LRI Children's Hospital

Management of Status Epilepticus

Staff relevant to:	Medical staff caring for Children within UHL Children's Hospital presenting with status epilepticus
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Contents

1. Introduction and Who Guideline applies to

This guideline describes the management of generalised convulsive status epilepticus (GCSE) in children up to 16 years of age, and applies to all UHL staff involved in the care of such patients.

It is consistent with current NICE guidance [1] and anticipated changes to the status epilepticus (SE) management algorithm within the Advanced Paediatric Life Support course manual (seventh edition), expected to be published later this year.

The international league against epilepsy (ILAE) defines SE as a 'condition resulting either from the failure of the mechanisms responsible for seizure termination or from the initiation of mechanisms, which lead to abnormally prolonged seizures (defined as greater than 5 mins). It can have long-term consequences (after 30 mins duration for generalised convulsive seizures), including neuronal death, neuronal injury, and alteration of neuronal networks, depending on the type and duration of seizures.' [2]

Treatment aimed at terminating seizure activity should start if:

1. *The child has been continuously seizing for 5 minutes*
   OR
2. *The child has had two or more seizures without regaining consciousness in between, over a period of 5 minutes or longer*

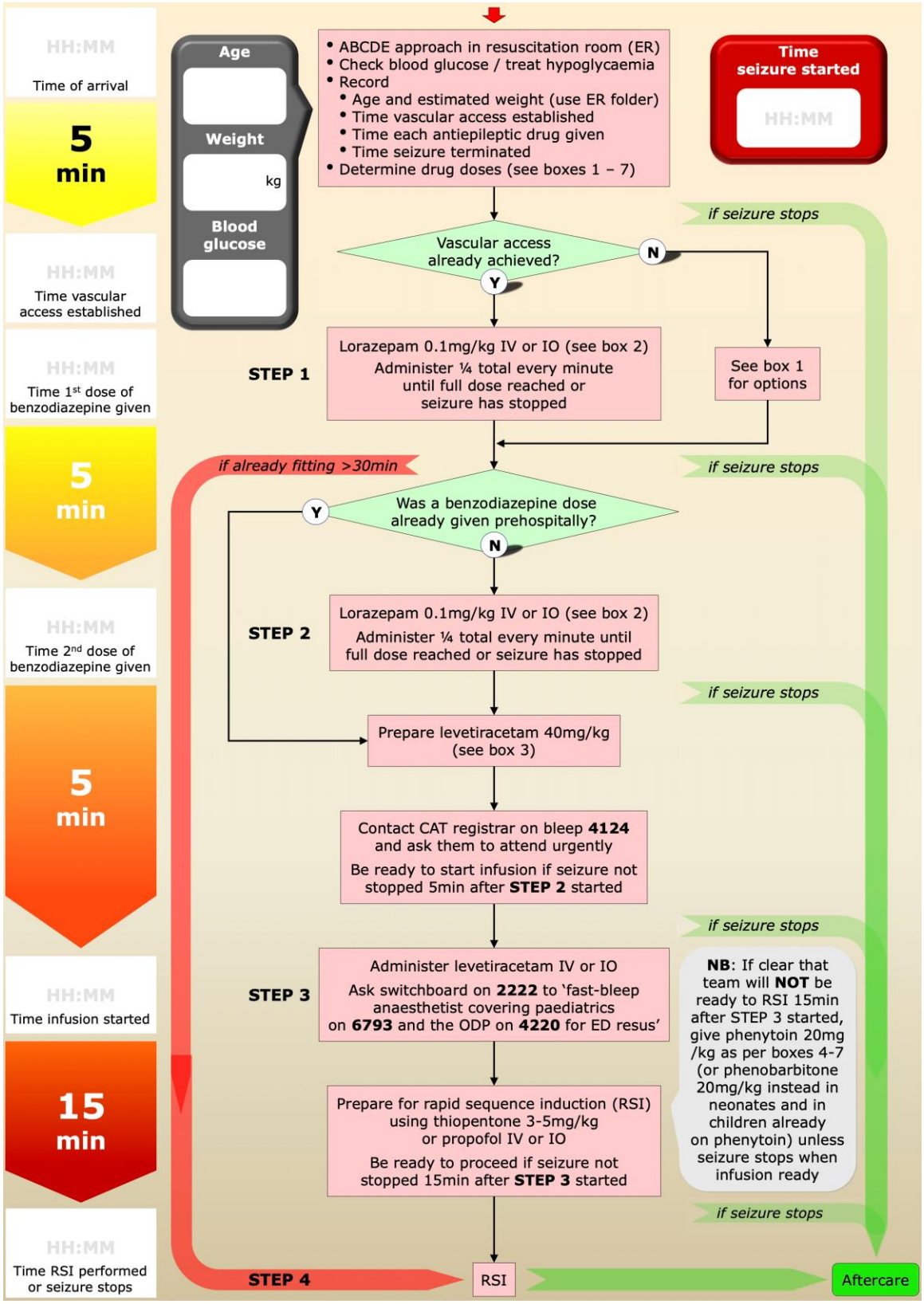
NB: Some children with known epilepsy (e.g. those with cluster seizures) have individualised management plans in place that clearly state the specific seizure duration (e.g. 15min) after which SE treatment should be started. Such management plans will usually be available on the ward or be brought into hospital by the child's parents, and should be followed.

