SIGN

Scottish Intercollegiate Guidelines Network

NHS Quality Improvement Scotland

81

Diagnosis and management of epilepsies in children and young people

A national clinical guideline

March 2005

KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

LEVELS OF EVIDENCE

1^{++}	High quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias
1^{+}	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1^{-}	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2^{++}	High quality systematic reviews of case control or cohort studies High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2^{+}	Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2^{-}	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, eg case reports, case series
4	Expert opinion

GRADES OF RECOMMENDATION

Note: The grade of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.

A	At least one meta-analysis, systematic review of RCTs, or RCT rated as 1^{++} and directly applicable to the target population*; or* A body of evidence consisting principally of studies rated as 1^{+}, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2^{++}, directly applicable to the target population, and demonstrating overall consistency of results*; or* Extrapolated evidence from studies rated as 1^{++} or 1^{+}
C	A body of evidence including studies rated as 2^{+}, directly applicable to the target population and demonstrating overall consistency of results*; or* Extrapolated evidence from studies rated as 2^{++}
D	Evidence level 3 or 4*; or* Extrapolated evidence from studies rated as 2^{+}

GOOD PRACTICE POINTS

☑	Recommended best practice based on the clinical experience of the guideline development group

ISBN 1 899893 24 5
First published 2005

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1 Introduction

1.1 THE NEED FOR A GUIDELINE

Epilepsy is one of the commonest chronic neurological conditions of childhood. In Scotland there are 5,000 to 7,000 children and young people with "active" epilepsy and 820 new principal diagnoses of epilepsy were made in 2003.[1,2] Seventy per cent of people who develop epilepsy do so in the first two decades of life. Serial seizures and status epilepticus are common in childhood; 40% of status epilepticus occurs in children under two years of age[3] and 75% of status epilepticus is the first seizure presentation in a child.[4] Both the condition, and its treatment, carry significant morbidity.

The diagnosis of epilepsy is often straightforward but, on occasion, immensely difficult. There is a wide differential diagnosis in assessing whether a seizure is epileptic or non-epileptic and this is particularly the case for children and young people. Misdiagnosis is a significant problem and there has also been much debate in the literature regarding the appropriate investigation of epileptic seizures. The evidence base for these topics is reviewed in this guideline.

The epilepsies are a heterogeneous group of childhood conditions that have differing diagnostic criteria, management and widely differing outcomes. It is important to identify the specific epilepsy syndrome wherever possible to refine the choice of medication to maximise benefit and minimise adverse effects. Children and their parents deserve information appropriate to their particular type of epilepsy.

There has been a substantial increase in the number of available antiepileptic drugs (AEDs), many of which have no current marketing licence (ie which are "unlicensed"), making the choice of an appropriate AED more complex. This issue is further discussed in section 5 and Annex 4.

Teenagers with epilepsy are a group who very often have particular needs not well addressed by more traditional paediatric and adult services. Some of these issues have already been raised in the sister publication *SIGN 70: Diagnosis and Management of Epilepsy in Adults*[5] and the guideline development group gratefully acknowledges the work of that group, upon which this guideline draws, where relevant.

The guideline is aimed at healthcare professionals involved in the diagnosis and management of the epilepsies of childhood, and it is hoped that it will also be used by children and their families. It tries to reflect the issues often raised by families, for example, with a section on learning and behaviour in children who have epilepsy.

1.2 REMIT OF THE GUIDELINE

This is an evidence based guideline covering the diagnosis and management of the epilepsies of children and young people aged from one month to 19 years of age (remaining in secondary education). The terms "children" or "child" are used throughout the guideline to cover the age band indicated above, except where there are issues specific to young people.

The guideline does not cover seizures in newborn babies, infants under one month of age, the management of non-epileptic seizures nor surgical or other specialised treatment for intractable seizures. Issues relating to contraception and reproduction have been covered in the adult guideline.[5]

Throughout this guideline reference has been made to seizures (synonymous with fit, turn and attack). It is important to emphasise that a seizure may be epileptic or non-epileptic. A convulsion or convulsive seizure refers to a particular type of seizure involving motor movements and this again may be epileptic or non-epileptic. A glossary appears in Annex 6.

1.3 DEFINITIONS

Epilepsy is defined as a condition characterised by recurrent epileptic seizures. An epileptic seizure is a clinical manifestation presumed to result from an abnormal and excessive discharge of a set of neurones in the brain.[6]

Epileptic seizures are categorised as either focal or generalised.

Focal (previously "partial") **epileptic seizures** arise in specific loci in one part of the cerebral cortex that carry with them identifiable clinical features either subjective or observed. Consciousness may or may not be retained or there may be partial loss of awareness.

Generalised epileptic seizures involve large areas of brain from the outset, usually both hemispheres, and are associated with early impairment of consciousness. They range from absences characterised only by impairment of consciousness, to generalised tonic-clonic seizures in which widespread convulsive activity takes place. Myoclonic, tonic and clonic seizures are all types of generalised seizures.

Epileptic syndromes have been defined by the commission on Classification and Terminology of the International League against Epilepsy as: "A complex of signs and symptoms that define a unique epilepsy condition. This must involve more than just the seizure type; thus frontal lobe seizures per se, for instance, do not constitute a syndrome".[7]

The classification of epilepsies and epilepsy syndromes has important practical implications when devising individual treatment plans and giving appropriate information to children and families. The likelihood of arriving at an epilepsy syndrome diagnosis is very much more likely in children than in adults.[8] This classification is presently undergoing a major review *(see Annex 1 for a list of some common epileptic syndromes in childhood)*.

1.4 STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. However, it is advised that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

1.5 REVIEW AND UPDATING

This guideline was issued in 2005 and will be considered for review in three years. Any updates to the guideline in the interim period will be noted on the SIGN website: **www.sign.ac.uk**

2 Diagnosis

2.1 INITIAL MANAGEMENT OF THE CHILD WITH A FIRST SEIZURE IN PRIMARY CARE OR ACCIDENT AND EMERGENCY DEPARTMENT

Many children with a first seizure, and in whom there will be a range of possible diagnoses, will present to their general practitioner (GP) or to an accident and emergency department (A&E). Five per cent of medical paediatric accident and emergency attendances follow a seizure.[9] Only a minority of such patients turn out to have epilepsy. A first seizure is extremely stressful for the family. Parents witnessing the event often believe their child is dying.[10]

Children are often febrile at the time of a first seizure. This may be a febrile seizure, but there is an important group of children whose apparent febrile seizure is due to bacterial meningitis or other central nervous system infection, and for whom early recognition and treatment is required.[11] Children without a fever may have had a non-epileptic event, an unprovoked epileptic seizure or an acute symptomatic seizure, the latter requiring urgent investigation and treatment.

2.1.1 MANAGEMENT OF THE CHILD WHOSE CONSCIOUS LEVEL IS DEPRESSED, EITHER IN THE COURSE OF A SEIZURE OR DURING RECOVERY

- "Airway, breathing and circulation" should be preserved according to established paediatric life support guidelines.[12]
- The seizure should be terminated promptly. Management of continuing seizure activity is discussed in section 6.
- The possible occurrence of an acute precipitating event should be established. Blood glucose should be checked (near-patient testing is preferable to blood analysis to ensure that hypoglycaemia is recognised and treated promptly). The clinician should be aware of the signs and symptoms of meningitis, other intracranial infection or covert injury and maintain a high index of suspicion, especially if recovery does not ensue rapidly. In some circumstances, urgent brain imaging may be indicated to identify other underlying causes.

2.1.2 MANAGEMENT OF THE FULLY RECOVERED CHILD

- It is not necessary to check full blood count, electrolytes, calcium or magnesium unless there are specific features on history and examination to suggest this might be helpful. [11]
- Following complete recovery from a brief non-focal seizure, and in the absence of intercurrent signs and symptoms, hospital admission for observation/investigation is not required. Criteria for admission from A&E to an acute care paediatric unit, developed using a formal consensus process, are listed in Table 1.[11]

4

Table 1. Criteria for admission to an acute care paediatric unit

Category	Criteria for admission
Age	< 1 year
Neurology	Glasgow Coma Scale < 15 one hour after seizure
Raised intracranial pressure	papilloedema, tense fontanelle
Generally unwell	irritable, disinterested, vomiting
Meningism	Kernig's sign positive, photophobia, neck stiffness
Signs of respiratory aspiration	respiratory distress, need for oxygen
High parent or carer anxiety	parents/carers feel unhappy to take the child home following a full discussion
Complex seizure	prolonged (ie > 15 minutes), or focal, or recurrent

Where a preliminary diagnosis of epilepsy has been made, subsequent investigations should follow the recommendations in section 3.

Information appropriate to the situation should be given to the child and carers. This might include discussion on risk of recurrence, what action should be taken in the event of a further seizure and appropriate reassurance about the nature of febrile seizures. Where there is diagnostic uncertainty, possible causes and the interim management should be discussed.

2.2 WHO SHOULD MAKE THE DIAGNOSIS?

The accurate diagnosis of one of the epilepsies of childhood can be very difficult. The differential diagnosis of a paroxysmal event in childhood is extensive and non-epileptic seizures are common. In a birth cohort long term follow up study at 11 years, nearly 7% of children had a history of seizures or other episodes of loss of consciousness. Two per cent had a history of febrile convulsions and in a similar number the diagnosis of epilepsy was refuted.[13] There are many features, commonly thought to be unique to epileptic seizures, which may also be found in non-epileptic events.[14]

The misdiagnosis of epilepsy is recognised as a diagnostic pitfall and may occur frequently.[15] Almost half of the children referred to a tertiary paediatric neurologist with a suggested diagnosis of epilepsy did not have that condition,[16] and in children referred with apparently poorly controlled epilepsy, misdiagnosis rates varied from 12% to 23%,[17,18] with syncopal seizures accounting for almost half of these diagnoses, behavioural disorder for 20% and breath-holding for 11%. Others included migraine and night terrors.[19] Non-epileptic seizures may also occur in treated patients with epilepsy. In a large video electroencephalogram (EEG) series of paroxysmal events in children, half of the recorded events were shown to be non-epileptic although 40% of these children also had epilepsy.[20] 3 4

In the Dutch study of epilepsy in childhood, four experienced paediatric neurologists classified the first event as "unclear" in 24% of children.[21] In over 400 children with multiple events thought to be epileptic the false-positive diagnosis rate was nearly 5%. By contrast, only 7 of 124 children with multiple unclear episodes at intake later received a diagnosis of epilepsy.

The misdiagnosis of epilepsy has significant implications for the iatrogenic adverse effects of medication and adverse psychosocial impact. The inappropriate treatment of young pregnant women with antiepileptic medication risks subsequent damage to an unborn child. The misdiagnosis of a cardiogenic syncope, such as one of the prolonged QT syndromes, may result in an otherwise preventable death.

Given these concerns regarding misdiagnosis, the breadth of epilepsy syndromes and the range of differential diagnoses, a service for children with epilepsy should have specialists with skills and interest in the management of epilepsy and other paroxysmal disorders. The history taking skills required to ascertain comprehensive witness accounts of events are built upon through training, continuing education and experience. They can be acquired only with an understanding of the range and complexity of the differential diagnosis that exists in children.[22] 4

D **The diagnosis of epilepsy should be made by a paediatric neurologist or paediatrician with expertise in childhood epilepsy.**

2.3 HISTORY TAKING AND CLINICAL FEATURES

Obtaining an accurate description of an event may be difficult.[23] A study of the accuracy of seizure descriptions by carers showed that only 44% accurately recalled the event.[24] As 75% of families fear their child is dying during a first witnessed convulsive seizure,[10] it is reasonable to suppose that their history of the seizure may be poor. It is often helpful to obtain multiple witness accounts. 2+

Important features to consider when taking a history are:

- what was the child doing and what happened just before and at the time the seizure started?
- were there any symptoms suggestive of an aura and what were they?
- what was the sequence and timing of events and seizure components?
- what happened as the seizure ended?
- what was the child like after the seizure and for how long?
- was there:
  - awareness during the event
  - unresponsiveness
  - staring
  - open or closed eyes
  - eyelid flutter
  - eyeball jerking or deviation (note direction)
  - facial twitching
  - body stiffness
  - chaotic jerking of limbs
  - rhythmic jerking of limbs
  - pallor or cyanosis
  - any other autonomic features?
- if more than one seizure was witnessed how similar were they?

Staring or blank spells, particularly in children with learning difficulties, often cause diagnostic difficulty. Key historical features will help select those seizures likely to be non-epileptic.

Factors more likely to be indicative of non-epileptic staring include:

- staring interrupted by voice or touch
- staring associated with rocking
- staring initially noticed by a professional carer rather than the family.

2++
3

Factors more likely to be indicative of epileptic staring include:[25,26]

- short, frequent (daily) events
- interruption of play and speech
- automatisms
- association with up-gaze and/or urinary incontinence.

There can be appropriate diagnostic uncertainty, particularly after a first seizure. A false negative diagnosis of epilepsy is probably less harmful than a false positive diagnosis. It is appropriate to share the uncertainty surrounding diagnosis and the importance of making a correct diagnosis with the child and family until a definite diagnosis is made.

A list of non-epileptic paroxysmal disorders seen at different ages in childhood is shown in Annex 2.

D **An accurate history of the event should be taken from first-hand witnesses and the child.**

3 Investigative procedures

3.1 ELECTROCARDIOGRAPHY

Children with convulsive seizures may have syncope (including cardiogenic syncope, such as a prolonged QT syndrome). A standard 12 lead electrocardiogram (ECG) is a simple, inexpensive, readily available technique which may allow a diagnosis of a cardiac arrhythmia. More specialised ECG monitoring techniques such as 24 hour recording and loop recording may be required should a cardiac abnormality be considered clinically likely. This might be achieved through a formal paediatric cardiac consultation. Details of how to calculate corrected QT interval (QTc) are given in Annex 3.

☑ All children presenting with convulsive seizures should have an ECG with a calculation of the QTc interval.

3.2 HOME VIDEO RECORDING

Home video camera recordings may reveal information not elicited by history taking and may support or refute a suspected diagnosis of epilepsy.[27,28] 3 4

☑ Home video camera recordings should be used in order to capture recurrent events where the diagnosis is in doubt.

