone responds to them.

Work is ongoing around the genetics of epilepsy; in future, it may be possible to genetically determine which treatments may work best for individuals. There have already been case studies of non-AEDs successfully used to treat seizures based on patients’ genetic profiles.

Warning of an imminent seizure could be immensely helpful, allowing a short-term treatment such as cllobazam to be given to ward it off. There is currently a good deal of research into technology that might predict seizures; the latest VNS device monitors changes in heart rate associated with a seizure and automatically triggers stimulation when it detects changes.

Detecting pre-ictal EEG changes may also provide warning of imminent seizures, but there is currently no portable device capable of doing this. However, wrist-worn technology linked to smartphone apps is being assessed, with some promise, for seizure prediction, again using the paroxysmal changes in heart rate that can precede a seizure.

Conclusion
Epilepsy is a fascinating condition. Its diagnosis requires fundamental clinical skills rather than a battery of tests. Nurses, whether specialist or generalist, need to be mindful of changes in patients’ presentation, and take time to record a detailed history at each encounter. While rapid treatment is vital in the acute setting, long-term management requires time, patience and diligence.

Nurses working in partnership with patients are in the best position to improve care, enhance lives and reduce the gap between current management and optimal seizure control. NT

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