Related documents: (links)

- **Febrile Convulsions UHL Childrens Guideline C42/2006**
- **Seizure Management UHL Childrens Hospital Guideline C77/2007**
- **Afebrile Seizure - First UHL Childrens Guideline C251/2016**
- **Afebrile Seizure - Recurrent UHL Childrens Medical Guideline C3/2017**
- **Midazolam for Intractable Seizure UHL Childrens Intensive Care Guideline C114/2016**
- **Raised Intracranial Pressure UHL Childrens Hospital Guideline C22/2019**

Generalised Tonic Clonic Seizures Management [3]

Please see **Appendix 1** and **Status Epilepticus in Children UHL Paediatric Emergency Department Guideline**[3](link) for full management tool with drug dose calculators. Print and Complete tool as part of medical record.



* **Phenytoin (and other drug calculations) available in appendix.**

2.0 Primary Assessment

The main aim of primary assessment is to identify any immediate life-threatening issues and correct those appropriately. The primary assessment should be performed in conjunction with status epilepticus algorithm above.

Airway

- Ensure patent airway
- Consider airway support adjuncts when airway is compromised
- Place child in recovery position once the seizure has stopped, if it safe to do so

Breathing

- Assess breathing – look for signs of respiratory distress, respiratory rate, and oxygen saturation
- Give high-flow oxygen via non-rebreather mask
- Monitor oxygen saturation

Circulation

- Establish intravenous or intraosseous access as is felt appropriate and as rapidly as possible
- Assess circulation- capillary refill time, heart rate (presence of bradycardia suggests raised intracranial pressure), blood pressure (significant hypertension >97th centile indicates possible aetiology such as intracranial bleed)

2.1 Recommended blood tests

Suspecting Meningitis/encephalitis	Known Epileptic and no signs of meningitis/encephalitis	Considering inborn errors of metabolism
Please refer to: • Meningitis UHL Childrens Medical Guideline(15) • Encephalitis UHL Childrens Medical Guideline(16)	Blood Glucose, FBC, U+E, calcium, magnesium, blood gas. Consider Anti-convulsants drug levels	Blood Glucose, FBC, U+E, calcium, magnesium, blood gas, blood c/s Consider Plasma Ammonia, Lactate, Serum amino acid, Urine amino and organic acids

- **Hypoglycaemia**: Give 2 ml/kg of 10% glucose. (See Hypoglycaemia - in Children NOT Diagnosed with Diabetes UHL Childrens Hospital Guideline(18))
- **Signs of shock**: Consider giving 10 ml/kg bolus of crystalloid initially and review the ongoing need of further bolus.
- **Suspected meningitis**: See Meningitis UHL Childrens Medical Guideline(15)
- **Suspected encephalitis**: See Encephalitis UHL Childrens Medical Guideline(16)
- **Signs of raised intracranial pressure**: See Raised Intracranial Pressure UHL Childrens Hospital Guideline(14)