3.3 ELECTROENCEPHALOGRAPHY

There are international consensus guidelines for recording and reporting EEGs in children.[29] Particular care is required in interpretation of the paediatric EEG. Overinterpretation of normal variants as epileptiform abnormalities is a recognised pitfall in adult recordings.[30,31] 2- 3 4

Age specific patterns may be misinterpreted as epileptiform discharges. The sensitivity of interictal EEG recordings is too low to be a reliable diagnostic test for epilepsy.[21,32] Around 40% of children with seizures will have a normal record on a first standard EEG recording.[21,33-35] Even with expert clinical evaluation and repeated recordings, the sensitivity of EEG is only 56% after a single event and 70% after multiple events, with a specificity of 78%.[21] 2+ 4

The EEG may show paroxysmal activity or background changes in up to 32% of normal children that could be misinterpreted as abnormal.[36] Epileptiform abnormalities are seen in up to 5% of normal children.[37-39] These rates are higher where there are pre-existing neurological abnormalities.[40,41] The rates of EEG abnormality may be further increased during the course of a sleep EEG recording and this may be a pitfall in children who do not have epilepsy.[42] 2+ 2-

An EEG recording should not be done indiscriminately to confirm or refute a diagnosis of an epileptic seizure since this will increase the risk of an erroneous diagnosis.

D **An EEG should only be requested after careful clinical evaluation by someone with expertise in childhood epilepsy.**

☑ The recording and interpretation of a paediatric EEG should be undertaken by a department familiar with childhood EEG and epilepsy.

3.3.1 STANDARD EEG

A standard EEG is often a valuable tool in children with epileptic seizures. It contributes to:

- identification of features of a focal or of a generalised epilepsy
- syndromic diagnosis
- choice of further investigation
- the therapeutic management of epilepsy
- prognosis of epilepsy.

The yield of EEG abnormalities adding to syndromic diagnosis is further increased when the EEG is performed within the first 24 hours of an epileptic seizure. [33,35,40] 2+

C **All children with recurrent epileptic seizures should have an EEG. An early recording may avoid the need for repeated EEG investigations.**

The choice of when to use EEG in children with seizures is often unclear. Among the most commonly asked questions on this topic are whether to use EEG after a first, unprovoked seizure, the use of EEG in children with recurrent or complex febrile seizures and the timing of EEG with respect to starting antiepileptic medication. These are discussed further in boxes 1-3 below.

Box 1 - The issue of a first, unprovoked convulsive epileptic seizure

The role of a standard inter-ictal EEG recording when a confident clinical diagnosis has been made is controversial. Those that support performing an EEG cite that useful information can be given to families regarding recurrence risk – an abnormal EEG doubles recurrence risk;[44] that information may contribute towards a decision to undertake neuroimaging;[33] that it may uncover a previously unrecognised epilepsy or provoking factors (such as photosensitivity); and it may be possible to reach a syndromic diagnosis. 2+ 4

Those against performing an EEG after a first unprovoked epileptic seizure argue that epilepsy should not be diagnosed after a first seizure and the likelihood of identifying an important intracranial abnormality in the absence of any other neurological signs is small.[45] Even if treatment were commenced after a single seizure the alteration in recurrence risk is relatively small and long term remission rates are unaltered.[46] Furthermore, description of the first seizure may not be accurate and an abnormal EEG may be misleading. 2++ 2- 3

☑ When a first seizure has been diagnosed as epileptic, an EEG may be considered for the purposes of assessing recurrence risk, making a syndromic diagnosis, and identifying precipitating factors. It should not be used to guide a decision on whether or not to commence antiepileptic drug medication.

Box 2 - Should children with recurrent or complex febrile seizures (prolonged > 15 minutes, focal or repetitive ie > 2 events in a 24 hour period) have an EEG?

The evidence that children with complex febrile seizures have an increased chance of developing epilepsy is contradictory.[47] The yield of abnormality of an early post-ictal EEG is low and similar to the reported rate of abnormality in children with simple febrile seizures.[48] 3

☑ An EEG is not indicated for children with recurrent or complex febrile seizures.

Box 3 - Should medication ever be started without an EEG?

Sodium valproate, ethosuxamide and benzodiazepines suppress the typical three per second spike-wave activity in childhood absence epilepsy. Sodium valproate significantly suppresses photic induced discharges (paroxysmal responses).[49] Benzodiazepines also abolish epileptiform discharges in benign childhood epilepsy with centrotemporal spikes (BECTS), electrical status epilepticus during sleep (ESES), non-convulsive status epilepticus (NCSE) and West's Syndrome.[50.51] 3 4

☑ Antiepileptic drug medication should not usually be started before an EEG recording since it may mask a syndromic diagnosis.

3.3.2 STANDARD EEG WITH SYNCHRONISED VIDEO

Time locked video recording during a standard EEG will contribute further to classification and diagnosis should a clinical event occur spontaneously or following induction. Among the epilepsies for which this is particularly useful are juvenile myoclonic epilepsy, infantile spasms[52,53] and absence seizures.[54]

2-
2+
3

3.3.3 REPEAT EEG RECORDINGS AND SLEEP EEG

If a first standard inter-ictal EEG is normal, there is evidence that a second recording increases the yield of diagnostically helpful abnormalities.[34,58] Sleep has an activating effect on the EEG and repeated recordings which include a period of sleep further increase the yield of epileptiform activity to almost 80%.[32,33] When used appropriately, sleep recordings may contribute significantly to epilepsy classification and particularly in syndromes such as benign rolandic epilepsy with centrotemporal spikes,[55] juvenile myoclonic epilepsy[56] and infantile spasms.[52,57]

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Methods of obtaining sleep EEG include:

- partial sleep deprivation
- spontaneous or overnight sleep
- sedation
- melatonin sleep.

Sleep recordings may be particularly difficult to achieve in children. There is no clear evidence that one method of obtaining sleep is significantly more productive than another.[34,57-59] Induced sleep with melatonin or overnight natural sleep with ambulatory EEG may be more acceptable in children than partial sleep deprivation.[60,61]

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2+
4

D **For children with recurrent epileptic seizures and a normal standard EEG, a second EEG recording including sleep should be used to aid identification of a specific epilepsy syndrome.**

3.3.4 ICTAL EEG RECORDING

In the majority of children with paroxysmal events the diagnosis will be apparent from a comprehensive clinical history supplemented by examination and home video recording where necessary. In situations of continuing clinical uncertainty where epilepsy is suspected, the next steps depend on the circumstances of the event, its frequency and availability of investigations. There are a variety of EEG techniques that allow for capture of the event (epileptic or non-epileptic) on EEG. The preferred method is the use of time locked video recording to allow correlation of the event with the EEG.[62-64] Ictal recording can include overnight sleep and will provide useful diagnostic information, facilitate epilepsy classification and identify previously unrecognised subtle events.[65,66]

2+
4

Short term video EEG recording

Where episodes occur most days, then referral for simultaneous video and EEG recording of attacks may be helpful. This may require only a few hours as an outpatient if events are very frequent or are inducible.[53,65]

2-
2+

Long term video EEG monitoring

Where episodes occur at least once a week, long term, inpatient video EEG monitoring will often allow a confident diagnosis to be made.[66]

2+

Ambulatory EEG recording

Ambulatory EEG recordings are also of value where events occur most days. They do not allow the same precise clinical correlation as video EEG recording, but may be less disruptive to family life and allow a more normal environment for observing a seizure.[67] Video recordings can supplement ambulatory recording.[68]

2-
2+

D **Where the clinical diagnosis of epilepsy is uncertain and if events are sufficiently frequent, an ictal EEG should be used to make a diagnosis of an epileptic or non-epileptic seizure.**

3.4 BRAIN IMAGING

Magnetic resonance imaging (MRI) scanning is superior to computed tomography (CT) scanning in elective imaging to identify abnormalities underlying epilepsy (sensitivity 95% *v* 32%) and avoids radiation.[69] In a series of 300 consecutive adults and children, MRI showed epileptogenic lesions in 12%, none of whom had generalised epilepsy.[33] 2+

Urgent imaging is usually not required for patients with an epileptic seizure alone,[70] but CT brain imaging may be required for suspected acute symptomatic seizures or in children with focal seizures under the age of three years.[71] 2+ 3

The International League Against Epilepsy has published recommendations on cranial imaging in epilepsy.[72] A useful review outlining established MRI techniques in epilepsy is also available.[73] 4

D **Most children with epilepsy should have an elective MRI brain scan. Children with the following epilepsy syndromes** *(which are following a typical course)* **do not need brain imaging:**

- **idiopathic** *(primary)* **generalised epilepsies** *(eg childhood absence epilepsy, juvenile myoclonic epilepsy or juvenile absence epilepsy)*
- **benign childhood epilepsy with centrotemporal spikes** *(benign rolandic epilepsy).*

3.5 OTHER DIAGNOSTIC INVESTIGATIONS

Other investigations (eg cytogenetic, molecular genetic and metabolic) may be indicated to identify specific aetiologies of non-idiopathic epilepsies, for example, symptomatic and cryptogenic epilepsies and for children with moderate or severe learning difficulties or cognitive regression. A preliminary classification of diseases frequently associated with epileptic seizures is shown in Annex 5.

3.6 GENETICS

Epilepsy often runs in families, and the recurrence risk for siblings or children of an affected person is increased compared with the background rate of epilepsy in the general population.[74-77] In most cases, the inheritance of epilepsy is multifactorial, with a contribution from more than one susceptibility gene, as well as from environmental factors.[78] Where one person in a family has idiopathic epilepsy the recurrence risk for siblings is 2.5 – 6.7% and for children is 1.6 – 6.3%.[79] The recurrence risk for symptomatic epilepsies relates to the underlying aetiology.

Studies aimed at finding genetic defects underlying the common forms of epilepsy have identified many different ion channel, neuronal receptor and synaptic abnormalities. Facilities for mutation testing are currently limited but testing may be indicated where three or more family members have idiopathic epilepsy. This should be done in conjunction with a clinical genetics service.

☑ In all patients with newly diagnosed epilepsy, a three generation family history should be taken (ie siblings, parents and grandparents, uncles, aunts, cousins).

☑ Families with a history of epilepsy should be referred to the Clinical Genetic Service particularly if three or more members of the family are affected.

☑ Families should be given information about the genetic aspects of epilepsy and likely recurrence risks.

3.7 PYRIDOXINE DEPENDENT SEIZURES

Pyridoxine dependent seizures form a rare, but easily treatable, epilepsy syndrome where seizures are largely resistant to AEDs. While there are typical neonatal presentations, children may present up until the third year of life.[80]

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☑ A trial of pyridoxine and its withdrawal is needed to diagnose pyridoxine dependency and should be considered in children with intractable epilepsy with onset under the age of three years.

3.8 REFERRAL TO A TERTIARY EPILEPSY SERVICE

There is no evidence regarding the criteria for referral of children to a tertiary epilepsy service. There may be diagnostic issues when specialist investigations are required such as videotelemetry or for clarification of a syndromic diagnosis.

☑ Referral to a tertiary referral service is recommended in any case where there are diagnostic difficulties and specialist investigations are required.

4 Management

This section includes provision of information to the child and family and management of risk. Initial management of the child with a first seizure in primary care and A&E settings is covered in section 2.1. Detailed pharmacological management of the child with epilepsy is considered in section 5. The management of serial seizures and status epilepticus is dealt with in section 6.

4.1 INFORMATION FOR DISCUSSION WITH CHILDREN, YOUNG PEOPLE AND THEIR CARERS

Families who have a child with epilepsy have a right to clear, accurate and appropriate information about the condition including the specific epilepsy syndrome, its treatment and the implications for everyday living. Surveys of people affected by epilepsy have reported that up to 90% of them wanted more information about the cause of epilepsy, effects and interactions of drugs and the avoidance of potentially dangerous situations.[81,82] As people forget or fail to take in much of what they are told during clinic visits, written information, helpline telephone numbers and contact details of voluntary organisations should be given to all families (*see Annex 8*). 4

Almost as important as the quality of information is the manner in which it is given. People with epilepsy place great importance on having a doctor who is approachable, communicative and knowledgeable.[83] Doctors have been criticised for failing to explain epilepsy properly to young people and neglecting the practical issues relating to everyday life.[84] Many people prefer talking to an epilepsy nurse or someone from a voluntary organisation with whom they feel more at ease.[85] Information may have to be repeated on different occasions to ensure understanding. Different people have different information needs at different times and the person giving the information should be sensitive to and guided by the family's needs at that particular time. A checklist is useful in giving a structure to discussion and ensuring important points are covered. This should be kept in the patient's records, ensuring other professionals are aware of what information has already been given. A sample information checklist is shown in Figure 1.

Sensitivity to the needs of individual families should guide the clinician on how much information to give at the first consultation.

Information for families should be suited to their understanding, making adjustments for different sociocultural contexts.[86] Observations of consultations reveal that information is often directed at parents rather than children.[87] Children with epilepsy were less able to explain their condition than children with asthma or diabetes.[88] Opportunities should be available for open discussion between healthcare professionals and the child or young person. 3

Parents of young children value written or video material to share with relatives and others who look after their children. Parents also want to discuss the implications of their child's epilepsy with someone knowledgeable.[89] 3

D **All children with epilepsy and their carers should be given information appropriate to their condition. A summary of the contents of these discussions should be recorded.**

D **Families should be given information to take home in the most suitable format making adjustments for different sociocultural contexts, eg leaflets, fact sheets, videos.**

☑ Information should be repeated over time and understanding assessed.

☑ A checklist should be used to help healthcare professionals deliver appropriate information to children, families and carers.

4.1.1 INFORMATION CHECKLIST

Figure 1: Example information checklist

General Information

❑ **General epilepsy information**

explanation of what epilepsy is
probable cause
recurrence risks what to do if your child has another seizure
explanation of investigative procedures (tests)
classification of seizures
syndromes
epidemiology
prognosis
genetics
first aid
sudden unexpected death in epilepsy (*SUDEP, see section 4.2.2*)

❑ **Lifestyle**

education (*see section 4.1.2*)
leisure activities
parenting
safety and appropriate restrictions
photosensitivity
alarms and monitors
identity bracelets

❑ **Antiepileptic drugs**

choice of drug
efficacy
missed doses
adverse effects
adherence
drug interactions

❑ **Psychosocial issues**

stigma
memory loss
depression
anxiety
maintaining mental well-being
self esteem
behaviour problems

❑ **Support organisations**

addresses and telephone numbers of national and local epilepsy organisations *(see Annex 8)*

Information for specific groups of children and young people

❑ **Young people (> 12 years)**

driving
employment
relationships
alcohol and recreational drugs
seizure triggers
contraception
preconception (including teratogenic risks)
pregnancy and breastfeeding
free prescriptions

❑ **Difficult to control epilepsy**

educational support
injury protection
financial allowances
multiagency support for family (education, social work, voluntary sector etc)
challenging behaviour

4.1.2 INFORMATION FOR SCHOOLS

Families are concerned about their child having a seizure at school and the possible associated stigma. School staff are keen to provide a safe environment for the child but this can lead to the child not being allowed to participate fully in some activities.[90] Schools should be given written information and school staff should be offered further discussion on epilepsy and its management, ideally involving the parent(s). Some voluntary organisations have leaflets on epilepsy safety specifically written for teachers. Discussions about any possible restrictions on activities within the school should always involve the parents, the child, school staff and a health professional/voluntary sector worker who is knowledgeable about epilepsy. There may be additional risk of minor injuries for some children who have epilepsy but inclusion and independence should be prioritised and joint decisions made about risk and safety.

