

Appendix A

Differential diagnosis of epilepsy in adults and children

1 Differential diagnosis of epilepsy in adults

Professor John Duncan prepared this section

Epileptic seizures need to be considered in the differential diagnosis of a range of clinical presentations. These are principally:

- Loss of awareness
- Generalised convulsive movements
- Drop attacks
- Transient focal motor attacks
- Transient focal sensory attacks
- Facial muscle and eye movements
- Psychic experiences
- Aggressive or vocal outbursts
- Episodic phenomena in sleep
- Prolonged confusional or fugue states

The principal differential diagnoses for each presenting clinical scenario follow with brief explanatory text the key diagnostic features of each diagnosis. It is not uncommon for a patient to come to medical attention after a dramatic event, but not to do so after minor episodes. Understanding the occurrence and nature of minor events is crucial to making an accurate diagnosis. A checklist of symptoms to specifically enquire for is given in Table 1.

Have there been any spontaneous and otherwise unexplained paroxysmal symptoms?

In particular:

Sudden falls

Involuntary jerky movements of limbs whilst awake

Blank spells

Unexplained incontinence of urine with loss of awareness, or in sleep

Odd events occurring in sleep, e.g. fall from bed, jerky movements, automatisms

Episodes of confused behaviour with impaired awareness, recollection

Possible simple partial seizures

Epigastric rising sensation

Déjà vu

Premonition

Fear

Elation, Depression

De-personalization, derealization

Inability to understand or express language (written or spoken)

Loss of memory, disorientation

Olfactory, gustatory, visual, auditory hallucination

Focal motor or Somatosensory deficit, or positive symptoms (jerking, tingling).

Table 1 Checklist of possible seizure-related symptoms to enquire for when considering a possible diagnosis of epilepsy

1.1 Principal differential diagnoses

1.1.1 Loss of awareness

Whatever the cause the patient may have amnesia for both the event and its exact circumstances. The three main causes are: syncope, epilepsy, and cardiac arrhythmias. Transient cerebral ischaemia due to vascular abnormalities is less common. Microsleeps (very short daytime naps) may occur with any cause of severe sleep deprivation or disruption. Other causes of diagnostic confusion are much rarer and include:

hypoglycaemia or other intermittent metabolic disorders, structural anomalies of the skull base affecting the brainstem, or lesions affecting the CSF circulation.

- Syncope

Syncope is the commonest cause of episodes of loss of awareness. Simple faints or vasovagal syncopal attacks can usually be related to identifiable precipitants. Most often they occur on getting up quickly, or standing for prolonged periods, particularly if associated with peripheral vasodilation (e.g. during hot, stuffy weather, crowded trains or rooms, or are related to drug or alcohol use). Frightening, emotional or unpleasant scenes, and painful stimuli may also be triggers, due to increased vagal activity.

There are various other causes of syncopal attacks, and classification depends on terminology. Cough and micturition syncope are well recognised. Changes in intrathoracic pressure (cough syncope), impaired baroreceptors due to atheroma of the carotid (carotid sinus syncope), cardiac arrhythmias, or autonomic disturbances may also lead to cerebral hypoperfusion and fainting. As these may not be due to vasovagal reflex changes, the typical aura of a vasovagal syncope may not be present.

- Epilepsy

Several types of seizure may present with loss of awareness as the sole reported feature. These include absences, complex partial, tonic or atonic seizures.

Typical absences involve arrest of activity, reduced or lost awareness, eyelid blinking or twitching, and sometimes small myoclonic facial or limb jerks, or brief facial automatisms such as lip smacking or chewing. Typical absences are usually brief but often occur many times per day. There may also be isolated myoclonic jerks. Atonic seizures usually give rise to drop attacks but may appear to cause blank spells if the patient is sat or laying down and so cannot fall.

Complex partial seizures may cause loss of awareness with few if any other features. Detailed enquiry must always be made for any associated psychic or motor phenomena that may raise the possibility of a seizure disorder.

- Cardiac disorders

There are often prodromal features similar to simple syncope, as well as palpitations, chest pain, shortness of breath or other features of cardiovascular insufficiency. Attacks due to transient complete heart block are abrupt and short with rapid loss of consciousness. Lack of cardiac output may be due to short episodes of ventricular tachycardia or fibrillation. Prolongation of the QT interval may lead to such events. Attacks may be preceded by palpitations, extreme fatigue or presyncopal features.

Mitral valve prolapse and aortic stenosis may present with episodic loss of awareness due to fluctuating cardiac output or associated arrhythmias. Aortic stenosis and hypertrophic cardiomyopathy is especially prone to present with episodes of sudden collapse with loss of awareness during exercise.

- Microsleeps

Any cause of sleep deprivation may lead to brief day-time naps, sometimes lasting for only a few seconds. Impaired quality of sleep may also be a factor. The most important is obstructive sleep apnoea. Narcolepsy can present with short periods of suddenly falling asleep during the day.

- Panic attacks

Panic attacks usually present with feelings of fear and anxiety, associated with autonomic changes and hyperventilation. This leads to dizziness or light-headedness, orofacial and/or peripheral paraesthesia (which may be asymmetric), carpopedal spasm, twitching of the peripheries, blurred vision, or nausea.

Occasionally these preludes may be forgotten, and attacks present with loss of awareness. Often, but not always, there is a clear precipitant, such as a particular situation. None of these features are consistent, however, and differentiation from epilepsy can be difficult.