  NB: Lumbar puncture should never be performed in a child with reduced level of consciousness

Disability

- Assess conscious level (AVPU), pupil size and reaction, and posture
- Pupillary size and reaction (very small pupils suggest opiate poisoning, dilated pupils are seen in atropine, amphetamine, tricyclic antidepressant poisoning)
- Decorticate or decerebrate posturing suggests raised intracranial pressure
- Focal neurological signs

Exposure

- Temperature – fever suggests febrile convulsion, meningo-encephalitis or poisoning
- Look for a petechial or purpuric rash
- Look for signs of trauma

2.2 Secondary assessment

History

- Try to obtain and document an eye witness account of episode if possible.
- Important points in history:
  - Duration of seizure
  - Treatment given
  - History of epilepsy
  - History of temp, recent trauma, poison ingestion
  - Changes in medication, compliance if known epileptic

Investigations

- Capillary blood glucose (CBG) monitoring in all children
- Bloods:
  - FBC, U&E, LFT, CRP, Blood Gas, Blood Culture.
  - Consider Plasma Ammonia, Lactate, Serum amino acid, Urine amino and organic acids to rule out inborn errors of metabolism.
  - Anticonvulsant levels if a known epileptic on anticonvulsants.
  - Save serum.
  - Consider toxicology screen depending of clinical presentation and history.
- Imaging:
  - CT scan of brain if suspect NAI, space occupying lesion, raised intracranial pressure (after treating with 2.7% saline or mannitol as per Raised Intracranial Pressure Guideline [14] or prolonged focal seizure. (An MRI may be needed later to evaluate other neurodevelopmental causes of epilepsy)
- ECG:
  - All children presenting with prolonged seizures should have an ECG performed to rule out long QT syndrome

2.3 Most common underlying causes

- Febrile convulsion
- Known epilepsy +/- acute illness, compliance issue or progression of the underlying disease
- Metabolic/hypoglycaemia/poisoning
- Meningitis/encephalitis [4]
- Trauma (including NAI)
- Hypoxia

2.4 Complications of Status Epilepticus

- Airway obstruction
- Cardiac arrhythmias
- Aspiration
- Pulmonary oedema
- Hypoxia
- Hyperthermia
- Hypertension
- Disseminated intravascular coagulation
- Respiratory depression secondary to benzodiazepines

2.5 Drugs See also appendix 1

a. Buccal midazolam (Buccolam)

- Buccolam is the only licensed oromucosal midazolam formulation for the treatment of prolonged, acute, convulsive seizures in infants, children and adolescents (from 3 months to <18 yrs of age).

- Administer on to buccal area from pre-filled oral syringe. Though midazolam administration to buccal area thought to be more effective than rectal diazepam, both cause a similar degree of respiratory depression. [5]

- **NB** Buccal midazolam should not be used in infants < 3 months of age:

    - From 1 month to < 3 month, use rectal diazepam
    - If aged less than 1 month, prioritise IV/IO access for lorazepam

b. Lorazepam IV/IO

Please see Appendix 1 for dosing table.

c. Levetiracetam IV/IO

- Two recent trials (EcLiPSE [6] and ConSEPT [7]) have strongly indicated that 40mg/kg levetiracetam is as efficacious as phenytoin in treating Status Epilepticus that has not responded to benzodiazepines, with more favorable side effects profile
- Levetiracetam can be administered through IV/IO route rapidly over 5min

d. Phenytoin IV/IO

- Refer to attached Appendix 1 (ED management tool) for information on dose and administration as without suitable precautions there are significant risks associated with the use of this drug. [3]

- Confirm the following is adhered to whilst using phenytoin infusion
    - ECG monitoring available and being used
    - Correct patient weight

- Legible prescription
- Patient is being monitored for any side effects especially cardiac rhythm abnormalities, hypotension and extravasation injury around the administering site

2.6 Cause-specific treatments

- Treat any potential underlying cause and complications, once identified as per local specific UHL guideline.