Many children feel that more open discussion about epilepsy and education of their peers is the best way of reducing stigma and dispelling myths leading to greater acceptance of them and their seizures.[84,91] The child should make the decision about what information is given to classmates. Epilepsy awareness training can be provided by health professionals, field workers or staff from voluntary organisations.

Children with epilepsy which is difficult to control may require extra support to enable them to participate in all aspects of the curriculum. Educational and clinical psychologists can be helpful in supporting school staff and the child and family throughout school life. If seizures are not controlled or treatment is causing adverse effects, this should be taken into account at exam time.

When children have a history of prolonged seizures, training on administration of emergency (or rescue) medication should be given to school staff who are willing to do this, and a care plan agreed with the school and family. Training of school staff (usually by the school nurse) in the administration of emergency medication should be updated regularly. Provision should be made for children with a short recovery period to be allowed to stay in school and rejoin the class when able.

- ☑ Children should be enabled to participate in the full range of school activities.
- ☑ Children who have epilepsy should have a written care plan for their epilepsy, drawn up in agreement with the school and family.
- ☑ Epilepsy awareness training and written information should be offered to schools.

4.2 MANAGEMENT OF RISK

4.2.1 SAFETY

When a diagnosis of epilepsy is made safety may be a major concern for carers. Children may be inappropriately restricted from participating in some sports, social activities and school trips.[90] In fact, children with epilepsy do not appear to have a higher rate of injury than their peers without epilepsy.[92,93] Few children need medical attention for seizure related injuries.[94,95] 2-3

Water based activities have different risks and require levels of supervision appropriate to the situation. Supervision during water activities (swimming, bathing, showering) reduces the risk of accidental drowning.[96]

Scalds and burns can occur during seizures. These are most commonly sustained during cooking, consuming hot drinks,[97] during showering[98] or by falling against radiators.

Children with learning difficulties have an increased risk of injury compared with the general population and epilepsy may compound this.[99] 3

Leaflets on maximising safety are produced by the voluntary agencies (*see Annex 8*).

Safety in some common situations

- **Bathing/showering**. Taking a shower is considered less of a risk than taking a bath. High sided shower bases should be avoided as they can trap water. Thermostatically controlled taps and showers minimise the risk of scalds. Bathing and showering are best undertaken with the bathroom door unlocked and with someone nearby.
- **Scalds and burns**. Radiator covers may help prevent burns. Specific information is produced by the voluntary agencies.
- **Swimming.** Swimming alone is not advised. The level of supervision required for an individual child should be based on the environment and the type of epilepsy.
- **Road safety.** Crossing at traffic lights where possible should minimise the risk of being knocked down should a seizure occur. When cycling, children with epilepsy should avoid traffic and cycle with a friend if possible. Cycling helmets should be worn.
- **Heights.** Rubberised flooring in play areas and crash mats in gymnasiums allow most children with epilepsy to participate in climbing activities with their peers. Abseiling and climbing can often be undertaken as long as those in charge of the activity are aware of the possibility of a seizure occurring and feel it can be managed safely.
- **Photosensitivity.** Only around 5% of children with epilepsy have seizures triggered by flickering light and this is commonest between the ages of 7 and 19 years. Antiepileptic treatment usually abolishes the photosensitive response and families should be given written information on strategies to minimise risk.

D **Children with epilepsy should be encouraged to participate in normal activities with their peers. Supervision requirements should be individualised taking into account the type of activity and the seizure history.**

4.2.2 DEATH IN EPILEPSY

People with epilepsy have an increased risk of premature death compared to the general population.[100] Most of these deaths can be explained by the condition underlying the epilepsy, seizure-related accidents, or status epilepticus. The vast majority of children with epilepsy who die do so for reasons relating to a severe underlying neurological impairment rather than the epilepsy itself.

In some situations, the death of someone with epilepsy cannot be adequately explained. Sudden unexpected death in epilepsy (SUDEP) is defined as *"sudden, unexpected, non-traumatic and non-drowning death in an individual with epilepsy, with or without evidence of a seizure, and excluding documented status epilepticus, where post-mortem examination does not reveal a toxicological or anatomic cause for death"*.[101] Most studies relate to adults and many are not based upon populations of patients with epilepsy but on examinations of the cause of death in people with epilepsy who subsequently died. The mechanism of SUDEP is poorly understood.

For people with idiopathic epilepsy and without additional severe neurological impairments, the risk of sudden unexpected death appears to be very low and may not exceed that of the general population.[102,103]

Population studies suggest that SUDEP is very uncommon in childhood.[104,105] However the risk of SUDEP appears to rise in the late teenage years and early adulthood. Factors associated with this are early age of onset of epilepsy, number of seizures, severe learning difficulty and seizure type.[106,107] 2+ 3

There is no general consensus on when the risk of SUDEP or other causes of premature death should be discussed with families, but it may be appropriate to discuss this issue with parents of children with symptomatic epilepsies or drug resistant epilepsies with tonic-clonic seizures.[108] 4

D **Families should be advised if the child has an increased risk of SUDEP. They can be reassured if the risk is considered to be low.**

5 Antiepileptic drug treatment

If antiepileptic drug treatment is to be effective, there must be a reasonable certainty about the diagnosis of epilepsy and/or epilepsy syndrome. Responses to individual drugs vary considerably according to seizure and syndrome type and the diagnosis should be reviewed at each clinical contact.

The decision to start treatment can have considerable long term implications. A successful partnership between the child, the child's family and healthcare team will achieve the best possible outcome and maximum adherence with the treatment plan.

Many medicines that are prescribed for children with epilepsy are either not licensed for use below a particular age or are used for an unlicensed indication ("off label use").[109,110] The Standing Committee on Medicines, a joint committee of the Royal College of Paediatrics and Child Health (RCPCH) and the Neonatal and Paediatric Pharmacists Group (NPPG), have recommended that the informed use of some unlicensed medicine or licensed medicines for an unlicensed indication is necessary in paediatric practice.[111] The full RCPCH/NPPG statement is reproduced in Annex 4. 4

The prescription of any medication requires an assessment of risk and of benefit. In this guideline the efficacy and safety of AEDs have been reviewed using the best available evidence. Where recommendations are graded for individual AEDs, this is done irrespective of the licensing status of that medication. This applies to steroids in section 5.2.3 and midazolam in section 6.2 which are currently unlicensed for the indication described.

With the exception of phenytoin there is no good evidence of significant difference in bioavailability between proprietary and generic AEDs.[112,113] For many children and families issues of familiarity and acceptability of an AED taken over many years may be important to ensure good adherence. Guaranteeing the consistent supply of a single formulation of a particular generic AED may be problematic because of wholesaler and community pharmacy purchasing arrangements and where there is a change in manufacturer of an AED. This could militate against the use of generic AEDs where frequent changes of formulation may be inevitable. 4

5.1 WHEN TO START ANTIEPILEPTIC DRUG TREATMENT

5.1.1 FEBRILE SEIZURES

Febrile seizures are common; most are brief and require no medical treatment. The child will usually only have one seizure. The overall risk of recurrence is 25%. Risk factors for recurrence are a first seizure before the age of 15 months; epilepsy or febrile seizures in a first degree relative; or a prolonged focal seizure. While phenobarbital and sodium valproate may reduce recurrence rates, the risk of adverse effects does not justify their routine use. They do not influence the risk of subsequently developing epilepsy.[114] Phenobarbital can cause adverse cognitive effects which may persist following withdrawal.[115,116] 1^+ 2^+

Intermittent rectal diazepam does not appear to alter recurrence rates of febrile seizures, or to influence later complications such as subsequent epilepsy and developmental disabilities.[117] However, parents should be given clear advice on the first aid management of a seizure and emergency medication if there has been a prolonged febrile seizure *(see section 6.2)*. 2^{++}

B **Children with febrile seizures, even if recurrent, should not be treated prophylactically with antiepileptic drugs.**

5.1.2 PROVOKED SEIZURES

Traumatic brain injuries are a common cause of provoked seizures in children. A systematic review that included children demonstrated that AEDs, in particular phenytoin and carbamazepine, given after head injury are effective in preventing early seizures (within one week). This early treatment is ineffective in reducing mortality or preventing the later emergence of epilepsy.[118] 1++

A **Long term prophylactic antiepileptic drug treatment for children with head injuries is not indicated.**

5.1.3 UNPROVOKED, TONIC-CLONIC EPILEPTIC SEIZURES

The majority of children with a first unprovoked seizure will not have a recurrence. Those with a normal EEG whose initial seizures occur whilst awake have a five year recurrence risk of 21%. Risk factors for recurrence include remote symptomatic aetiology, abnormal EEG, a history of prior febrile convulsions and age less than three years.[44,119] 2++

A follow-up study of children who had experienced tonic-clonic seizures found that, in nearly half of the children, the frequency of seizures diminished without treatment.[120] A further population based cohort study suggests that children may have up to ten tonic-clonic or partial seizures before either subsequent seizure control or seizure remission rate are adversely affected.[121] This study excluded seizure types more typically associated with epilepsy syndromes for which treatment is recognised to be problematic. 2+ 3

In a large randomised study, around three quarters of children did not experience seizure recurrence within seven days following a first unprovoked, tonic-clonic epileptic seizure. Among children who did relapse, those given AED therapy immediately following their first seizure experienced 50% fewer seizures than the control group, however longer term follow up of the same cohort showed that remission rates were similar in both groups. [122,46] 1++ 1+

When considering treatment, the clinician, the child and family must take into account both what may be an isolated event and the risks of adverse effects of AED treatment. The benefit of early treatment appears to be confined to a short term reduction in seizure recurrence risk but has no effect on long term remission rates.

A **Antiepileptic drug treatment should not be commenced routinely after a first, unprovoked tonic-clonic seizure.**

☑ The decision to commence antiepileptic drug treatment should be reached jointly by the epilepsy specialist and the family. It should be informed by a knowledge and understanding of the epilepsy syndrome, including an assessment of recurrence risk and the likelihood of long term remission.

5.2 CHOICE OF FIRST ANTIEPILEPTIC DRUG

There is a paucity of studies on the comparative efficacy of AEDs in specific epilepsy syndromes.

In newly diagnosed epilepsy, across age groups and all seizure types, several randomised control trials of carbamazepine, sodium valproate, clobazam, phenytoin and phenobarbital show that they are effective but fail to identify significant differences in efficacy between these medications.[123-127] In a single trial, topiramate failed to show an advantage over carbamazepine or sodium valproate.[128] 1++ 1+

The potential adverse effects of AEDs should be a major determinant of the choice of drug in the individual child. Antiepileptic drugs can exacerbate seizures in some epileptic syndromes *(see Table 2)*.[129-133] 3 4

*Table 2: Antiepileptic drugs which may **WORSEN** specific syndromes or seizures*

Antiepileptic drug	Epileptic syndrome/seizure type
carbamazepine, vigabatrin, tiagabine, phenytoin	childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy[134]
vigabatrin	absences and absence status[134]
clonazepam	generalised tonic-status in Lennox-Gastaut Syndrome[135]
lamotrigine	Dravet's syndrome[132] juvenile myoclonic epilepsy[136,137]

5.2.1 GENERALISED EPILEPSIES

A systematic review of the treatment of absence epilepsy in children found no RCTs upon which to make recommendations about the respective merits of individual AEDs.[138] Randomised trials comparing the efficacy of sodium valproate and ethosuxamide in childhood absence epilepsy have found no difference in effectiveness.[139,140] One RCT demonstrated that lamotrigine was better than placebo in the treatment of absence seizures, but this was a small study with a very short period of follow up.[141]

1+ 1- 2+

There are no robust systematic reviews or RCTs to support the use of specific AED monotherapy in other generalised epilepsy syndromes.

Results from case series suggest that sodium valproate is effective for the treatment of idiopathic generalised epilepsies (juvenile myoclonic epilepsy, generalised seizures on early morning wakening, juvenile absence epilepsy).[142-144] No comparative studies were identified to determine whether any of the newer drugs are as effective.

3

In a retrospective case series which examined remission rates in idiopathic generalised epilepsies treated with sodium valproate, topiramate or lamotrigine remission was most likely to be achieved with sodium valproate, followed by topiramate. Remission was least likely to be induced by lamotrigine.[145]

3

In symptomatic generalised epilepsies (Lennox-Gastaut syndrome, Dravet's syndrome, atypical absence epilepsies and unclassified myoclonic epilepsies), sodium valproate, lamotrigine and clobazam reduce seizure frequencies.[146-149]

1++ 3

C **The choice of first AED should be determined where possible by the syndromic diagnosis and potential adverse effects.**

5.2.2 FOCAL EPILEPSIES

A wide range of AEDs (phenytoin, sodium valproate, carbamazepine, clobazam, lamotrigine, topiramate, oxcarbazepine, vigabatrin) are effective as monotherapy in the treatment of focal seizures.[150-155,173] There are very few head-to-head studies comparing the effectiveness of different AEDs. None subclassify focal seizures into epilepsy syndromes.

1++ 1+ 3

5.2.3 WEST'S SYNDROME AND EPILEPTIC INFANTILE SPASMS

The goal of treatment is to abolish epileptic spasms and hypsarrythmia. In West's syndrome secondary to tuberous sclerosis, vigabatrin is more effective than corticosteroids[156,157] increasing development quotients and resolving autistic-type features.[158] For other aetiologies including cryptogenic forms of West's syndrome prednisilone or corticotropin appear to be more effective than vigabatrin.[159] In adults, vigabatrin has been associated with significant adverse effects (*see section 5.4.2*).