- Hypoglycaemia

Hypoglycaemic attacks causing loss of consciousness are extremely rare except in patients with treated diabetes mellitus. Very occasional cases may be seen due

to insulin secreting tumours. In such cases there may be a history of a missed meal prior to the attack.

- Other neurological disorders

If a head injury causes loss of consciousness, there is amnesia. In accidental head injury, particularly road traffic accidents, it may be difficult to distinguish amnesia caused by the injury from cases in which there was a loss of consciousness that caused the accident. Isolated episodes of loss of awareness may also be caused by abuse of psychotropic drugs or other substances. Occasionally, structural CNS abnormalities may present with episodes of loss of awareness.

- Non-epileptic attack disorder (NEAD)

Non-epileptic attack disorder, previously known as pseudoseizures typically gives rise episodes of two broad types:

- (a) attacks involving motor phenomena
- (b) attacks of lying motionless.

The latter are often prolonged, continuing for several minutes or sometimes hours. Such behaviour is very rare in epileptic seizures: there will nearly always be other positive phenomena in epileptic attacks that last for more than a few minutes. In addition, attacks are often triggered by external events or stress. Patients with NEAD often have a history of abnormal illness behaviour. Non-epileptic attack disorder is much commoner in females than males, and usually commences in adolescence or early adulthood (see Table 2).

	Epileptic attack	NEAD
Precipitating cause	Rare	Common, emotional & stress related
When alone or asleep	Common	May be reported
Onset	Usually short	May be short or over several minutes
Aura	Various, usually stereotyped	Fear, panic, altered mental state
Speech	Cry, grunt at onset; muttering, words in automatisms	Semi-voluntary, often unintelligible
Movement	Atonic, tonic; if clonic, synchronous small amplitude jerks	Asynchronous flailing of limbs; pelvic thrusting; opisthotonus
Injury	Tongue biting, fall; directed violence rare	May bite tongue, cheeks, lip, hands, throw self to ground. Directed violence not uncommon
Consciousness	Complete loss in generalized tonic-clonic; may be incomplete in complex partial	Variable, often inconsistent with seizure type
Response to stimulation	None in generalized tonic-clonic; may respond in complex partial and post-ictally	Often reacts and this may terminate episode
Incontinence	Common	Sometimes
Duration	Few minutes	Few minutes, may be prolonged.
Recovery	Depends on seizure type. Few minutes and more prolonged confusion	May be rapid or very prolonged

Table 2 Differentiation of epileptic seizures and non-epileptic attack disorder (NEAD)

1.1.2 Generalised convulsive movements

- Epilepsy

A generalised convulsion is generally the most readily diagnosed epileptic phenomenon. Classically, there is a cry, generalised stiffening of body and limbs, followed by rhythmic jerking of all four limbs, associated with loss of awareness, eyes staring blankly, tongue biting and urinary incontinence. The generalized convulsive movements usually last for a minute or so, and as the attack proceeds the jerking slows in frequency and increases in amplitude. There is often cyanosis, and afterwards irregular breathing followed by confusion, headache and sleepiness.

- Syncope with secondary jerking movements
People who faint often have small, brief myoclonic twitches of the extremities. With prolonged cerebral hypoperfusion these may be more prominent, and be reported as "a convulsion". The myoclonic jerking is usually irregular and short lived.
- Primary cardiac or respiratory abnormalities presenting with secondary anoxic seizures
Episodes of complete heart block may have syncopal features followed by collapse and secondary anoxic seizures. Usually the attacks last for less than one minute.
- Involuntary movement disorders and other neurological conditions
There is no alteration in consciousness. The best known is paroxysmal kinesogenic choreoathetosis. Attacks are usually precipitated by sudden specific movements. They last a few seconds to minutes. Paroxysmal dystonia presents with attacks lasting for minutes to hours. Patients with known involuntary movement disorders such as idiopathic torsion dystonia may show severe acute exacerbations mimicking convulsive movements.
Patients with learning disabilities often have stereotyped or repetitive movements, which may include head banging or body rocking, and more subtle movements which may be difficult to differentiate from complex partial seizures.
- Hyperekplexia
Attacks are characterised by excessive startle, may cause stiffening, and collapse with a sudden jerk of all four limbs. Attacks are provoked by sudden unexpected stimuli, usually auditory. Hyperekplexia needs to be distinguished from seizures induced by startle.
- Non-epileptic attack disorder (NEAD)
Non-epileptic attacks involving prominent motor phenomena are commoner than those with arrest of activity. Movements are varied but often involve semi purposeful thrashing of all four limbs, waxing and waning over many minutes, distractibility or interaction with the environment, prominent pelvic movements and

back arching (Table 2). Non epileptic attacks may be difficult to differentiate from complex partial seizures of frontal lobe origin, which can present with very bizarre motor attacks.

1.1.3 Drop attacks

Any cause of loss of awareness may proceed to a sudden collapse or drop attack.

Epilepsy, syncope and other cardiovascular disorders are the commoner causes of drop attacks.

- Epilepsies

Sudden drop attacks are common in patients with learning disabilities and secondary generalised epilepsies. The falls may be tonic or atonic.

- Cardiovascular

If cerebral hypoperfusion is sufficient to cause sudden collapse there is usually loss of awareness (see above). Syncope and cardiac abnormality are rare causes of a presentation with drop attacks.

- Movement disorders

Most movement disorders that cause drop attacks have other more prominent features which make the diagnosis clear (e.g. Parkinson's disease). Paroxysmal kinesogenic choreoathetosis may cause drop attacks if there is lower limb involvement.