- Consider treating for Meningitis and/or Encephalitis after prolonged febrile convulsion without a clear focus of infection. [1] Encephalitis should be considered in children with signs of cerebral infection, accompanied by any of these
  - focal neurological signs
  - focal seizures and
  - decreased level of consciousness

  Please ensure all the relevant investigations are completed when treatment is commenced.

- Ongoing management after control of status epilepticus should follow these specific UHL guidelines. (links)
  - Febrile Convulsions UHL Childrens Guideline C42/2006 (9)
  - Seizure Management UHL Childrens Hospital Guideline C77/2007 (10)
  - Afebrile Seizure - First UHL Childrens Guideline C251/2016(11)
  - Afebrile Seizure - Recurrent UHL Childrens Medical Guideline C3/2017(12)
  - Midazolam for Intractable Seizure UHL Childrens Intensive Care Guideline C114/2016(13)

2.7 Actions at discharge

- Information to be provided to parents:
  - about epilepsy, (https://www.epilepsy.org.uk/) [8]
  - safety and lifestyle issues
  - about use of rescue medications-buccal midazolam, if required
  - follow up arrangements and future investigations if required: EEG, brain imaging
- BLS training for parents and carers (arranged via children's day care-Ext **16317**).
- Consider parental training for buccal midazolam/ PR diazepam if it is felt to be necessary for the ongoing management of the patient, preferably prior to discharge.
- Advise about importance of events diary with clear eyewitness account of what happens before, during and after the episode, and if possible and safe to do then to have a video record of the further episodes.
- Review of episode & Follow up by paediatrician to be arranged prior to discharge. Inform on call paediatric neurology team via SWITCH (0900-1700 hrs) if the patient is already known to them and attending clinician, either in the emergency department or in paediatric ward, feels that patient would require adjustment in his antiepileptic dosages. Patient attending out of hours (1700-0900 hrs) should be informed to ring paediatric neurology nurse (**0116 258 6908**) to update about their presentation in ED, should they get discharged from the ED overnight.

3. Education and Training

Ensure healthcare professionals managing children with status epilepticus are properly trained and up to date with life skill certification (APLS) as is required for their job.

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
1. Manage all children who are fitting on arrival or found to have generalised convulsive status epilepticus in the hospital ward as per guideline algorithm (exceptions: children with known history of seizures and a written management plan)	Audit	Consultant Paediatric Neurologist	2 Yearly	Departmental audit meeting
2. Take a careful eyewitness history to ascertain possible cause and document in the patient's clinical record	Audit	Consultant Paediatric Neurologist	2 Yearly	Departmental audit meeting
3. Check blood glucose of actively fitting children and document in the patient's clinical record	Audit	Consultant Paediatric Neurologist	2 Yearly	Departmental audit meeting

5. Supporting Reference and related documents

1. National Clinical Guideline Centre (UK). The Epilepsies: The Diagnosis and Management of the Epilepsies in Adults and Children in Primary and Secondary Care: Pharmacological Update of Clinical Guideline 20. London: Royal College of Physicians (UK); 2012.
2. Trinka E et al. A definition and classification of status epilepticus – Report of the ILAE Task Force on Classification of Status Epilepticus. Epilepsia, 2015.
3. WieseMF. Status Epilepticus in Children UHL Paediatric Emergency Department Guideline. UHL PAGL. 2021.
4. Chin RF, Neville BG,Scott RC. Meningitis is a common cause of convulsive status epilepticus with fever. Arch Dis Child. 2005;90:66-9.
5. McMullan J, et al. Midazolam Versus Diazepam for the Treatment of Status Epilepticus in Children and Young Adults: A Meta-analysis. Acad Emerg Med 2010; 17 (6): 575 – 582
6. Lyttle Mark D, et al. Levetiracetam versus phenytoin for second-line treatment of paediatric convulsive status epilepticus (EcLiPSE): a multicentre, open-label, randomised trial. The Lancet 2019; 393 (10186) P2125-2134.
7. Dalziel SR, et al. Levetiracetam versus phenytoin for second-line treatment of convulsive status epilepticus in children (ConSEPT): an open-label, multicentre, randomised controlled trial. Lancet. 2019 May 25;393(10186):2135-2145.
8. Epilepsy Action, UK. https://www.epilepsy.org.uk/.
9. Febrile Convulsions UHL Childrens Guideline C42/2006
10. Seizure Management UHL Childrens Hospital Guideline C77/2007
11. Afebrile Seizure - First UHL Childrens Guideline C251/2016
12. Afebrile Seizure - Recurrent UHL Childrens Medical Guideline C3/2017