1+

High dose sodium valproate therapy (100-300 mg/kg/day)[160] and nitrazepam[161] are efficacious in resistant West's syndrome. Topiramate also has some effect in controlling infantile spasms refractory to other medications.[162] | 3

B **In West's syndrome, corticotropin or corticosteroids should be used as first line treatment. Where West's syndrome is caused by tuberous sclerosis, vigabatrin is superior.**

5.3 ANTIEPILEPTIC DRUG COMBINATION THERAPY

Up to 70% of childhood epilepsies will respond to the first or second AED. If two appropriate AEDs have failed independently as monotherapy, the chance of further monotherapy controlling seizures is very low and combination therapy should be considered.[163] Prior to initiating combination therapy, consider: | 2++ 3

- Is the diagnosis correct? (*see sections 2 and 3*)
- Is adherence with treatment poor?[164]
- Is the choice and dose of AED appropriate for the epilepsy syndrome or seizure type?[131] *(see Table 2)*

5.3.1 IDIOPATHIC GENERALISED EPILEPSIES

In drug resistant idiopathic generalised epilepsy, topiramate, lamotrigine and clobazam are effective as add-on treatments.[147,165,166] | 1+

5.3.2 SYMPTOMATIC GENERALISED EPILEPSIES

Lamotrigine and topiramate are effective add-on treatments in Lennox-Gastaut syndrome.[167-169] Clobazam, clonazepam and nitrazepam can be useful in the idiopathic and symptomatic generalised epilepsies.[170] | 1++ 1+ 3

Stiripentol has antiepileptic activity in Dravet's Syndrome when used with clobazam and sodium valproate.[171] Topiramate may also be used in combination with other first line AEDs.[172] | 1++ 3

5.3.3 FOCAL SEIZURES

Lamotrigine, gabapentin, topiramate, tiagabine and oxcarbazepine are effective as add-on therapies for focal seizures.[173-177] | 1++ 1+

There is evidence from case series that levetiracetam and acetazolamide may also be useful.[178-180] | 3

The child, family, carers and doctors should accept that some seizures persist despite adequate trials of appropriate medication. This is particularly true in certain epilepsy syndromes and some epilepsies associated with severe cerebral palsy and severe/profound learning difficulties. Reduction of seizure frequency must be balanced against the adverse effects of drugs. For some children with intractable epilepsy, it may sometimes be appropriate to withdraw all antiepileptic drugs.

A **When appropriate monotherapy fails to reduce seizure frequency, combination therapy should be considered.**

☑ The choice of combination therapy should be guided by the epilepsy syndrome and the adverse effect profile of the AED.

☑ Where there is no response to an appropriate AED, the diagnosis and treatment of epilepsy should be reviewed.

5.4 ADVERSE EFFECTS OF ANTIEPILEPTIC DRUGS

Adverse effects from AEDs are common and are a major cause of discontinuing drug treatment. Many adverse effects are dose related and predictable. These can be minimised by gradual escalation of the dose and dose reduction should symptoms persist.

5.4.1 IDIOSYNCRATIC DRUG REACTIONS

Idiosyncratic drug reactions usually arise early in treatment but can occur at any time and are potentially serious. Rash is a common adverse effect in children and is associated with carbamazepine, phenytoin and lamotrigine. Rarely, a severe hypersensitivity syndrome may occur which may be life threatening.

5.4.2 CHRONIC ADVERSE EFFECTS

Sodium valproate is associated with significant weight gain in children and adolescents.[181] Being overweight at the start of treatment may be a significant predictor of further weight gain with this drug.[182] | 2+

Parents frequently report cognitive adverse effects of AEDs in their children. The few well controlled studies do not demonstrate significant cognitive impairment with clobazam, sodium valproate, carbamazepine or phenytoin.[183,184] Phenobarbital may have an adverse effect on cognitive function in children.[115] | 2+

For adults treated with vigabatrin, visual field impairment is relatively common and may be irreversible. Few data exist in children. The risk of visual field defects must be balanced against the benefits of treating West's syndrome or symptomatic focal epilepsies.

Gum enlargement or overgrowth is frequently associated with phenytoin and rarely with sodium valproate and vigabatrin.[185] This can prevent the maintenance of good oral hygiene and lead to bleeding, tenderness, dental decay, periodontal disease and infection. Overgrowth can be reduced by meticulous daily oral hygiene, but this may be difficult in some children, particularly in those with physical and learning difficulties. | 3

5.4.3 TERATOGENIC SIDE EFFECTS

The overall risk of major fetal malformation is approximately 2% in any pregnancy. This increases 2-3 fold in women taking a single AED.[186] Data suggest that the risk with sodium valproate may be higher than with lamotrigine or carbamazepine.[187,188] | 2++ 3

Two retrospective epidemiological studies have also suggested an association between in utero exposure to sodium valproate and risk of developmental delay.[189,190] | 3

Recent advice from the Medicines and Healthcare Products Regulatory Agency (MHRA) states that women of childbearing potential should not be started on sodium valproate without specialist advice.[191] | 4

☑ Adolescent girls taking AEDs and their parents should be advised of the risks of fetal malformations and developmental delay.

Contraception and pregnancy in patients with epilepsies are addressed in SIGN guideline 70 *Investigation and Management of Adults with Epilepsy*.[5]

5.4.4 MONITORING FOR ADVERSE EFFECTS IN ANTIEPILEPTIC DRUGS

There is no evidence to suggest that routine laboratory monitoring for adverse effects can reduce the risk of developing a given adverse effect to a drug. Laboratory monitoring is required in symptomatic patients only.

There is evidence that routine monitoring of AED drug levels does not affect clinical management, except to adjust phenytoin dosage.[192] | 1+

B **Routine AED level monitoring is not indicated in children.**

☑ Clear advice on the management of the potential adverse effects of AEDs should be discussed with children and parents or carers.

5.5 COMPLEMENTARY THERAPY

There is no evidence to support the use of complementary therapies in children and young people with epilepsy. Families should be asked about the use of complementary therapy and advised about potential adverse effects, mainly interactions with prescribed medication. There is potential for reduction of the plasma concentrations of carbamazepine, phenobarbital and phenytoin if St John's Wort is used concomitantly.[193] 4

5.6 PSYCHOLOGICAL TREATMENT

There is no robust evidence to suggest that psychological treatments such as cognitive behaviour therapy or EEG biofeedback are effective in the treatment of seizures in children.[194] Psychological symptoms associated with epilepsy may merit treatment in their own right.

5.7 WITHDRAWAL OF ANTIEPILEPTIC DRUGS

Overall, 60 to 70% of children who have been seizure free on AEDs for two years or more will remain seizure free when the drugs are withdrawn.[195,196] Any relapses tend to occur within two years. Long term remission can be regained following a further seizure free period back on treatment.[197] 1+

A number of risk factors determine seizure relapse following withdrawal. Relapse risk is increased in symptomatic epilepsy, by age at seizure onset (12 years or older), short duration of seizure freedom (less than six months), and an abnormal EEG at discontinuation.[196,198-201] A syndromic diagnosis may also predict relapse. Juvenile myoclonic epilepsy, a common epilepsy syndrome in adolescence, has a particularly high relapse rate.[202] 1++ 1+ 3

Decisions regarding AED withdrawal should be informed by discussion with the child and family. Important factors influencing that decision include fear of further seizures, risk of death or injury and concerns about the adverse effects of continued AED treatment. In young people, issues concerning driving, employment and pregnancy should also be considered.

In children there appears to be no difference between gradual withdrawal of AEDs over a six month period and a quick taper of six weeks.[203] Sudden discontinuation of AEDs, particularly phenobarbital and the benzodiazepines should be avoided. 1+

A **Withdrawal of antiepileptic drug treatment should be considered in children who have been seizure free for two or more years.**

5.8 WHEN TO REFER FOR TERTIARY CARE

There is no robust evidence regarding the criteria for referral of children to a tertiary epilepsy service. Children with drug resistant epilepsy (those who have failed to respond to two appropriate drugs in adequate dosage after a six month period) should be referred.[204] Early referral should be considered in infants and preschool children with very frequent seizures and developmental stagnation.

The ketogenic diet has a role to play in the management of intractable epilepsy and significant proportions of children will experience clinically significant seizure reduction.[205-207] This technique should be supervised in a unit where expertise in the diet exists. 3

Neurosurgical procedures are an effective treatment for some children with drug resistant epilepsy. Some children will be cured by appropriate surgery. It is important that referral for surgery be considered early in any focal drug resistant epilepsy as the benefits will be greater in younger patients. If curative surgery is not feasible, children with intractable epilepsy should be referred for consideration of palliative surgical procedures (corpus callosotomy, subpial transection and vagal nerve stimulation). Assessment for surgery should be performed in a specialist unit.

☑ Referral to tertiary specialist care should be considered if a child fails to respond to two AEDs appropriate to the epilepsy in adequate dosages over a period of six months.

6 Management of prolonged or serial seizures and convulsive status epilepticus

6.1 DEFINITIONS

Most tonic-clonic seizures last less than two minutes. Children who have prolonged seizures (> 5 minutes) or serial seizures (brief, repetitive seizures with recovery of consciousness between seizures) are more likely to progress to convulsive status epilepticus (CSE).

Convulsive status epilepticus is conventionally defined as epileptic activity persisting for 30 minutes, causing a wide spectrum of clinical symptoms.[208] Early treatment before admission to hospital reduces the length of seizure and leads to the use of fewer drugs.[209] 1+

6.2 PROLONGED OR SERIAL SEIZURES

The management of a prolonged seizure and of serial seizures is similar.

Rectal diazepam is effective in treating prolonged/serial seizures[210,211] but has many shortcomings when used in the home and community settings. These include difficulties in administration for wheelchair users and unreliable bowel absorption. It is socially unacceptable for many young people and their carers. 1+

Buccal or intranasal midazolam is as effective as rectal diazepam in the treatment of prolonged seizures.[212] Parents and carers have found buccal or nasal midazolam easy to use and a preferable alternative in a community setting.[213,214] For a small number of children, rectal paraldehyde may be more appropriate. 1+ 3

B **Prolonged or serial seizures should be treated with either nasal or buccal midazolam or rectal diazepam.**

Approximately 80% of children will respond to benzodiazepine emergency medication.[215] Children who fail to respond to initial emergency medication should be managed according to the recommendations in section 6.3. It is not necessary to wait until seizure activity has persisted for beyond 30 minutes. 3 4

6.3 CONVULSIVE STATUS EPILEPTICUS

Convulsive status epilepticus is a medical emergency with a significant morbidity and mortality that can sometimes be attributed to inadequate or delayed treatment. Overtreatment also carries significant risks of respiratory and cardiac depression. The management of CSE in children is based largely on the management of CSE in adults, using age appropriate doses.[216]

Annex 7 gives an example protocol for the management of convulsive status epilepticus. There is little robust evidence to guide the design of a management pathway in childhood CSE. While many protocols for the management of CSE now suggest intravenous lorazepam as "first line" treatment there is no robust evidence that this is superior to diazepam.[216] Where intravenous access is difficult in children, intramuscular midazolam is as effective as initial intravenous diazepam.[217] 1+ 2++

If the seizure has not stopped following administration of a first dose of benzodiazepine, management guidelines have generally suggested repeating this dose followed by a loading dose of phenytoin.[218] Cardiac monitoring is necessary during phenytoin infusion. 4

☑ All units admitting children should have a protocol for the management of convulsive status epilepticus.

6.3.1 CONVULSIVE STATUS EPILEPTICUS CONTINUING LONGER THAN 30 MINUTES

If CSE persists beyond a further 30 minutes, the child should be admitted to an intensive treatment unit and EEG monitoring should be undertaken. Midazolam, phenobarbital or thiopental are most commonly used in these circumstances.[219] 3

6.3.2 NON-CONVULSIVE STATUS EPILEPTICUS

Non-convulsive status epilepticus (NCSE) may accompany any brain insult. The underlying cause should be treated appropriately. NCSE is also commonly encountered in the epileptic encephalopathies. In children with or without a previous diagnosis of epilepsy, who show a change in personality, recent onset psychosis, any regression in communication, motor or behavioural skills, the diagnosis of NCSE should be considered. The diagnosis of NCSE is difficult and critically dependent on EEG.

There are no prospective randomised controlled trials for the treatment of NCSE in children. Treatment with benzodiazepines (oral, buccal, nasal, rectal)[220-222] corticotropin[223,224] or sodium valproate is effective.[225] Resistant NCSE may require intravenous lorazepam and/or phenytoin.[226] 3 4

☑ Management of children with non-convulsive status epilepticus is complex and should be discussed with a specialist.

7 Behaviour and learning

7.1 ACADEMIC OUTCOME

Epilepsy and learning disabilities are common conditions both singly and in combination. The relationship between them is complex. In some situations a particular condition may be the cause of the epilepsy, in others it may be an effect of the epilepsy and in others the precise cause and effect relationship may be unclear.

Although many children with epilepsy have intellectual functioning in the normal range, specific patterns of cognitive strengths and weaknesses, including memory impairment may be associated with this disorder. Up to 50% of children with epilepsy require additional support at school.[13] Many of these children have learning disabilities which relate to an underlying brain disorder. However, in other situations difficulties in learning may be more directly related to the epilepsy and its management, for example, frequent epileptic discharges and adverse effects of medication.[227] 4

Certain epilepsy syndromes, including West's syndrome, Dravet syndrome, myoclonic astatic epilepsy, Landau-Kleffner syndrome and Lennox-Gastaut syndrome, are strongly associated with severe cognitive deterioration (epileptic encephalopathy). Other epilepsy syndromes (eg benign childhood epilepsy with centrotemporal spikes, limbic epilepsies or childhood absence epilepsy) can be associated with milder or specific educational problems.[228-232]

7.2 BEHAVIOURAL/PSYCHIATRIC DISORDERS

Effects on learning may be further compounded by associated behavioural difficulties. Children with epilepsy have approximately double the rates of behavioural and psychiatric disorders compared with the general childhood population.[233-239] Depression scores are elevated in one in four children with epilepsy, and anxiety scores are elevated in one in seven children. 3 4

The prevalence of Attention Deficit Hyperactivity Disorder (ADHD) symptoms is reported in up to 40% of children with epilepsy (depending on the population studied and selection criteria). Attention difficulties rather than hyperactivity predominate in children who have epilepsy and ADHD.[240] 3

☑ All children with epilepsy should have their behavioural and academic progress reviewed on a regular basis by the epilepsy team. Children with academic or behavioural difficulties should have appropriate educational and/or psychological assessment and intervention.

7.3 ANTIEPILEPTIC DRUGS

Parents frequently report behavioural and cognitive adverse effects in children receiving AEDs. Assessing the nature and effect of AEDs on cognition has been difficult to isolate from the effects of epilepsy, underlying brain disorder, variations in IQ scoring and environmental factors. Despite the large body of evidence on this subject there are few well controlled studies. Phenobarbital treatment may result in severe memory impairment, significant falls in IQ scores and behavioural disturbance.[241,242] However, the cognitive adverse effects of carbamazepine and sodium valproate appear to be limited to mild, general psychomotor slowing. There are no satisfactory studies on the newer AEDs upon which to make clear recommendations.[243,244] Combination therapy may further increase the likelihood of adverse side effects. 4

☑ If a child experiences cognitive or behavioural adverse effects from a specific AED, an alternative drug should be considered.