- Brainstem, spinal or lower limb abnormalities

There are usually fixed neurological signs. Tumours of the third ventricle may present with sudden episodes of collapse. Spinal cord vascular abnormalities may present with lower limb weakness leading to falls without impairment of awareness.

- Cataplexy

Cataplexy usually occurs in association with narcolepsy, although it may be the presenting clinical feature. There is no loss of consciousness with attacks.

Attacks may be precipitated by emotion, especially laughter. Often there is only loss of tone in the neck muscles, with slumping of the head rather than complete falls.

- Metabolic disorders

Periodic paralysis due to sudden changes in serum potassium is rare. The condition may be familial or associated with other endocrine disorders or drugs. Usually there is a gradual onset, and the attacks last for hours.

- Idiopathic drop attacks

These attacks are most common in middle aged females. They take the form of a sudden fall without loss of consciousness. Characteristically the patients remember falling and hitting the ground. Recovery is instantaneous, but injury may occur.

- Vertebrobasilar ischaemia

This condition is over diagnosed and probably accounts for very few drop attacks. Typically, the attacks occur in the elderly, with evidence of vascular disease and cervical spondylosis. The attacks may be precipitated by head turning or neck extension resulting in distortion of the vertebral arteries and are of sudden onset, with features of brainstem ischaemia such as diplopia, vertigo, and bilateral facial and limb sensory and motor deficits.

1.1.4 Transient focal motor attacks

The commonest cause of transient focal motor attacks is epilepsy. Tics may develop in adolescence. Paroxysmal movement disorders are rare, although unilateral paroxysmal kinesogenic choreoathetosis may mimic motor seizures. Transient cerebral ischaemia usually presents with negative phenomena. Tonic spasms of multiple sclerosis are usually seen once other features of the illness have become apparent, but may be a presenting feature.

- Focal motor seizures

Focal motor seizures may involve jerking and posturing of one extremity, or reflect the spread of epileptic activity along the primary motor cortex. There is often associated paraesthesia. There may be localised transient weakness following the attack for seconds or minutes, sometimes longer. Seizures arising in many different brain regions may cause dystonic posturing.

Epilepsia partialis continua is a rare form of epilepsy that often causes diagnostic confusion. There is very frequent focal motor activity such as jerking of the hand. This can persist for hours or days, continue into sleep, and may go on for years. The movements often become slow and pendulous, with some associated dystonic posturing.

- Tics

Tics usually present with stereotyped movements in childhood or adolescence, sometimes restricted to one particular action (e.g. eye blink) but may be multiple in nature. Tics may be confused with myoclonic jerks. They can be suppressed voluntarily, although to do so leads to a rise in psychological tension and anxiety that is then relieved by the patient allowing the tics to occur. Repetitive tics and stereotypies are particularly common in those with intellectual disability.

- Transient cerebral ischaemia

Transient ischaemic attacks (TIAs) usually present with negative phenomena, i.e. loss of use of a limb, hemiplegia or other deficits, although positive phenomena such as paraesthesiae may occur. Transient ischaemic attacks may last for a few minutes, but may persist for up to 24 hours. TIAs are not usually stereotyped or repeated with the frequency of epileptic seizures, and there are usually associated features to suggest vascular disease.

- Tonic spasms of multiple sclerosis

These spasms usually occur in the setting of known multiple sclerosis, but may be the presenting feature, although other evidence of multiple sclerosis may be found on examination and investigation. The spasms may last for several seconds, sometimes longer than one minute.

- Paroxysmal movement disorders

Paroxysmal kinesogenic choreoathetosis may present with focal motor attacks that are very similar to epileptic events. Tremor may occur in a variety of movement disorders and is usually sufficiently persistent to elucidate the non-epileptic nature, but may be difficult to distinguish from certain forms of epilepsy partialis continua. Myoclonus of subcortical origin may be suspected from the distribution of involved muscles (e.g. spinal myoclonus may be restricted to specific segments, either unilateral or bilateral). Peripheral nerve entrapment usually presents with weakness but occasionally can present with episodic jerks or twitches.

1.1.5 Transient focal sensory attacks

- Somatosensory attacks

Epileptic seizures involving the primary sensory cortex are less common than motor seizures, and may cause spreading paraesthesia. Seizures involving the second sensory areas or mesial frontal cortex may cause sensory illusions. There are usually other epileptic features due to involvement of adjacent or related brain structures. Transient sensory phenomena may also be seen in peripheral nerve compression or other abnormalities of the ascending sensory pathways, hyperventilation or panic attacks and in TIAs. TIAs are not usually stereotyped or repeated with the frequency of epileptic seizures, and there are usually associated features to suggest vascular disease.

Lesions of sensory pathways cause persistent symptoms, but diagnostic confusion may arise in the early natural history, when complaints are intermittent, or if they are posture related. Hyperventilation may be associated with localised areas of paraesthesia (e.g. one arm). Intermittent sensory illusions may be experienced in relation to amputated or anaesthetic limbs. Migrainous episodes may also cause localised areas of paraesthesia, but usually have the distinction of a gradual evolution of sensory phenomena, both positive and negative, and associated features of migraine.