13. Midazolam for Intractable Seizure UHL Childrens Intensive Care Guideline C114/2016
14. Raised Intracranial Pressure UHL Childrens Hospital Guideline C22/2019
15. Meningitis UHL Childrens Medical Guideline C22/2014
16. Encephalitis UHL Childrens Medical Guideline C21/2014
17. Sepsis UHL Childrens Hospital Guideline B31/2016
18. Hypoglycaemia - in Children NOT Diagnosed with Diabetes UHL Childrens Hospital Guideline C19/2017

6. Key Words

Status epilepticus, Convulsive status epilepticus

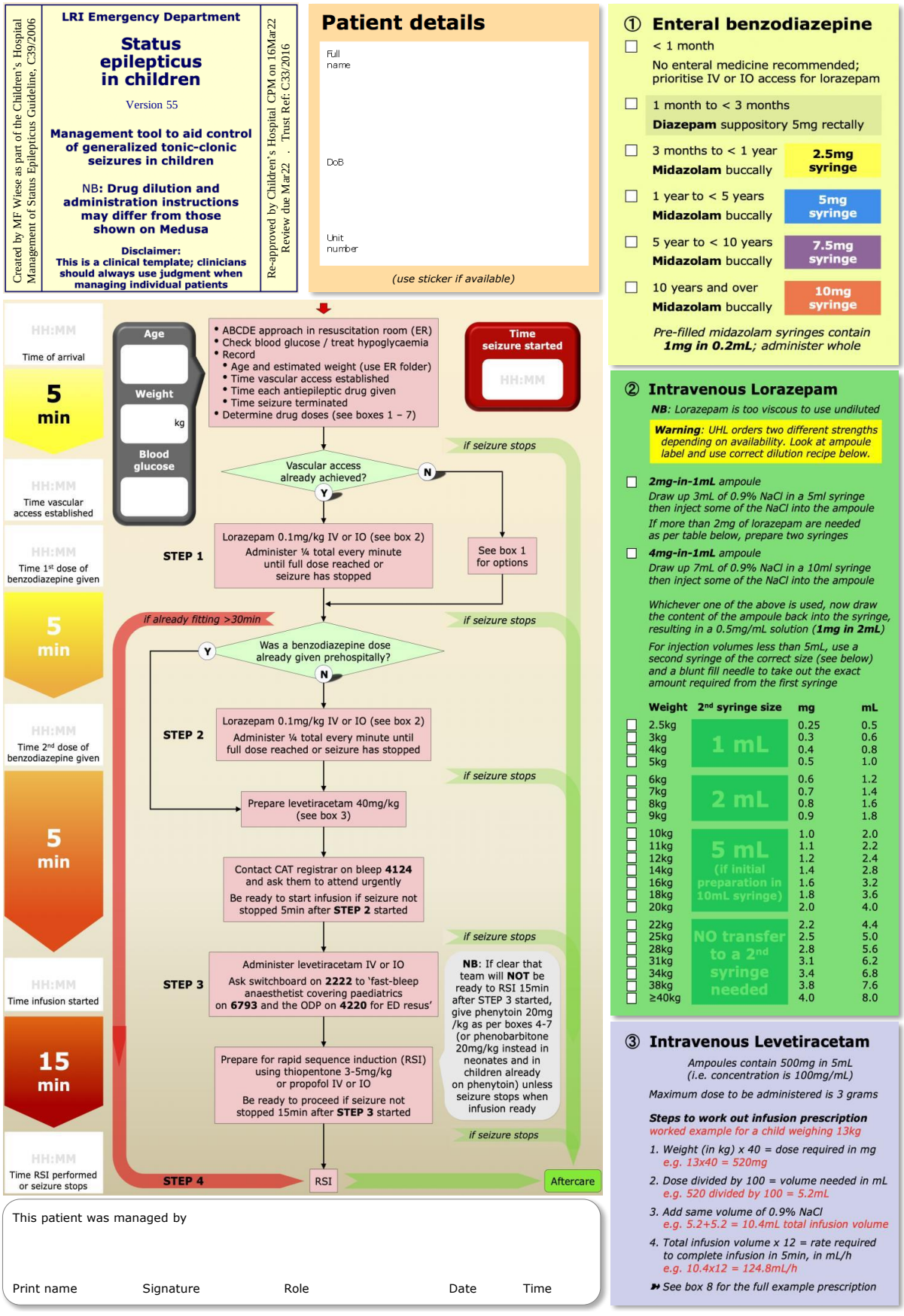
The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details	
Guideline Lead (Name and Title) Birendra Rai - Paediatric registrar Martin Wiese – Consultant in Emergency Medicine	**Executive Lead** Chief Medical Officer
Details of changes made during review: 1. General formatting overhauled 2. Guideline now covers all children from birth up to 16 years of age 3. Definition of status epilepticus amended to align with the ILAE 2015 definition 4. ED management proforma for SE in children integrated into this guideline 5. Levetiracetam now standard step 3 antiepileptic drug 6. Dosing interval after both benzodiazepine doses reduced to 5 minutes 7. Paraldehyde removed as treatment option 8. Dose of intravenous glucose for hypoglycaemia treatment amended 9. Dose of hypertonic saline for treatment of raised ICP amended 10. Links to related paediatric seizure guidelines added 11. Action at discharge section amended to include options for parents/carer's education and training about epilepsy, follow up plans and paediatric neurology team referrals 12. Reference list updated	