7.4 ASSOCIATED NEUROLOGICAL CONDITIONS

There is an increased prevalence of epilepsy in children with learning difficulties. 15% of children with mild learning difficulties and 30% with severe learning difficulties will develop epilepsy.[245]

Epilepsy is commonly seen in children with cerebral palsy and, particularly, in those with quadriplegia. One in five children with hemiplegia has active epilepsy[246] and there is a strong association of epilepsy with cognitive impairment.[247]

Epilepsy prevalence rates in autism, encompassing a range of seizure types, show significant variation (5-38%).[248] When epilepsy and learning difficulty coexist the risk of autism rises threefold by 10 years of age.[249] 4

Many neurogenetic disorders present with epileptic seizures. Examples include Down's Syndrome, Angelman Syndrome, Rett Syndrome, Fragile X Syndrome and tuberous sclerosis. Children with these conditions often have epilepsy that is more severe and management is further complicated by the underlying disorder.

7.5 EPILEPSY AND THE USE OF OTHER MEDICATIONS

7.5.1 NEUROSTIMULANTS

Children and young people with epilepsy show increased prevalence of ADHD symptoms.[250] National guidelines support the use of neurostimulants to reduce the core symptoms of ADHD.[251,252] 3 4

Although the British National Formulary recommends caution in the use of neurostimulants when there is a history of epilepsy (and discontinuation if seizures occur), there is no reliable evidence that such treatment is associated with an increased seizure risk, altered antiepileptic drug levels, or increased drug related adverse effects.[253-256] 3 4

D **Neurostimulant treatment should not be withheld, when indicated, from children with epilepsy and ADHD.**

7.5.2 MELATONIN

Sleep disorders are common problems in children with epilepsy and require appropriate management.[257,258] In some situations melatonin is appropriate and this medication is widely prescribed in paediatric practice.[259,260] 4

Concerns that melatonin may be a proconvulsant have not been confirmed.[261,262]

D **Epilepsy, or a history of seizures, are not contraindications to the use of melatonin for the treatment of sleep disorders in children and young people.**

7.5.3 OTHER PSYCHOTROPIC MEDICATION

Other psychotropic medication may be of considerable value in the management of some children and young people with epilepsy and associated behavioural and psychiatric disorders. Care should be taken to exclude those in whom alternative management strategies, for example behavioural approaches, may be appropriate.[263]

Fluoxetine is presently the only selective serotonin reuptake inhibitor (SSRI) recommended by the Medicines and Healthcare products Regulatory Agency (MHRA) for the treatment of depression and obsessive compulsive disorders in children and young people.[264] Atypical neuroleptics, such as risperidone, are increasingly used in the management of challenging behavioural problems associated with autism and in children with severe aggression.[265,266]

Systematic studies in relation to the use of antidepressants and neuroleptic medications in children with epilepsy are lacking.

The British National Formulary recommends caution in the use of SSRIs (fluoxetine) and risperidone in patients with epilepsy, although there is evidence, principally from adult studies that significant seizure exacerbations are rare.[267,268] 4

☑ Selective serotonin reuptake inhibitors and atypical neuroleptics such as risperidone should not be withheld, when indicated, in children and young people with epilepsy and associated behavioural and psychiatric disorders.

8 Models of care

Children with epilepsy require a multidisciplinary approach to their care. This may include a range of professionals, for example, primary, secondary and tertiary care paediatricians and neurologists, paediatric epilepsy nurses, child psychiatrists and psychologists. Access is also required to a range of diagnostic and investigative tools, including neurophysiology and neuroradiology. Close liaison with education, social work and voluntary sector is of considerable importance.

8.1 SPECIALIST EPILEPSY CLINICS

A Cochrane review found no good studies from which to determine the effectiveness of epilepsy clinics in comparison to medical clinics.[269]

Many audits, patient satisfaction surveys and national reports express concern about standards of epilepsy care in adults and children. Highlighted problems are lack of systematic follow up, inappropriate use of investigations, patients being seen by non-specialists, inappropriate drug usage, poor communication between primary and secondary care, inadequate information and time for discussion, and poor patient knowledge.[270]

Specialist clinics are well established in the management of other chronic childhood diseases such as diabetes, cystic fibrosis and childhood cancer.[271] A similar model is likely to be suitable for children with epilepsy. The needs of young people (aged > 13 years), and their transition to the adult service should be addressed.[22] A dedicated young persons' clinic is a suitable setting for discussion of issues appropriate to the age group *(see section 4.1.1)*.[272] 4

Where locality based specialist neurology services are not available or difficult to access, clinical networks may be a suitable model. Services developed within the network could include joint consultations with visiting neurologists, shared protocols, access to appropriate investigations, continued medical education, audit, and peer review.

In contrast to the management of epilepsy in adults, it is unusual for the general practitioner to take the lead in the management of childhood epilepsy.[273] If the GP is to contribute effectively to care, good communication with the specialist clinic is essential. The clinic letter to the GP or paediatrician should cover the topics discussed at the consultation, with particular reference to:

- diagnosis
- prognosis
- management
- follow up
- monitoring seizures, aiming to improve control by adjustment of medication or re-referral.

The letter should be copied to families and, when appropriate, to the young person with epilepsy. It is good practice to include the community paediatrician and any nursing staff involved (eg health visitor, school nurse, community paediatric nurse) in the correspondence. Parents should be encouraged to share the correspondence with school staff.

☑
- Children with epilepsy should have access to specialist epilepsy services, including dedicated young people and transition clinics
- Each child should have an individual management plan agreed with the family and primary care team
- Annual review is suggested as a minimum, even for children with well controlled epilepsy, to identify potential problems, ensure discussion on issues such as withdrawal of treatment, and minimise the possibility of becoming lost to follow up.

8.2 ROLE OF EPILEPSY NURSE SPECIALISTS

Systematic evaluation has provided no robust evidence that epilepsy nurse specialists, compared to traditional models of care, improve seizure frequency, depression and anxiety scores or quality of life scores. [270] 2++

However other studies have suggested improvements in continuity of care, AED adherence and length of inpatient stays [274-277] Seventy per cent of patients attending clinics run by epilepsy nurse specialists had previously unidentified problems resolved by the nurse including misdiagnosis, overmedication and lack of awareness of drug side effects.[278]

The role of epilepsy nurses follows the wider role of the specialist nurse and includes: 3

- being a first contact and advocate for the child and family
- providing specific up to date information and advice
- liaison between the family, school and the multidisciplinary team involved in the child's care.

D **Each epilepsy team should include paediatric epilepsy nurse specialists.**

8.3 ROLE OF THE VOLUNTARY SECTOR

There are agencies throughout the UK *(See Annex 8)* which offer information, advice, support, advocacy and training for families affected by epilepsy. A survey of contacts between 2002-2003 made to four agencies (National Society for Epilepsy, Epilepsy Action, Epilepsy Scotland and Quarriers Fieldwork Service in Grampian) showed that many people (patients, carers and professionals) request information about all aspects of epilepsy from their helplines and websites and these appear to be popular sources of information. They also provide leaflets and training to people with epilepsy, families and carers as well as health, educational and other professionals.

☑ Children and families should be advised of the range of services provided by the voluntary sector.

9 Development of the guideline

9.1 INTRODUCTION

SIGN is a collaborative network of clinicians and other healthcare professionals and is part of NHS Quality Improvement Scotland. SIGN guidelines are developed by multidisciplinary groups of practicing clinicians using a standard methodology based on a systematic review of the evidence. Further details about SIGN and the guideline development methodology are contained in "SIGN 50: A Guideline Developer's Handbook", available at **www.sign.ac.uk**

9.2 THE GUIDELINE DEVELOPMENT GROUP

Dr Martin Kirkpatrick *(Chair)*	*Consultant Paediatric Neurologist, Ninewells Hospital, Dundee*
Mrs Sheena Bevan	*Quarriers Epilepsy Fieldworker and Clinical Liaison Officer, Aberdeen*
Ms Jo Campbell	*School Nurse, Elgin*
Ms Francesca Chappell	*Information Officer, SIGN*
Dr John Dean	*Consultant Geneticist, Aberdeen Royal Infirmary*
Dr Liam Dorris	*Lecturer in Clinical Psychology, University of Glasgow and Paediatric Neuropsychologist, Royal Hospital for Sick Children, Glasgow*
Ms Margot Dymock	*Service Manager, Children's Services, Dundee*
Dr Ali El-Ghorr	*Programme Manager, SIGN*
Dr George Farmer	*Consultant Paediatrician, Raigmore Hospital, Inverness*
Dr Eleanor Guthrie	*General Practitioner, Glasgow*
Dr Khalid Ibrahim	*Specialist Registrar, Ninewells Hospital, Dundee*
Dr Patricia Jackson	*Consultant Paediatrician, Royal Hospital for Sick Children, Edinburgh*
Mrs Patricia MacLaren	*Lay Representative, Aberdeen*
Ms Arlene Mooney	*National Association of Special Educational Needs, Edinburgh*
Dr Ann O' Hara	*Associate Specialist, Royal Hospital for Sick Children, Aberdeen*
Dr Moray Nairn	*Programme Manager, SIGN*
Dr Mary O' Regan	*Consultant Paediatric Neurologist, Royal Hospital for Sick Children, Glasgow*
Dr Michael Prendergast	*Consultant Child and Adolescent Psychiatrist, Prudhoe Hospital, Northumberland*
Dr Aline Russell	*Consultant Clinical Neurophysiologist, Southern General Hospital, Glasgow*
Dr Chris Steer	*Consultant Paediatrician, Victoria Hospital, Kirkcaldy*
Mrs Ailsa Stein	*Information Officer, SIGN*
Ms Susan Stewart	*Helpline and Information Manager, Epilepsy Scotland, Glasgow*
Mrs Sue Stobie	*Lead Divisional Pharmacist, Royal Hospital for Sick Children, Edinburgh*
Mrs Lesslie Taylor	*Lay Representative, Helensburgh*
Dr William Whitehouse	*Senior Lecturer in Paediatric Neurology, Queen's Medical Centre, Nottingham*
Ms Margaret Wilson	*Paediatric Epilepsy Nurse, Royal Hospital for Sick Children, Glasgow*

The membership of the guideline development group was confirmed following consultation with the member organisations of SIGN. All members of the guideline development group made declarations of interest and further details of these are available on request from the SIGN Executive. Guideline development and literature review expertise, support and facilitation were provided by the SIGN Executive.

9.3 SYSTEMATIC LITERATURE REVIEW

The evidence base for this guideline was synthesised in accordance with SIGN methodology. A systematic review of the literature was carried out using an explicit search strategy devised by a SIGN Information Officer. Databases searched include Medline, Embase, CINAHL, PsychINFO, and the Cochrane Library. The year range covered was 1980-2003. Internet searches were carried out on various websites including the New Zealand Guidelines Programme, NELH Guidelines Finder, and the US National Guidelines Clearinghouse. The Medline version of the main search strategies can be found on the SIGN website, in the section covering supplementary guideline material. The main searches were supplemented by material identified by individual members of the development group. All selected papers were evaluated by a minimum of two members of the group using standard SIGN methodological checklists before conclusions were considered as evidence.

9.4 SIGN AND NICE

The National Institute for Clinical Excellence (NICE) technology appraisal 79, Newer Drugs for Epilepsy in Children,[279] approved for use in Scotland in 2004, gave guidance on the use of licensed medications for epilepsy in children. Recommendations in sections 5 and 6 of this SIGN guideline, which considers both licensed and unlicensed medications, may therefore differ from those given in the NICE appraisal.

In July 2001 the Department of Health and National Assembly for Wales instructed NICE to develop a clinical guideline on epilepsy. This work was allocated to the National Collaborating Centre for Primary Care (NCC-PC). Concurrently, SIGN were working on the development of two epilepsy guidelines: SIGN 70, Diagnosis and Management of Adults with Epilepsy (published in April 2003) and this guideline, SIGN 81, Diagnosis and Management of Epilepsies in Children and Young People (published in March 2005). Members of the two SIGN guideline development groups, the NICE guideline development group and representatives of both SIGN Executive and the NCC-PC met frequently throughout the development phases of the respective guidelines in order to ensure that the publications would complement rather than conflict with each other. The results of the evidence reviews completed by each team were shared, but the formulation of recommendations for each guideline remained separate.

9.5 CONSULTATION AND PEER REVIEW

9.5.1 NATIONAL OPEN MEETING

A national open meeting is the main consultative phase of SIGN guideline development, at which the guideline development group presents its draft recommendations for the first time. The national open meeting for this guideline was held on 9 October 2003 and was attended by around 180 representatives of all the key specialties relevant to the guideline. The draft guideline was also available on the SIGN website for a limited period at this stage to allow those unable to attend the meeting to contribute to the development of the guideline.

9.5.2 SPECIALIST REVIEW

This guideline was also reviewed in draft form by the following independent expert referees, who were asked to comment primarily on the comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations in the guideline. SIGN is very grateful to all of these experts for their contribution to the guideline.