- Transient vestibular symptoms

Acute attacks of vertigo may occasionally be due to a seizure in parietal or temporal lobes. In these cases there are generally associated features that point to cerebral involvement, such as a focal somatosensory symptoms, déjà vu or disordered perception. Peripheral vestibular disease is a much more common cause and may give rise to paroxysmal rotational vertigo and perception of linear motion and there are often also other symptoms of auditory and vestibular disease such as: deafness, tinnitus, pressure in the ear and relation to head position.

- Visual symptoms

Migraine is a common cause of episodic visual phenomena. The evolution is usually gradual, over several minutes, with fortification spectra, and associated photophobia, nausea and headache. Epileptic phenomena are usually much shorter, evolving over seconds, and the visual hallucinations are more commonly of coloured blobs, rather than jagged lines.

1.1.6 Facial muscle and eye movements

Changes in facial movements may occur in various neurological conditions including focal motor seizures, complex partial seizures with automatisms, tics, dystonias or other paroxysmal movement disorders, especially drug induced dyskinesias and hemifacial spasm, as well as psychological disorders.

- Partial seizures

Benign rolandic epilepsy usually presents with seizures in childhood affecting the face, often with unilateral grimacing, hemicorporeal sensory and motor phenomena, or secondarily generalised seizures occurring in sleep. Focal motor seizures may cause twitching of one side of the face that may be restricted to specific areas. Eye deviation may be seen with seizures arising in frontal, parietal or occipital cortex.

Complex partial seizures may cause automatisms with lip smacking, chewing, swallowing, sniffing or grimacing, with amnesia and impaired awareness. If these features are due to seizure activity the attacks are usually relatively infrequent,

whereas with dystonia or other movement disorders episodes are likely to occur many times per day.

- **Movement disorders**

Hemifacial spasm typically presents in the elderly or middle aged with clusters of attacks that initially involve the eye but subsequently spread to the rest of that side of the face. Facial weakness may develop that persists between attacks.

Bruxism may occur either during the day or in sleep, especially in children with learning disability. Episodes are usually more prolonged than with the automatisms of complex partial seizures, and there are no associated features to suggest an epileptic basis.

As with dystonia and other movement disorders affecting the face there may be evidence of involvement elsewhere, and attacks are usually more frequent than is seen with isolated seizures.

- **Other neurological disorders**

Defects of eye movement control are common in patients with a wide range of neurological disorders. There are usually associated features that indicate a non-epileptic basis. Bizarre eye movements also occur in blindness and may be mistaken for epileptic activity. Careful examination is required to ascertain the precise features of the eye movement disorder, and in particular any precipitating factors or features of cerebellar or brainstem disease.

1.1.7 Psychic experiences

Intermittent psychic phenomena can be seen in partial seizures (especially of temporal lobe origin), migraine, panic attacks, transient cerebral ischaemia, drug induced flash-backs, or with illusions associated with loss of a sensory modality as well as psychotic illnesses.

- **Epilepsy**

Partial seizures of temporal lobe origin are especially likely to be manifest by auras involving psychic phenomena. The most common are fear, déjà vu,

memory flashbacks, visual, olfactory or auditory hallucinations. Other manifestations include altered perception of the environment with a distancing from reality or change in size or shape of objects; altered language function; emotions such as sadness, elation, and sexual arousal.

Psychic experiences may have some relation to past experiences. They are usually recalled as brief scenes, sometimes strung together. They usually lack clarity, for example a patient may describe an illusion of someone standing in front of them who they know, but they cannot name them or describe them in detail. A rising epigastric sensation may occur alone or in association with such experiences. Elemental visual phenomena, such as flashing lights, are more often seen in occipital lobe epilepsy. Altered thought patterns may be seen in both temporal and frontal lobe seizures.

- Migraine

Migrainous psychic phenomena may involve an initial heightening of awareness. The principal features are usually visual illusions that may be elemental or complex. They rarely have the same intense emotional components of temporal lobe illusions or hallucinations. The time course is usually more prolonged than with partial seizures, and there are associated features of a pounding headache, photophobia and nausea or vomiting. There may be recognized precipitants, and there is often a relevant family history.

- Panic attacks

These are usually associated with feelings of fear and anxiety. Hyperventilation may lead to dizziness and light-headedness. There are often unpleasant abdominal sensations similar to the epigastric aura of partial seizures. The evolution, associated increases in heart rate and respiration, longer time course and history of precipitating factors generally make the diagnosis clear.

- Drug induced flashbacks

These share many of the qualities of psychic temporal lobe seizures. They are individualised hallucinations usually related to the circumstances of the drug

abuse, often with emotional content of fear or anxiety. A careful history should be taken for substance abuse, especially LSD and mescaline.

- Hallucinations or illusions caused by loss of a primary sense
Hallucinations and illusions of an absent limb are well recognised in amputees. Similarly, people who lose sight either in the whole or part field may experience visual hallucinations or illusions in the blind field. Such phenomena can be elemental or complex and include evolving scenes. Similar experiences can occur with deafness.
- Such experiences due to the loss of a primary sense present particular diagnostic difficulty when they occur in the setting of a structural lesion which could result in both phenomena. An occipital infarction, for example, could cause visual loss and could also give rise to epileptic seizures. Often the hallucinations due to sensory loss are more prolonged, lasting for minutes or hours, but can be brief.
- Psychotic hallucinations and delusions
Hallucinations and delusions are the hallmark of psychotic illnesses. The following features would suggest a psychiatric rather than epileptic basis: complex nature with an evolving or argued theme, auditory nature involving instructions or third person language, paranoid content or associated thought disorder. Psychotic episodes are usually more long lasting than isolated epileptic seizures, although intermittent psychosis may have a similar time course to nonconvulsive status. Persistent mood changes may be a helpful guide, but even short temporal lobe seizures may be followed by mood changes lasting for hours or days. Furthermore, flurries of epileptic attacks may themselves cause an organic psychosis lasting for several days. Ruminations and pseudo-hallucinations, in which the patient retains some insight, may occur in affective disorders.
- Non-epileptic attack disorder (NEAD)
Non-epileptic attack disorder may be associated with reports of hallucinations and illusions. These often evolve out of previous questioning by members of the medical profession. Initially the symptoms may seem plausible, but should be

suspected if they are florid and multiple in type (e.g. auditory, olfactory and visual at different times) with evolving stories or patterns of expression.