Appendix 1: LRI Emergency Department SE Management tool

Status Epilepticus in Children UHL Paediatric Emergency Department Guideline (link)

Click link above for a print version of the tool below; complete as part of medical record



Appendix 2: Phenytoin preparation and levetiracetam example prescription

Status Epilepticus in Children UHL Paediatric Emergency Department Guideline (link)

LRI ED IV Phenytoin Preparation Aid: Patients < 50kg

Do not use if patient is already taking Phenytoin . Use adults version of this aid if patient weighs > 49kg

- Run infusion via designated syringe driver (labelled 'for phenytoin infusion in kids only'; stored in the resuscitation room)
- Total loading dose when using tables below will be 19 – 20.3 mg/kg
- Neat infusion of phenytoin is preferred (dilution carries risk of precipitation), but this is impractical in smaller patients due to the tiny drug volumes needed. In those weighing up to 30kg, drug is therefore diluted in 0.9% sodium chloride as per below.

Find patient's weight in one of the tables below, then follow its *SPECIFIC* instructions (NB: all four are different)

④ 2 – 12 kg

Draw up 45mL 0.9% sodium chloride in a 60mL syringe. Add 1 vial (250mg in 5mL) of phenytoin, resulting in a **5mg/mL** solution (i.e. **1mg=0.2mL**). Find required volume in table below and expunge excess from syringe.