Dr Richard Appleton	*Consultant Paediatric Neurologist, Alder Hey Hospital, Liverpool*
Dr Sarah Aylett	*Consultant Paediatric Neurologist, Great Ormond Street Children's Hospital, London*
Professor Gus Baker	*Professor of Clinical Neuropsychology and Consultant Clinical Neuropsychologist, The Walton Centre for Neurology and Neurosurgery, Liverpool*
Dr Gordon Bates	*Child and Adolescent Neuropsychiatrist, Birmingham Children's Hospital NHS Trust*
Dr Harry Baumer	*Consultant Paediatrician, Derriford Hospital, Plymouth*
Dr Michael Blair	*Consultant Paediatrician, Crosshouse Hospital,Kilmarnock*
Dr Alison Blake	*Consultant Clinical Neurophysiologist, Worcester Royal Infirmary*
Dr Duncan Cameron	*Consultant Paediatrician, Clan Clwyd Hospital, Rhyl*
Dr Stephen Chapman	*Consultant Paediatric Radiologist, The Children's Hospital, Birmingham*
Ms Margaret Edwards	*Teaching Fellow, Department of Nursing and Midwifery, Stirling University*
Dr Colin Ferrie	*Consultant Paediatric Neurologist, Leeds General Hospital, Leeds*
Dr Elaine Hughes	*Consultant Paediatrician, Kings College Hospital, London*
Dr Harpreet Kohli	*Medical Adviser, NHS Quality Improvement Scotland*
Dr Neil Leadbeater	*Health Planning and Quality Division, National Pharmaceutical Forum, Scottish Executive Health Department*
Dr Donald MacGregor	*Consultant Paediatrician, Perth Royal Infirmary, Perth*
Dr Ailsa McLellan	*Consultant Paediatric Neurologist, Royal Hospital for Sick Children, Edinburgh*
Dr Robert McWilliam	*Consultant Paediatric Neurologist, Glasgow, for Academy of Royal Colleges and Faculties in Scotland*
Miss Laura Meikle	*Additional Support for Learning Act Implementation Team, Scottish Executive Education Department*
Professor Patrick Morrison	*Consultant Clinical Geneticist, Belfast City Hospital Trust*
Dr Barbara Philips	*Consultant in Paediatric Emergency Medicine, Alder Hey Hospital, Liverpool*
Dr Andrew Power	*Head of Medicines Management Team, Gartnavel Royal Hospital, Glasgow*
Dr Helen Shannon	*Consultant Radiologist, Raigmore Hospital, Inverness*
Dr Kate Spillane	*Consultant Clinical Neurophysiologist, Ninewells Hospital, Dundee*
Dr Zenobia Zaiwalla	*Consultant in Paediatric Clinical Neurophysiology, Park Hospital for Children and Special Centre for Children with Epilepsy, Oxford*

9.5.3 SIGN EDITORIAL GROUP

As a final quality control check, the guideline was reviewed by an editorial group comprising the relevant specialty representatives on SIGN Council to ensure that the specialist reviewers' comments have been addressed adequately and that any risk of bias in the guideline development process as a whole has been minimised. The editorial group for this guideline was as follows:

Dr James Beattie	*Royal College of General Practitioners*
Professor Chris Kelnar	*Royal College of Paediatrics and Child Health*
Professor Gordon Lowe	*Chair of SIGN; Co-editor*
Dr Safia Qureshi	*SIGN Programme Director; Co-editor*
Dr Sara Twaddle	*Director of SIGN; Co-editor*
Dr Christine Walker	*Royal College of Radiologists*

9.6 ACKNOWLEDGEMENTS

SIGN is grateful to the following individuals who have acted as advisors to the guideline development group:

Dr Tom Beattie	*Director of Accident and Emergency, Royal Hospital for Sick Children, Edinburgh*
Dr Barry Corkey	*Senior Dental Officer, NHS Fife*
Dr Alexandra Greene	*Health Anthropologist, University of St Andrews*

SIGN is also grateful to the following former members of the guideline development group who have contributed to the development of this guideline:

Dr Anne-Lise Dickie	*Community Learning Disability Nurse, Edinburgh*
Dr Rod Gibson	*Consultant Neuroradiologist, Western General Hospital, Edinburgh*
Ms Doune Weaver	*Lay Representative, Menstrie*

10 Implementation and audit

10.1 LOCAL IMPLEMENTATION

Implementation of national clinical guidelines is the responsibility of each NHS Board and is an essential part of clinical governance. It is acknowledged that every Board cannot implement every guideline immediately on publication, but mechanisms should be in place to ensure that the care provided is reviewed against the guideline recommendations and the reasons for any differences assessed and, where appropriate, addressed. These discussions should involve both clinical staff and management. Local arrangements may then be made to implement the national guideline in individual hospitals, units and practices, and to monitor compliance. This may be done by a variety of means including patient-specific reminders, continuing education and training, and clinical audit.

10.2 KEY POINTS FOR AUDIT

Diagnosis

- Percentage of children with suspected epilepsy seen by epilepsy specialist
- Percentage of children with epilepsy having a syndromic diagnosis
- Percentage of children with epilepsy having a seizure classification.

Investigative Procedures

- Percentage of children with epilepsy having a 12 lead ECG where the presentation has been a convulsive episode
- Percentage of children with recurrent epileptic seizures having an EEG recording.

Management

- Percentage of children with epilepsy having referral to a tertiary specialist where two drugs have been trialled in adequate dosages over a six month period
- Percentage of children with epilepsy having written information on their condition
- Percentage of children with epilepsy having restrictions placed on school or leisure activities
- Percentage of schools offered epilepsy awareness training and written epilepsy information.

Antiepileptic drug therapy

- Percentage of children with epilepsy having evidence of communication about adverse effects of medication
- Percentage of children with epilepsy having evidence of discussion regarding fetal risks in epilepsy with teenage girls and families.

Status epilepticus

- Percentage of children with CSE whose treatment has deviated from hospital CSE protocol.

Behaviour and learning

- Percentage of children with epilepsy whose academic progress has been documented.

Models of care

- Percentage of children with epilepsy having evidence of a written care plan
- Percentage of children with epilepsy offered access to an epilepsy nurse specialist.

Other audits

The British Paediatric Neurology Association publishes an audit toolbox which contains several audits for children with suspected epilepsy (www.bpna.org.uk/audit/).

10.3 RECOMMENDATIONS FOR RESEARCH

- Competency assessment for epilepsy specialists
- Effectiveness of specialist young persons clinics
- Switching between branded/generic medicines
- Interventions to improve adherence and concordance
- Pros/cons of discussion of SUDEP and its timing with families
- Head to head comparator trials of AEDs in specific epilepsy syndromes
- Standardised quality of life studies
- Methods of obtaining sleep for EEG
- Relationship between rage attacks and epilepsies.

10.4 RESOURCE IMPLICATIONS

This section is based on discussions with the guideline development group regarding current resource use in Scotland and the likely impact of implementation of the recommendations of the guideline. Where current practice will not change as a result of the recommendations, it is unlikely that there will be resource implications.

The following table shows recommendations that are likely to have significant resource implications if implemented across Scotland. This does not consider the resource implications associated with good practice points, although it is recognised that these may be significant.

Recommendation	Likely resource implication
D **The diagnosis of epilepsy should be made by a paediatric neurologist or paediatrician with expertise in childhood epilepsy.**	Many of the 500-800 children diagnosed annually in Scotland are diagnosed in general hospital and community paediatric services. Full implementation of this recommendation will require the identification of the group of paediatricians with expertise in childhood epilepsy. This group may have immediate and ongoing professional development needs. There may be further impact on numbers of paediatric neurologists in Scotland.
D **Most children with epilepsy should have an elective MRI brain scan. Children with the following epilepsy syndromes** *(which are following a typical course)* **do not need brain imaging:** ▪ **idiopathic** *(primary)* **generalised epilepsies** *(eg childhood absence epilepsy, juvenile myoclonic epilepsy or juvenile absence epilepsy)* ▪ **benign childhood epilepsy with centrotemporal spikes** *(benign rolandic epilepsy).*	MRI facilities are increasingly available within district general hospitals (DGHs) in Scotland. Availability of specialists to interpret the MRI is more limited – this recommendation has resource implications in terms of training and sharing of specialist skills between DGHs across NHSScotland.
D **Each epilepsy team should include paediatric epilepsy nurse specialists.**	Scotland currently has 5 epilepsy nurse specialists. To fully meet the needs of the 5,000-7,000 children in Scotland will require significant increases in the numbers of nurses, including training and ongoing administrative support for these posts.

Annex 1
Epilepsy syndromes

In addition to the classification by extent of the spread of the affected neurones in the brain (focal and general), epilepsy is also classified by syndrome or grouped according to a set of common characteristics, such as the following:

- Patient age
- Type of seizure or seizures
- Whether a cause is known or not (idiopathic).

The following table shows an example of a classification of epilepsy syndromes.

GROUPS OF SYNDROMES	SPECIFIC SYNDROMES
Idiopathic focal epilepsies of infancy and childhood	■ Benign infantile seizures (nonfamilial) ■ Benign childhood epilepsy with centrotemporal spikes ■ Early-onset benign childhood occipital epilepsy (Panayiotopoulos type) ■ Late-onset childhood occipital epilepsy (Gastaut type)
Familial (autosomal dominant) focal epilepsies	■ Benign familial neonatal seizures ■ Benign familial infantile seizures ■ Autosomal dominant nocturnal frontal lobe epilepsy ■ Familial temporal lobe epilepsy ■ Familial focal epilepsy with variable foci
Symptomatic and probably symptomatic focal epilepsies	■ Limbic epilepsies – Mesial temporal lobe epilepsy with hippocampal sclerosis – Mesial temporal lobe epilepsy defined by specific etiologies – Other types defined by location and etiology ■ Neocortical epilepsies – Rasmussen syndrome – Hemiconvulsion-hemiplegia syndrome – Migrating partial seizures of early infancy – Other types defined by location and etiology

Idiopathic generalized epilepsies	■ Benign myoclonic epilepsy in infancy ■ Epilepsy with myoclonic astatic seizures ■ Childhood absence epilepsies ■ Epilepsy with myoclonic absences ■ Idiopathic generalized epilepsies with variable phenotypes – Juvenile absence epilepsy – Juvenile myoclonic epilepsy – Epilepsy with generalized tonic-clonic seizures only (eg GTCS on awakening) ■ Generalized epilepsies with febrile seizures plus*
Reflex epilepsies	■ Idiopathic photosensitive occipital lobe epilepsy ■ Other visual sensitive epilepsies ■ Primary reading epilepsy ■ Startle epilepsy ■ Other reflex epilepsies
Epileptic encephalopathies (in which the epileptiform abnormalities may contribute to progressive dysfunction)	■ Early myoclonic encephalopathy ■ Ohtahara syndrome ■ West's syndrome ■ Dravet syndrome (previously known as severe myoclonic epilepsy in infancy) ■ Myoclonic status in nonprogressive encephalopathies* ■ Lennox-Gastaut syndrome ■ Landau-Kleffner syndrome ■ Epilepsy with continuous spike-waves during slow-wave sleep
Progressive myoclonus epilepsies	*See Annex 2*
Seizures not necessarily requiring a diagnosis of epilepsy	■ Benign neonatal seizures ■ Febrile seizures ■ Reflex seizures ■ Alcohol-withdrawal seizures ■ Drug or other chemically induced seizures ■ Immediate and early post traumatic seizures ■ Single seizures or isolated clusters of seizures ■ Rarely repeated seizures (oligoepilepsy)

* Syndrome in development

Adapted from: *Engel J Jr. A Proposed Diagnostic Scheme for People with Epileptic Seizures and with Epilepsy: Report of the ILAE Task Force on Classification and Terminology. Epilepsia 2001; 42(6):796-803.*

Annex 2
Non-epileptic paroxysmal disorders

INFANTS: AGE 2 MONTHS TO 2 YEARS

Stiff baby/hyperekplexia
Cyanotic and pallid breath-holding spells, reflex anoxic seizure, reflex asystolic syncope
Shuddering attacks
Paroxysmal torticollis Extrapyramidal drug reactions, dystonia
Sandifer syndrome
Stereotypies Constipation Infantile gratification disorder
Fabricated and induced illness
Spasmus nutans
Benign paroxysmal vertigo
Benign myoclonus of early infancy
Alternating hemiplegia of childhood
Sleep disorders

- Rhythmic movement sleep onset disorder
- Benign neonatal sleep myoclonus

CHILDHOOD: AGE 2-12 YEARS

Cyanotic and pallid breath-holding spells, reflex anoxic seizure, reflex asystolic syncope
Syncope
Migraine and migraine equivalents
Recurrent abdominal pain
Cyclic vomiting
Benign paroxysmal vertigo
Tics
Paroxysmal torticollis
Paroxysmal kinesigenic choreoathetosis
Sandifer syndrome
Dystonic drug reactions
Constipation
Stereotypics and daydreaming
Infantile gratification disorder
Fabricated and induced illness
Pseudoseizures
Sleep disorders

- Rhythmic movement sleep onset disorder
- Night terrors
- Sleep walking
- Talking in your sleep
- Narcolepsy

ADOLESCENT AGE GROUP: 12 YEARS TO ADULT

Syncope
Migraine and variants
Psychogenic seizures
Movement disorders
Paroxysmal kinesiogenic choreoathetosis
Paroxysmal dystonic choreoathetosis
Paroxysmal hereditary ataxias
Tremor
Tics
Transient global amnesia
Sleep disorders

- Nocturnal myoclonus, hypnic jerks
- Night terrors
- Sleep walking
- Talking in your sleep
- Narcolepsy

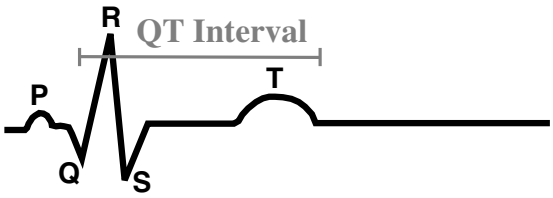
ADDITIONAL NON-EPILEPTIC EVENTS IN CHILDREN WITH LEARNING DIFFICULTIES

Self stimulation
Hyperventilation
Stereotypies
Sandifer syndrome
Spasticity
Clonus
Headache/Pain
Dystonic posturing
Choreoathetosis

Adapted from: *Paolicchi JM. The spectrum of nonepileptic events in children. Epilepsia. 2002;43 Suppl 3:60-4.*

Annex 3
Calculation of corrected Qt interval

The duration of the QT interval is a measure of the time required for ventricular depolarization and repolarization to occur. It is measured, on an ECG trace, from the initiation of the Q wave of the QRS complex to where the T wave returns to isoelectric baseline.



Because of its inverse relationship to heart rate, the QT interval is routinely transformed (normalized) into a heart rate independent "corrected" value known as the QTc interval. This can be achieved either by using Bazett's formula or by reading off the QTc value from a nomogram (see below).

Bazett's formula:

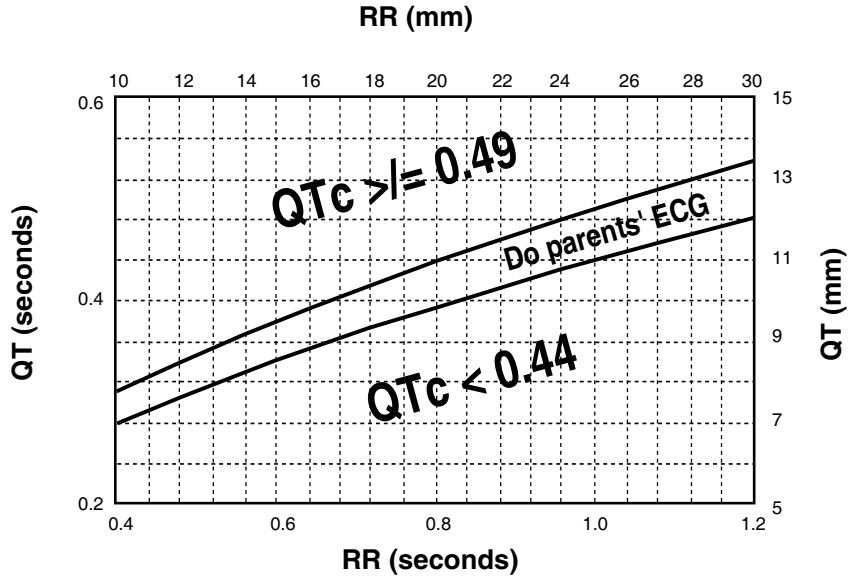
$$QTc = \frac{QT}{\sqrt{RR}}$$

Normal value: < 0.44 seconds

Indeterminate: 0.44 – 0.49 seconds

Abnormal: > 0.49 seconds

If ECG paper speed is at 25 mm/second use the nomogram below:



This nomogram indicates when the QTc is in one of three ranges. If the QTc is above the lower line (QTc >/= 0.44) a 12-lead ECG is suggested.