1.1.8 Aggressive or vocal outbursts

These are rarely epileptic in nature if they occur in isolation. They are especially common in adults and children with learning disabilities. In this setting there is organic brain disease which could lower the overall seizure threshold. Most cases do not have their basis in epilepsy.

A not infrequent forensic issue is the occurrence of violent, or other, crimes in patients with epilepsy, in which it is a defence claim that the crime was committed in a state of automatism. Certain features are strong evidence against an epileptic basis to the attack.

- Absence of a prior history of epilepsy with automatisms
- Premeditation and evidence of planning or preparation
- Directed violence
- Evidence of complicated and organized activity during the episode
- Recall of events during the episode
- Witness accounts not indicative of a disturbance of consciousness
- Subsequent attempts at escape or concealment of evidence.

1.1.9 Episodic phenomena in sleep

Attacks occurring during sleep present particular diagnostic difficulties because they are often poorly witnessed, and the patient may have little, if any, recall of the event or the preceding circumstances.

- Normal physiological movements
Whole body jerks commonly occur in normal subjects on falling asleep.

Fragmentary physiological myoclonus usually involves the peripheries or the face, and occurs during stages 1 and 2 and REM sleep.

Periodic movements of sleep may be an age related phenomenon, being seen in less than 1% of young adults, but occurring with increasing frequency during middle and old age such that they are present in perhaps half the elderly population. Typically these movements occur at regular intervals of 10-60 seconds and may occur in clusters over many minutes.

- Frontal lobe epilepsy

Frontal lobe seizures may display specific sleep related characteristics causing diagnostic confusion. Such attacks are often frequent, brief, bizarre and maybe restricted to sleep. Attacks may include apnoea, dystonic, myoclonic, or choreiform movements that may be unilateral or bilateral, and some retention of awareness. The attacks are scattered throughout the night, and usually arise from non-REM sleep. Frequency is highly variable, but some patients have more than 20 attacks in a night. An important clue to the diagnosis is the occurrence of additional secondary generalised seizures and seizures occurring in wakefulness.

- Other epilepsies

Seizures arising in other brain regions may present with nocturnal attacks. Patients may be aroused by an aura, although often this is not recalled when attacks arise from sleep. Complex automatisms, in which patients get out of bed and wander around may cause confusion with parasomnias. With nocturnal seizures of any type the partner is frequently awoken by particular components, such as vocalisation and does not witness the onset.

Generalised tonic-clonic seizures not uncommonly occur on or shortly after awakening.

- Pathological fragmentary myoclonus

Excessive fragmentary myoclonus persisting into sleep stages 3 and 4 may be seen with any cause of disrupted nocturnal sleep.

- Restless leg syndrome

The restless leg syndrome is characterised by an urge to move the legs,

especially in the evening when lying or sitting. It may be associated with various unpleasant paraesthesiae. All patients with restless legs have periodic movements of sleep. These may be severe and can also occur during wakefulness. In addition there may be a variety of brief daytime dyskinesias.

- Non REM parasomnias

These involve night terrors or sleep walking. They usually present in childhood or adolescence, and are often familial. The attacks arise from slow wave sleep, typically at least thirty minutes, but not more than four hours, after going to sleep and the timing is often stereotyped. Attacks may be spaced out by months or years and rarely occur more than once per week, and usually no more than one attack occurs in a single night. They are more likely after stressful events, or when sleeping in a strange bed.

Night terrors involve intense autonomic features (sweating, flushing, palpitations) and a look of fear. Patients may recall a frightening scene or experience, but do not usually recount a vivid dream prior to the attacks. They may be difficult to arouse, and confused for several minutes. Vocalisations are common. Sleep walking may involve getting out of bed and performing complex tasks. Sometimes it is possible to lead the patient back to bed without awakening. They may respond if spoken to, but their speech is usually slow or monosyllabic. Brief, abortive episodes are commoner, involving sitting up in bed with fidgeting and shuffling (mimicking a complex partial seizure). Non-REM parasomnias may cause self injury but rarely directed aggression. They are associated with enuresis.

- REM parasomnias

REM parasomnias usually occur in middle age or the elderly, and show a marked male predominance. They more often occur in the later portion of sleep. During REM sleep patients may have an increase in the frequency or severity of fragmentary myoclonus, thrash about, call out, display directed violence, or appear to enact vivid dreams. Attacks may last from seconds to minutes. If awoken patients may recall part of these dreams. Although REM sleep behaviour disorders may occur in healthy elderly subjects they are also seen in association

with drugs (e.g. tricyclics) or alcohol, or central nervous system diseases such as multisystem atrophy. The possibility of REM sleep disorders needs to be considered both at initial presentation, and also in patients known to have central nervous system disorders.