Weight	Phenytoin dose (20mg/kg)		Infusion rate (1 mg/kg/min)
kg	Drug mg	Required volume mL	(mL/h)
☐ 2	40	8	24
☐ 3	60	12	36
☐ 3.5	70	14	42
☐ 4	80	16	48
☐ 5	100	20	60
☐ 6	120	24	72
☐ 7	140	28	84
☐ 8	160	32	96
☐ 9	180	36	108
☐ 10	200	40	120
☐ 11	220	44	132
☐ 12	240	48	144

⑤ 13 – 25 kg

Draw up 40mL 0.9% sodium chloride in a 60mL syringe. Add 2 vials (2x250mg in 5mL) of phenytoin, resulting in a **10mg/mL** solution (i.e. **1mg=0.1mL**). Find required volume in table below and expunge excess from syringe.

Weight	Phenytoin dose (20mg/kg)		Infusion rate (1 mg/kg/min)
kg	Drug mg	Required volume mL	(mL/h)
☐ 13	260	26	78
☐ 14	280	28	84
☐ 15	300	30	90
☐ 16	320	32	96
☐ 17	340	34	102
☐ 18	360	36	108
☐ 19	380	38	114
☐ 20	400	40	120
☐ 21	420	42	126
☐ 22	440	44	132
☐ 23	460	46	138
☐ 24	480	48	144
☐ 25	500	50	150

⑥ 26 – 30 kg

Discard 40mL 0.9% sodium chloride from a 100mL bag. Add 3 vials (3x250mg in 5mL) of phenytoin to the remaining 60mL, resulting in a **10mg/mL** solution (i.e. **1mg=0.1mL**). Find required volume in table below and draw it up from the bag into a 60mL syringe.

Weight	Phenytoin dose (20mg/kg)		Infusion rate (1 mg/kg/min)
kg	Drug mg	Required volume mL	(mL/h)
☐ 26	520	52	156
☐ 27	540	54	162
☐ 28	560	56	168
☐ 29	580	58	174
☐ 30	600	60	180

⑦ 31 – 49 kg

Find required volume of **NEAT p**henytoin in table below.

Do not dilute.

Vials contain 250mg in 5mL, or **50mg/mL** (i.e. **1mg=0.02mL**). Draw up exact amount in 60mL syringe.

Weight	Phenytoin dose (19– 20.3 mg/kg)		Infusion rate (1 mg/kg/min)
kg	Drug mg	Volume mL	(mL/h)
☐ 31	600	12	36
☐ 32 - 34	650	13	39
☐ 35 - 36	700	14	42
☐ 37 - 39	750	15	45
☐ 40 - 42	800	16	48
☐ 43 - 44	850	17	51
☐ 45 - 47	900	18	54
☐ 48 - 49	950	19	57

Example prescription for 13kg patient

Example prescription for 32kg patient

PARENTERAL INFUSIONS							
	Infusion Fluid		Additions to Infusion				
Date	Type/Strength	Vol.	Medicine	Dose	Route	Time to run or ml/hr	Prescriber
03/12/21	0.9% NaCl	26mL (10mg/mL)	Phenytoin	260mg	IV	78mL/h	Your Name
03/12/21	50mg/mL	13mL	Phenytoin (neat)	650mg	IV	39mL/h	Your Name

- Continuous cardiac monitoring must be in place and NIBP and respiratory rate must be measured frequently
- Connect infusion via a 0.22-0.45 micron in-line filter if diluted drug is given (**NB**: This is not required if neat phenytoin is used)
- Use dedicated IV access & flush IV line generously with 0.9% sodium chloride before & after infusion (**NB**: Do not use glucose)
- The rate of infusion has been calculated to ensure that it will complete within 20min
- Stop infusion if low BP or bradycardia observed; restart once resolved, halving the rate (i.e. will then complete within 40min)

⑧ Levetiracetam example prescription *for 13kg patient as per worked example in box 3*

	Infusion Fluid		Additions to Infusion				
Date	Type/Strength	Vol.	Medicine	Dose	Route	Time to run or ml/hr	Prescriber
14/02/22	0.9% NaCl	5.2mL	Levetiracetam	520mg = 5.2mL	IV	124.8mL/h (i.e. runs over 5min)	Your Name