Adapted from: *Information for pediatric neurologists - evaluating the child with syncope or first seizure for Long QT syndrome by measuring the corrected QT interval on EEG. [cited 5 December 2004]. Available from url: http://home.gwi.net/seahorsepress/hopepage.htm*

Annex 4

The use of unlicensed medicines or licensed medicines for unlicensed applications in paediatric practice

Policy statement produced by the joint RCPCH/NPPG Standing Committee on Medicines (February 2000)

This statement has been drawn up by the Standing Committee on Medicines, a joint committee of the Royal College of Paediatrics and Child Health and the Neonatal and Paediatric Pharmacists Group. It aims to inform and guide health professionals and parents who prescribe, dispense or administer medicines for children, and health service managers who have a responsibility to support them. The statement forms part of the introduction to Medicines for Children, the first national paediatric formulary offering guidance on the use of therapeutic drugs given to children.

The recommendations of the Committee are that:

- Those who prescribe for a child should choose the medicine which offers the best prospect of benefit for that child, with due regard to cost.
- The informed use of some unlicensed medicines or licensed medicines for unlicensed applications is necessary in paediatric practice.
- Health professionals should have ready access to sound information on any medicine they prescribe, dispense or administer, and its availability.
- In general, it is not necessary to take additional steps, beyond those taken when prescribing licensed medicines, to obtain the consent of parents, carers and child patients to prescribe or administer unlicensed medicines or licensed medicines for unlicensed applications.
- NHS Trusts and Health Authorities should support therapeutic practices that are advocated by a respectable, responsible body of professional opinion.

LICENSING

1. For a medicine to be marketed in the United Kingdom it must have received a Product Licence, now called a marketing authorisation. It is then said to be licensed. Many medicines that are given to children are not licensed for the particular indication, age of the child, suitable formulation, or route of administration. This position arises when a pharmaceutical company has made an application to the Licensing Authority for a marketing authorisation for use of the medicine in adults, but chooses not to make an application for the use of that medicine in particular ways in children. Certain medicines that are given to children have not received a licence for any indication, and are said to be unlicensed.
2. The use of unlicensed medicines or licensed medicines for unlicensed applications is necessary in paediatric practice when there is no suitable alternative. Such uses are informed and guided by a respectable and responsible body of professional opinion.
3. The Medicines Act and Regulations (which incorporate the relevant EC directives) provide exemptions which enable doctors to:
   - prescribe unlicensed medicines;
   - use in particular (named) patients, unlicensed products specially prepared, imported or supplied;
   - use medicines which are not authorised to be marketed, in clinical trials, after approval of the trial by the Medicines Control Agency (MCA) either through the Doctors and Dentists Exemption Scheme or, in the case of pharmaceutical industry sponsorship, through the Trials Certificate (Exemption) Scheme;
   - use or advise the use of licensed medicines for indications, or in doses, or by routes of administration, outside the recommendations of the licence;
   - override the warnings and the precautions given in the licence.

4. In each case, the doctor has to be able to justify the action taken as being in accordance with a respectable, responsible body of professional opinion.

The informed use of unlicensed medicines or of licensed medicines for unlicensed applications is necessary in paediatric practice.

SOURCES OF INFORMATION

5. Although the choice of a medicine is not necessarily determined by its licence status, it will take account of information made available as a consequence of licensing and contained in the marketing authorisation. When the Product Licence does not include indications for use in children, the marketing authorisation is of limited help. When the medicine is unlicensed, the necessary information must be sought elsewhere. It often is available, though might not be readily accessible.

6. To meet the need for accessible sound information and guidance the Committee has undertaken the preparation of a new formulary, Medicines for Children. The standing of its contributors and of those who undertake independent review will ensure that it is an authoritative statement of paediatric therapeutic practice in this country.

INFORMATION FOR OTHER HEALTH PROFESSIONALS AND THE PUBLIC

7. Parents, patients and teachers, and others in loco parentis, require information about medicines from health professionals, including general practitioners, paediatricians, nurses, health visitors, and pharmacists. The information must be given in a way they can understand, and be accurate and consistent. This is particularly important when the specialist who has advised the use of unlicensed medicines or licensed medicines for unlicensed applications, hands over the care of the patient and responsibility for the administration of the medicine to someone else. Given the complexity of therapeutic and pharmacological information, and the burdens upon those giving and receiving it, the need is for sound, practical and sensible arrangements for communication, supplemented by readily available sources of reference.

It is essential that health professionals should have ready access to sound information on any medicine they prescribe, dispense or administer, and on its availability.

CONSENT OF PARENTS, CARERS AND PATIENTS

8. Health professionals must respect the right of child patients and their parents to participate in decisions on the health care of the child, and seek to ensure that those decisions are properly informed. In normal paediatric practice no additional steps, beyond those taken when prescribing licensed medicines, are required to obtain the consent of patients and parents/carers for the use of unlicensed medicines.

9. Clinicians are anxious that the licence status of a drug should not be perceived as reflecting what is or is not best for the child. They are mindful of a possible impact upon the confidence of parents and patients who might then be reluctant to accept advice, with consequences for a child who might not receive a medicine that offers benefit.

10. Most licensed medicines are dispensed in standard packages together with a Patient Information Leaflet (PIL) approved by the Licensing Authority. When the licence does not include indications for children, the PIL may caution against such use. Naturally, this may undermine confidence in the advice given by health professionals, besides provoking a call for explanation. The Committee has produced two generic PILs, for patients and parents/carers respectively, which explains why it may be necessary to prescribe unlicensed medicines or to use licensed medicines for unlicensed applications. This leaflet will be made widely available to hospitals and pharmacies and may be of practical value in such situations.

11. There are circumstances when a clinician will decide to give fuller information than is usually judged necessary. These may arise when a medicine is new or experimental; or carries known or possible risks of harm, even if those risks are small in relation to the disorder to be treated; or when the concerns of some parents, carers or patients generate a need for more detailed discussion and explanation on the medicines that are prescribed. In each instance, practice is guided by clinical judgement. *We consider that in general it is not necessary to take additional steps, beyond those taken when prescribing licensed medicines, to obtain the consent of parents, carers and child patients to prescribe or administer unlicensed medicines or licensed medicines for unlicensed applications.*

POLICIES OF NHS TRUSTS

12. Some NHS Trusts have suggested that a clinician should not use an unlicensed medicine, or a licensed medicine for unlicensed application. In 1993 the Department of Health stated that it would not expect that a health authority would seek to fetter a clinician's freedom to prescribe by expressly directing its medical staff against prescribing unlicensed products or licensed products for unlicensed purposes. The Department of Health's lawyers also stated that, should a health authority so direct its medical staff, a court would be reluctant to support the authority in those circumstances.

13. However the emphasis on risk management and evidence based medicine in Clinical Governance's framework implies that Trusts may be encouraged to introduce systems and protocols to monitor, and even direct, the use of both licensed and unlicensed medicines. We understand that, because the Medicines Act's (1968) exemptions remain current, the courts would not hold the prescription of an unlicensed medicine to be a breach of the duty of care, if that treatment was supported by a respected body of medical opinion. The best evidence available should always inform the prescription of medicines for children.

We consider that NHS Trusts should support therapeutic practices that are advocated by a respectable, responsible body of professional opinion.

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Annex 5
Diseases frequently associated with epileptic seizures

GROUPS OF DISEASES	SPECIFIC DISEASES
Progressive myoclonic epilepsies	Ceroid lipofuscionosis Sialidosis Lafora disease Unverricht-Lundborg disease Neuroaxonal dystrophy Myoclonic Epilepsy with Ragged Red Fibres (MERRF) Dentatorubropallidoluysian atrophy (DRPLA) Other
Neurocutaneous disorders	Tuberous sclerosis complex Neurofi bromatosis Hypomelanosis of Ito Epidermal nevus syndrome Sturge—Weber syndrome
Malformations due to abnormal cortical developments	Isolated lissencephaly sequence Miller—Dieker syndrome X-linked lissencephaly Subcortical band heterotopia Periventricular nodular heterotopia Focal heterotopia Hemimegalencephaly Bilateral perisylvian syndrome Unilateral polymicrogyria Schizencephalies Focal or multifocal cortical dysplasia Microdysgenesis
Other cerebral malformations	Aicardi syndrome Progressive Encephalopathy with Hypsarrthrhythmia and Optic atrophy (PEHO) syndrome Acrocallosal syndrome Other
Tumours	Dysembyroblastic Neuro Epithelial Tumour (DNET) Gangliocytoma Ganglioglioma Cavernous angiomas Astrocytomas Hypothalamic hamartoma (with gelastic seizures) Other

Chromosomal abnormalities	Partial monosomy 4P or Wolf—Hirschhorn syndrome Trisomy 12p Inversion duplication 15 syndrome Ring 20 chromosome Other
Monogenic mendelian diseases with complex pathogenetic mechanisms	Fragile X syndrome Angelman syndrome Rett syndrome Other
Inherited metabolic disorders	Non-ketotic hyperglycinaemia D-Glyceric acidaemia Propionic acidaemia Sulphite-oxidase deficiency Fructose 1-6 diphosphatase deficiency Other organic acidurias Pyridoxine dependency Aminoacidopathies (maple syrup urine disease, phenylketonuria, other) Urea cycle disorders Disorders of carbohydrate metabolism Disorders of biotin metabolism Disorders of folic acid and B12 metabolism Glucose transport protein deficiency Menkes' disease Glycogen-storage disorders Krabbe disease Fumarase deficiency Peroxisomal disorders Sanfilippo syndrome Mitochondrial diseases (pyruvate dehydrogenase deficiency, respiratory chain defects, Mitochondrial Encephalopathy with Lactic Acidosis and Stroke-like episodes; MELAS)

Adapted from: *Engel J Jr. A Proposed Diagnostic Scheme for People with Epileptic Seizures and with Epilepsy: Report of the ILAE Task Force on Classification and Terminology. Epilepsia 2001; 42(6):796-803.*

Annex 6
Glossary

Adherence – the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a healthcare provider

Bioavailability - In pharmacology, bioavailability is a term used to describe a pharmacokinetic property of drugs, namely, the fraction of a dose which reaches the systemic circulation

Concordance – this term is intended to convey a respect for the aims of both the health professional and the patient and signifies a negotiated agreement between the two

Convulsion – seizure characterized by marked motor activity eg jerking and or stiffness, may be epileptic or non-epileptic

Cryptogenic epilepsy syndrome – a syndrome which is believed to be symptomatic but no aetiology identified

Epilepsy – a condition characterised by recurrent epileptic seizures

Epilepsy syndrome – A group of signs and symptoms that collectively define or characterize a specific epileptic disease or disorder

Epileptic encephalopathy – a condition in which the epileptiform abnormalities themselves are believed to contribute to the progressive disturbance in cerebral function

Epileptic seizure – a clinical manifestation of epileptic (excessive and/or hypersynchronous), usually self limiting, activity of neurones in the brain

Febrile seizures (febrile convulsions) – a seizure occurring in children after one month of age, associated with febrile illness not caused by infection of the central nervous system, without previous neonatal seizures or a previous unprovoked seizure, and not meeting the criteria for other symptomatic seizures

Complex febrile seizures are focal**,** prolonged (15 min) or recurrent within 24 hours or associated with post-ictal neurological impairments

Focal (previously "partial") **seizure** – an epileptic seizure whose initial semiology indicates initial activation of only part of the cerebral hemisphere

Generalised seizure – an epileptic seizure whose initial semiology indicates more than minimal involvement of both cerebral hemispheres

Idiopathic epilepsy syndrome – a syndrome that is only epilepsy, with no underlying structural brain lesion or other neurological signs or symptoms

Inter-ictal – between seizures

Seizure – paroxysmal disturbance of brain function that may be epileptic, syncopal (anoxic) or due to other mechanisms

Semiology – initial symptoms, signs and their sequence

Specialist – a paediatrician with further training and expertise in the epilepsies

Status Epilepticus – describes a situation where there is recurrent or continuous seizure activity lasting longer than 30 minutes during which the person does not regain consciousness

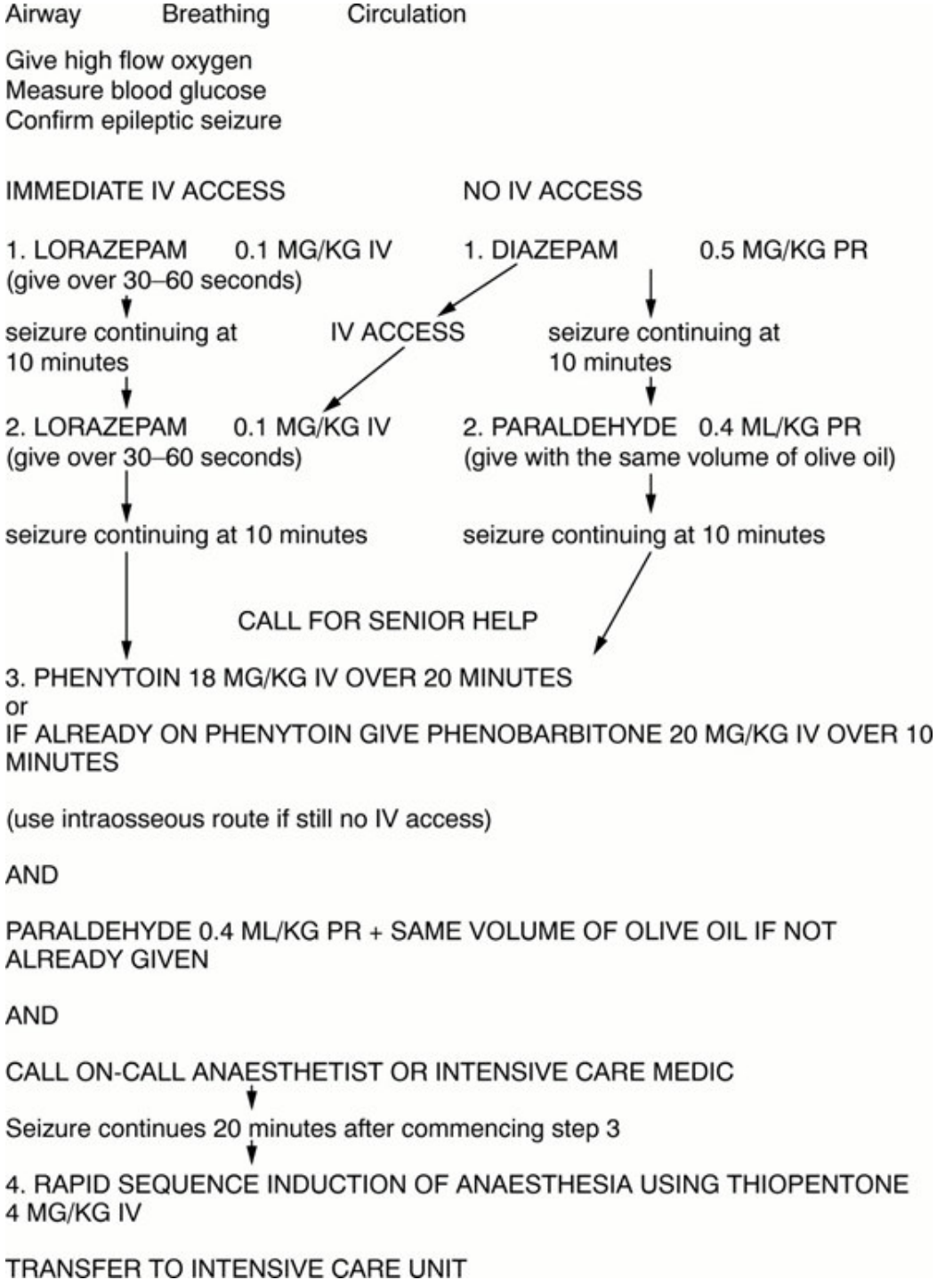
Symptomatic epilepsy syndrome – a syndrome in which the epileptic seizures are the result of one or more identifiable structural lesions of the brain