- Sleep apnoea

Patients with sleep apnoea usually present with day-time hypersomnolence. However, the apnoeic episodes may cause episodic grunting, flailing about or other restless activity that appears to mimic nocturnal epilepsy. Occasionally the resultant hypoxia leads itself to secondary seizures.

- Other movements in sleep

Nocturnal body rocking may occur in patients with learning disability, or following head injuries. In patients with many different forms of day-time dyskinesias, similar movements may occasionally occur during overnight sleep, usually in the setting of brief arousals.

1.1.10 Prolonged confusional or fugue states

Epileptic seizures usually last for seconds or minutes. After generalised convulsions (or less often complex partial seizures) there may be confusion lasting for many minutes, but rarely more than an hour. Such episodes only present diagnostic difficulty if the initial seizure is unwitnessed or forgotten. Nevertheless, epileptic states can last for longer periods of time, as can other types of cerebral disorder and the differential diagnosis of prolonged epileptic confusional states (non-convulsive status) should include: acute encephalopathy, nonconvulsive status epilepticus, transient global amnesia, intermittent psychosis, hysterical fugue (NEAD).

- Acute encephalopathy

Virtually any severe metabolic disturbance may cause an acute encephalopathy (e.g. diabetic ketoacidosis, hypoglycaemia, respiratory, renal or hepatic failure, drug ingestion, hyperpyrexia, sepsis). Transient metabolic disturbances are most often seen in treated diabetes mellitus due to insulin induced hypoglycaemia.

Occasionally metabolic disorders may present with exacerbations with symptomatology lasting for hours or days that give the appearance of an episodic condition. These include: porphyria and urea cycle enzyme defects. Acute neurological conditions also need to be considered, particularly: encephalitis, meningitis, other intracranial infection, head injury, cerebral infarction or haemorrhage. Drug abuse may cause isolated episodes or recurrent bouts, related to intoxications.

- Nonconvulsive status epilepticus

Patients with complex partial seizures, typical or atypical absences may present with prolonged confusional states due to complex partial epilepticus or absence status. Such attacks may be the first manifestation of the seizure disorder, or occur in the setting of known epilepsy.

- Intermittent psychosis

Although usually more sustained, psychiatric disorders may present with episodes of delusions, hallucinations or apparent confusion, lasting for hours or days.

- Transient global amnesia

These episodes typically commence acutely, and last for minutes or hours and involve both retrograde and anterograde amnesia. Patients may perform complex activities, but afterwards have no recall of them. There is a lack of other neurological features to the attacks, and consciousness appears to be preserved. The attacks may involve bilateral medial temporal dysfunction which in some patients may be on the basis of ischaemia, whilst some may have an epileptic basis.

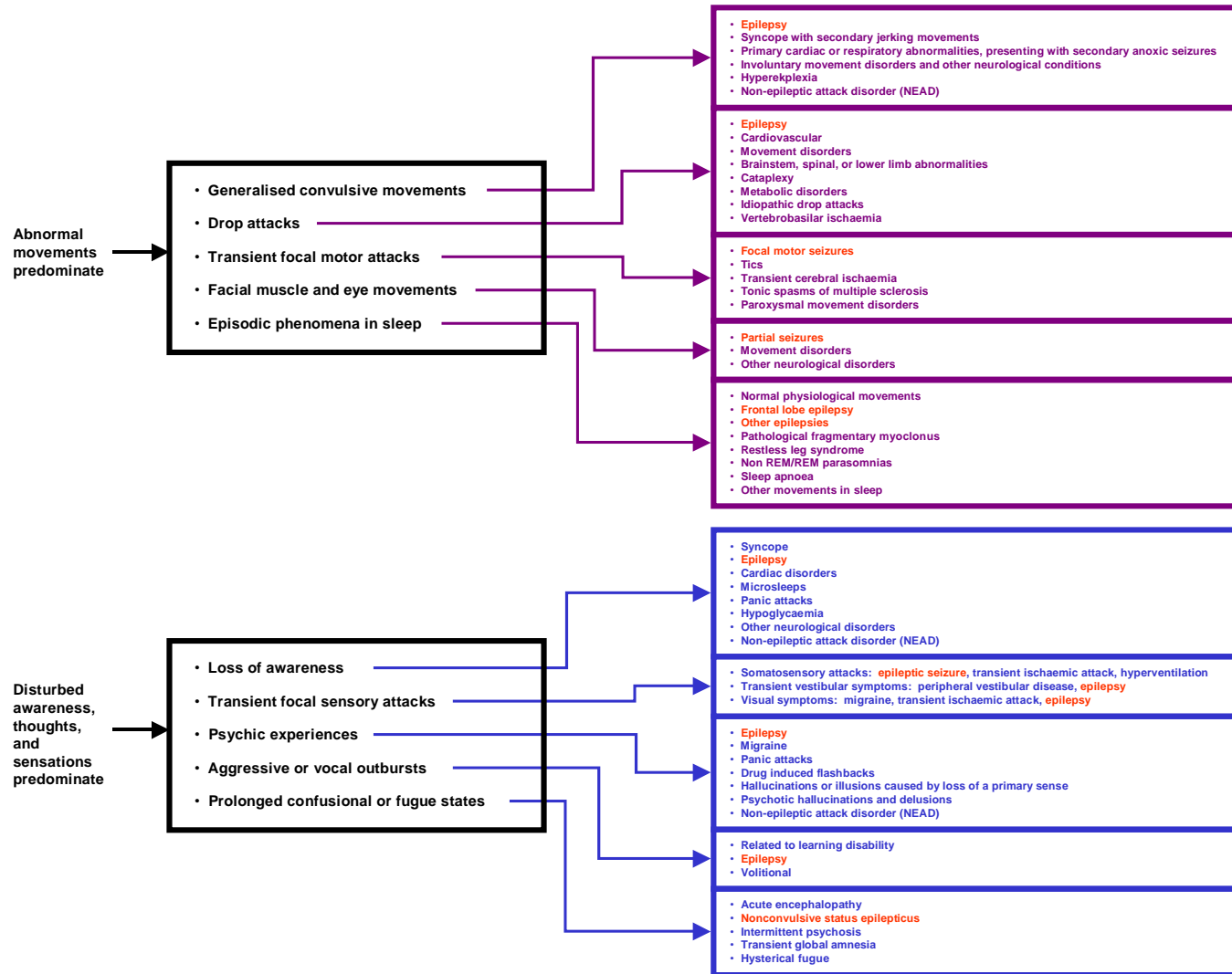
- Hysterical fugue

A fugue state may arise without an organic physical cause, as a conversion symptom. These episodes may be brief or very prolonged, lasting for days or even weeks. If seen at the time of an episode inconsistencies are often found on examination of the mental state. In some cases, the question of malingering arises, most commonly in a situation in which the person's state prevents questioning by Law Officers. The diagnosis is more difficult to identify if the

patient is only seen subsequently. The matching of witness accounts and the apparent sequence of events is essential, but it may remain difficult to come to a firm conclusion. In this situation, there is sometimes a forensic aspect, typically when the person concerned is alleged to have committed a crime and they profess to have no memory of the events.

A checklist of possible seizure-related symptoms to enquire for when considering a possible diagnosis of epilepsy can be found in Table 1.

Figure 1 Differential diagnosis in adults



2 Differential diagnosis of epilepsy in children

Drs Helen Cross and Amanda Freeman prepared this section

There are a range of possibilities in the differential diagnosis when considering the child with a 'funny turn'. The considerations will vary depending on certain key features of the event, as well as the age of the child. The history is key to any diagnosis, and is likely to be far more useful than any investigation that can be requested. Always seek the initial event – a trigger or warning, however young the child. There may be a typical behaviour prior to any event or a slightly older child may be able to relate a feeling prior to or during the event. A description of each change in the child should be sought, and the evidence of loss or not of awareness. Other important aspects of the history are medications taken, developmental history and past medical history but information from these will only be supplementary to the history of the events themselves. There are a number of possibilities within the differential diagnosis of epilepsy in childhood; however a lack of awareness of such alternatives remains the major reason for error and the premature, possible misdiagnosis, of epilepsy. The following is a classification of possibilities, although not exhaustive.

Syncope & related disorders	
• Disorders of orthostatic control	Reflex syncope
• Respiratory syncope	Reflex & expiratory apnoeic syncope
	'Fainting lark'
	Upper airway obstruction
• Cardiac syncope	Arrhythmias
	Complete heart block
	Wolf parkinson white
	Brugada syndrome
• Brainstem syncope	Tumour
	Brain stem herniation or compression
• Other	Hyperekplexia
	Anoxic epileptic seizures
Neurological	Tics
	Myoclonus
	Paroxysmal dystonia
	Sandifers syndrome
	Paroxysmal dyskinesias
	Cataplexy
	Benign paroxysmal vertigo/torticollis
	Migraine
	Alternating hemiplegia
	Eye movement disorders
	Overflow movements
Behavioural/psychiatric	Daydreams
	Dissociative states
	Self gratification behaviour
	Hyperventilation
	Panic/anxiety
	Non epileptic attack disorder
	Fabricated attacks
	Pseudosyncope
	Stereotypies/ritualistic behaviour
Parasomnias	Sleep myoclonus
	Headbanging
	Confusional arousal
	REM sleep disorder/night terrors

Table 3 Classification of possibilities in childhood epilepsy

2.1 The child under the age of 12 months

In a child of this age it may be incredibly difficult to determine the true nature of an event when taking the history for the first time. There is likely to be considerable anxiety on the part of carers, and if there is any doubt, referral is advised.

- Is the event related to any particular activity?

For example, feeding may suggest reflux, history of medication ingestion may suggest dystonic reaction, sleep may suggest benign sleep myoclonus.

- What is the major motor component?

Is the major motor component apparent hypertonia, hypotonia or dystonia?

Is this movement repetitive or sustained?

Either repetitive short duration over short period or with greater duration between. Repetitive jerks may imply seizures, although only from sleep may be sleep myoclonus. Repetitive spasms will be stereotyped, in clusters. Sudden sustained hypertonia may give a clue to hyperekplexia or brainstem syncope

Are semi-purposeful movements seen at any time?

This may give a clue as to the state of awareness

What parts of the body are involved in the movements?

For example, whole body, eyes vs limb, all limbs vs single/multiple

- Is there a behaviour change?

Does the child stare unresponsively?

Is eye movement seen in association with this? Can they be distracted?

Is the child distressed?

If so intermittently or continuously? Distress may suggest awareness – seen in seizures, particularly in between spasms during clusters

Is there apparent fear?

Of course that may be manifest by distress, and therefore an apparent awareness of what is happening

- Is the event characterised by other phenomena?

Is there a colour change?