Syncopal seizure – an anoxic seizure resulting from syncope

Syncope – transient loss of consciousness due to a sudden decrease in cerebral perfusion of oxygenated blood

Annex 7

Example treatment protocol for an acute tonic-clonic convulsion in a hospital setting including established convulsive status epilepticus



Adapted from: *Appleton R, Choonara I, Martland T, Phillips B, Scott R, Whitehouse W. The treatment of convulsive status epilepticus in children. The Status Epilepticus Working Party, Members of the Status Epilepticus Working Party. Arch Dis Child. 2000 Nov;83(5):415-9.*

Annex 8
Useful contact details

This annex contains contact details for organisations which provide different levels of support and further information for patients and carers.

David Lewis Centre for Epilepsy
Mill Lane, Warford, Alderley Edge, Cheshire SK9 7UD
Tel: 01565 640 000

Enlighten – Action for Epilepsy
5 Coates Place, Edinburgh EH3 7AA
Tel: 0131 226 5458 • Fax: 0131 220 2855
Email: info@enlighten.org.uk • Website: www.enlighten.org.uk

Epilepsy Action
New Anstey House, Gate Way Drive, Yeadon, Leeds LS19 7XY
Helpline: 0808 800 5050 • Fax: 0808 800 5555
Email: helpline@epilepsy.org.uk • Website: www.epilepsy.org.uk

Epilepsy Bereaved
PO Box 112, Wantage, Oxon OX12 8XT
24 hour contact line: 01235 772852 • Tel: 01235 772850
Website: http://dspace.dial.pipex.com/epilepsybereaved/eb/call/index.htm

Epilepsy Connections
100 Wellington Street, Glasgow G2 6DH
Tel: 0141 248 4125 • Fax: 0141 248 5887
Website: www.epilepsyconnections.org.uk

Epilepsy Scotland
48 Govan Road, Glasgow G51 1JL
Helpline: 0808 800 2200 • Fax: 0141 419 1709
Email: enquiries@epilepsyscotland.org.uk • Website: www.epilepsyscotland.org.uk

Joint Epilepsy Council of the UK and Ireland
Tel: 01943 871 852
Website: www.jointepilepsycouncil.org.uk

National Association for Welfare of Children in Hospitals
Action for Sick Children (Scotland)
172 Leith Walk, Edinburgh EH6 5EA
Tel: 0131 553 6553
Website: www.actionforsickchildren.org

National Centre for Young People with Epilepsy (NCPYE)
St Piers Lane, Lingfield, Surrey RH7 6PW
Tel: 01342 832 243
Website: www.ncype.org.uk

National Society for Epilepsy
Chesham Lane, Chalfont St Peter, Bucks SL9 ORJ
Helpline: 01494 601 400 • Tel: 01494 601 300 • Fax: 01494 871 1927
Website: www.epilepsynse.org.uk

Quarriers
Quarriers Village, Bridge of Weir, Renfrewshire PA11 3SX
Tel: 01505 616000 • Fax: 01505 613906
Email: enquiries@quarriers.org.uk • Website: www.quarriers.org.uk

Abbreviations

A&E	Accident and Emergency
ADHD	Attention Deficit Hyperactivity Disorder
AED	Antiepileptic Drug
BECTS	Benign Childhood Epilepsy with Centrotemporal Spikes
CSE	Convulsive Status Epilepticus
CT	Computed Tomography
DGH	District General Hospital
ECG	Electrocardiogram
EEG	Electroencephalogram
ESES	Electrical Status Epilepticus during Sleep
GP	General Practitioner
MHRA	Medicines and Healthcare products Regulatory Agency
MRI	Magnetic Resonance Imaging
NCC-PC	National Collaborating Centre for Primary Care
NCSE	Non-convulsive Status Epilepticus
NICE	National Institute for Clinical Excellence
NPPG	Neonatal and Paediatric Pharmacists Group
PIL	Patient Information Leaflet
QTc	Corrected QT Interval
RCPCH	Royal College of Paediatrics and Child Health
RCT	Randomised Controlled Trial
SIGN	Scottish Intercollegiate Guidelines Network
SSRI	Selective Serotonin Reuptake Inhibitor
SUDEP	Sudden Unexpected Death in Epilepsy

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BEHAVIOUR AND LEARNING

Although many children with epilepsy have intellectual functioning in the normal range, learning and behavioural problems are more prevalent in this group than in the general childhood population.

☑ All children with epilepsy should have their behavioural and academic progress reviewed on a regular basis by the epilepsy team. Children with academic or behavioural difficulties should have appropriate educational and/or psychological assessment and intervention.

▶ EPILEPSY AND THE USE OF OTHER MEDICATIONS

D **Neurostimulant treatment should not be withheld, when indicated, from children with epilepsy and ADHD.**

D **Epilepsy, or a history of seizures, are not contraindications to the use of melatonin for the treatment of sleep disorders in children and young people.**

☑ Selective serotonin reuptake inhibitors and atypical neuroleptics such as risperidone should not be withheld, when indicated, in children and young people with epilepsy and associated behavioural and psychiatric disorders.

CALCULATION OF CORRECTED QT INTERVAL

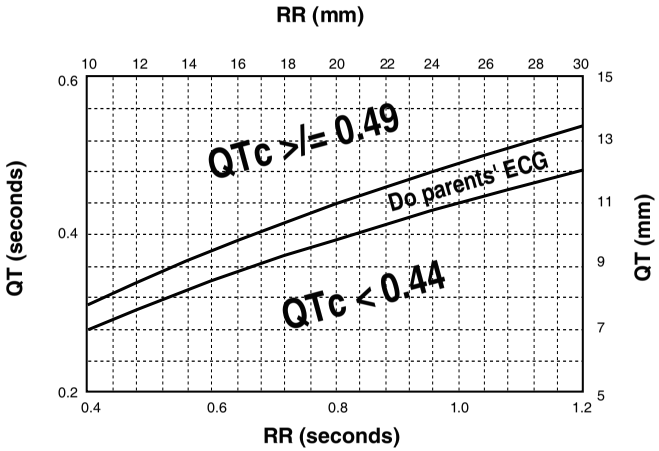
Bazett's formula:

$$QTc = \frac{QT}{\sqrt{RR}}$$

Normal value: < 0.44 seconds
Indeterminate: 0.44 – 0.49 seconds
Abnormal: > 0.49 seconds

OR

If ECG paper speed is at 25 mm/second use the nomogram below:



This nomogram indicates when the QTc is in one of three ranges. If the QTc is above the lower line (QTc >/= 0.44) a 12-lead ECG is suggested.

MODELS OF CARE

☑
- Children with epilepsy should have access to specialist epilepsy services, including dedicated young people and transition clinics
- Each child should have an individual management plan agreed with the family and primary care team
- Annual review is suggested as a minimum, even for children with well controlled epilepsy, to identify potential problems, ensure discussion on issues such as withdrawal of treatment, and minimise the possibility of becoming lost to follow up.

D **Each epilepsy team should include paediatric epilepsy nurse specialists.**

☑ Children and families should be advised of the range of services provided by the voluntary sector.

▶ USEFUL CONTACT DETAILS

Enlighten – Action for Epilepsy
5 Coates Place
Edinburgh, EH3 7AA
Tel: 0131 226 5458 • Fax: 0131 220 2855
Email: info@enlighten.org.uk
Website: www.enlighten.org.uk

Epilepsy Action
New Anstey House, Gate Way Drive
Yeadon, Leeds LS19 7XY
Helpline: 0808 800 5555 • Fax: 0808 800 5555
Email: helpline@epilepsy.org.uk
Website: www.epilepy.org.uk

Epilepsy Connections
100 Wellington Street
Glasgow, G2 6DH
Tel: 0141 248 4125 • Fax: 0141 248 5887
Website: www.epilepsyconnections.org.uk

Epilepsy Scotland
48 Govan Road, Glasgow G51 1JL
Helpline: 0808 800 2200 • Fax: 0141 419 1709
Email: enquiries@epilepsyscotland.org.uk
Website: www.epilepsyscotland.org.uk

DIAGNOSIS AND MANAGEMENT OF EPILEPSIES IN CHILDREN AND YOUNG PEOPLE

DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

There is wide differential diagnosis of paroxysmal episodes in childhood. Misdiagnosis of epilepsy appears to be a significant problem and may have major longer term implications. A service for children with epilepsy should have specialists with skills and interest in the management of epilepsy and other paroxysmal disorders.

D **The diagnosis of epilepsy should be made by a paediatric neurologist or paediatrician with expertise in childhood epilepsy.**

D **An EEG should only be requested after careful clinical evaluation by someone with expertise in childhood epilepsy.**

INVESTIGATIVE PROCEDURES

ECG AND EEG

☑ All children presenting with convulsive seizures should have an ECG with a calculation of the QTc interval.

☑ Home video camera recordings should be used in order to capture recurrent events where the diagnosis is in doubt.

C **All children with recurrent epileptic seizures should have an EEG. An early recording may avoid the need for repeated EEG investigations.**

D **For children with recurrent epileptic seizures and a normal standard EEG, a second EEG recording including sleep should be used to aid identification of a specific epilepsy syndrome.**

D **Where the clinical diagnosis of epilepsy is uncertain and if events are sufficiently frequent, an ictal EEG should be used to make a diagnosis of an epileptic or non-epileptic seizure.**

☑
- An EEG is not indicated for children with recurrent or complex febrile seizures.
- Antiepileptic drug medication should not usually be started before an EEG recording since it may mask a syndromic diagnosis.

BRAIN IMAGING

D **Most children with epilepsy should have an elective MRI brain scan. Children with the following epilepsy syndromes** (which are following a typical course) **do not need brain imaging:**

- **idiopathic** (primary) **generalised epilepsies** *(eg childhood absence epilepsy, juvenile myoclonic epilepsy or juvenile absence epilepsy)*
- **benign childhood epilepsy with centrotemporal spikes** *(benign rolandic epilepsy).*

MANAGEMENT

INFORMATION AND PLANNING

D **Children with epilepsy should be encouraged to participate in normal activities with their peers. Supervision requirements should be individualised taking into account the type of activity and the seizure history.**

☑ A checklist should be used to help healthcare professionals deliver appropriate information to children, families and carers.

D **Families should be advised if the child has an increased risk of SUDEP. They can be reassured if the risk is considered to be low.**

INFORMATION FOR SCHOOLS

☑ Children should be enabled to participate in the full range of school activities.

☑ Children who have epilepsy should have a written care plan for their epilepsy, drawn up in agreement with the school and family.

☑ Epilepsy awareness training and written information should be offered to schools.

ANTIEPILEPTIC DRUG TREATMENT

WHEN TO START ANTIEPILEPTIC DRUG TREATMENT

B **Children with febrile seizures, even if recurrent, should not be treated prophylactically with antiepileptic drugs.**

A **Long term prophylactic antiepileptic drug treatment for children with head injuries is not indicated.**

A **Antiepileptic drug treatment should not be commenced routinely after a first, unprovoked tonic-clonic seizure.**

*Antiepileptic drugs which may **WORSEN** specific syndromes or seizures*

Antiepileptic drug	Epileptic syndrome/seizure type
carbamazepine, vigabatrin, tiagabine, phenytoin	childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy
vigabatrin	absences and absence status
clonazepam	generalised tonic status in Lennox-Gastaut Syndrome
lamotrigine	Dravet's syndrome juvenile myoclonic epilepsy

ANTIEPILEPTIC DRUG TREATMENT (Contd.)

WHICH DRUG TO GIVE?

C **The choice of first AED should be determined where possible by syndromic diagnosis and potential adverse effects.**

A **When appropriate monotherapy fails to reduce seizure frequency, combination therapy should be considered.**

☑ The choice of combination therapy should be guided by the epilepsy syndrome and the adverse effect profile of the AED.

☑ Where there is no response to an appropriate AED, the diagnosis and treatment of epilepsy should be reviewed.

☑ Referral to tertiary specialist care should be considered if a child fails to respond to two AEDs appropriate to the epilepsy in adequate dosages over a period of six months.

MANAGEMENT OF PROLONGED OR SERIAL SEIZURES AND CONVULSIVE STATUS EPILEPTICUS

B **Prolonged or serial seizures should be treated with either nasal or buccal midazolam or rectal diazepam.**

☑ All units admitting children should have a protocol for the management of convulsive status epilepticus.

ADVERSE EFFECTS

☑ Clear advice on the management of the potential adverse effects of AEDs should be discussed with children and parents or carers.

B **Routine AED level monitoring is not indicated in children.**

☑ Adolescent girls taking AEDs and their parents should be advised of the risks of fetal malformations and developmental delay.

WITHDRAWAL OF ANTIEPILEPTIC DRUGS

A **Withdrawal of AED treatment should be considered in children who have been seizure free for two or more years.**

The prescription of any medication requires an assessment of risk and of benefit. In this guideline the efficacy and safety of AEDs have been reviewed using the best available evidence. Where recommendations are graded for individual AEDs, this is done irrespective of the licensing status of that medication.