Pallor or cyanosis may be seen in cardiac arrhythmias; cyanotic attacks are commonly associated with reflux. Flushing may be seen with repetitive movement in self gratification behaviour

Is there a change in breathing pattern?

Deep/stertorous breathing with loss of awareness may be seen in generalised seizures, compared with retained awareness in self gratification behaviours.

Can the event be interrupted?

If so, then the event is probably a partial seizure or NEAD. If the event cannot be interrupted, then possibly a generalised seizure.

2.2 In the toddler (aged 1 to 3 years)

- Is the event related to any particular activity?

Sleep or waking state; parasomnias are very common at this age and in some instances mimic seizures. Night terrors usually occur at a specific time each night, and during which the child may appear unreachable.

Confusional arousals may also cause alarm as the child is inaccessible

Adverse/noxious events; if the event is always triggered by this consider breath holding/reflex anoxic seizures

Fever; as in febrile seizures

Movement – as in paroxysmal dyskinesias

Feeding – as in Sandifers syndrome

Excitement – as in overflow movements

Note stereotypic movements/ritualistic behaviours may be seen in children with developmental delay/communication disorders at any time, but particularly excitement/stress or boredom

Emotion – as in cataplexy

- What is the major motor component?

Is a fall the major component of the event?

Is the major motor component apparent hypertonia, hypotonia or dystonia?

Hypertonia consider reflex/epiratory syncope, tonic/tonic clonic seizure, hyperekplexia

Hypotonia consider syncope, cataplexy, 'akinetic' drop attack although the latter unlikely to occur in the absence of other seizure types

Dystonia consider dyskinesia, benign paroxysmal torticollis (BPT)

Unsteadiness consider benign paroxysmal vertigo (BPV), intermittent ataxia

Is this movement repetitive or sustained?

Either repetitive short duration over short period or with greater duration between. Repetitive jerks may imply seizures. Although repetitive short movements predominantly of the face may be tics

Are semi-purposeful movements seen at any time?

This may give a clue as to the state of awareness

What parts of the body are involved in the movements?

For example, whole body, eyes vs limb, all limbs vs single/multiple

- Is there a behaviour change?

Does the child stare unresponsively?

Is eye movement seen in association with this? Can they be distracted?

Is the child distressed?

If so intermittently or continuously?

Is there apparent fear?

Of course that may be manifest by distress, and therefore an apparent awareness of what is happening.

- Is the event characterised by other phenomena?

Is there a colour change?

Pallor or cyanosis may be seen in cardiac arrhythmias; cyanotic attacks are commonly associated with expiratory apnoeic (breath holding) attacks. Flushing may be seen with self gratification behaviour.

Is there a change in breathing pattern?

Either an increase or decrease may give a clue to the above.

Can the event be interrupted?

2.3 In the older child (aged 3 to 12 years)

- Is the event related to any particular activity?

Sleep or waking state; parasomnias are very common at this age and in some instances mimic seizures.

Movement – as in paroxysmal dyskinesias

Excitement – as in overflow movements

Note stereotypic movements/ritualistic behaviours may be seen in children with developmental delay/communication disorders at any time, but particularly excitement/stress or boredom.

Emotion – as in cataplexy

- What is the major motor component?

Is a fall the major component of the event?

Is the major motor component apparent hypertonia, hypotonia or dystonia?

Hypertonia consider reflex/epiratory syncope, tonic/tonic clonic seizure, hyperekplexia

Hypotonia consider syncope, cataplexy, 'akinetic' drop attack although the latter unlikely to occur in the absence of other seizure types

Dystonia consider dyskinesia

Unsteadiness consider intermittent ataxia

Is this movement repetitive or sustained?

Either repetitive short duration over short period or with greater duration between. Repetitive jerks may imply seizures. Although repetitive short movements predominantly of the face may be tics

Are semi-purposeful movements seen at any time?

This may give a clue as to the state of awareness although older child likely to be able to relay information about event

What parts of the body are involved in the movements?

For example, whole body, eyes vs limb, all limbs vs single/multiple

- Is there a behaviour change?

Does the child stare unresponsively?

Is eye movement seen in association with this? Can they be distracted – by touch rather than voice alone? The most common cause of 'blank spells' remains daydreaming. Typical absence seizures occur relatively frequently, at any time and are of short duration (5-10 seconds)

Is there apparent fear?

Is there aggressive/destructive behaviour?

True 'rage' attacks in isolation are rarely, if ever epileptiform in origin. Typically they are seen in children with learning difficulties, but are not unseen in children with very specific learning problems that have not yet been recognised. The children may become aggressive and destructive, and may have little, if any recollection of the event

- Is the event characterised by other phenomena?

Is there a colour change?

Pallor or cyanosis may be seen in cardiac arrhythmias. Pallor is likely to be seen in association with any syncope. Flushing may be seen with self gratification behaviour

Is there a change in breathing pattern?

Either an increase or decrease may give a clue to the above

Is there visual symptomatology?

Visual disturbance, if so at what stage of the event – may suggest primary or secondary phenomenon. What is the character of such (repeated) stereotyped colours or formed object likely to be seizure; late distorted vision? secondary.

Are there sensory symptoms?

If so, then maybe partial seizure, or paraesthesias due to other causes

Is there vocalisation?

Audible words or nonsense? At what stage of the event? Directed speech/vocal outbursts are unlikely to be epileptic.

Can the event be interrupted?

If so unlikely to be a seizure.

Figure 2 Differential diagnosis in children

