PROLONGED SEIZURE

MODULE: NEUROLOGY

TARGET: ALL PAEDIATRIC TRAINEES; NURSING STAFF

BACKGROUND:

Prolonged seizure is the most common neurological medical emergency in children. It continues to be associated with significant morbidity and mortality.

The Royal College of Paediatrics and Child Health (RCPCH) has set standards for training; by the completion of level one training, all trainees are expected to be able to initiate therapy in a child presenting with prolonged seizure.
INFORMATION FOR FACULTY

LEARNING OBJECTIVES

At the end of the session, participants should:

1. Recognise role of intraosseus access when IV access unsuccessful
2. Be able to initiate and continue anticonvulsant treatment for acute status epilepticus
3. Understand principles of anticonvulsant treatment
4. Have knowledge of common causes of seizures in babies and children
5. Form differential diagnosis for status epilepticus
6. Refer to intensive care team whilst maintaining patient safety until they take over.
7. Engage in multidisciplinary team management

SCENE SETTING

Location: Emergency Department
Expected duration of scenario: 15 mins
Expected duration of debriefing: 30 mins

EQUIPMENT AND CONSUMABLES

Mannequin (baby)
Monitoring
O₂ facemask
Bag valve mask
Laryngoscope
Size 3.5, 4.0 ETT
IV cannula plus fixation stickers
EZ-IO device
0.9% saline
10 % dextrose
Simulated Drugs:
  IV Lorazepam
  Buccal Midazolam/PR Diazepam
  PR Paraldehyde
  IV Phenytoin
  IV Phenobarbitone
Syringes (enteral, 5ml, 10ml, 50ml)
Drug chart
Obs chart
Blood gas results
SORT Emergency drug chart (if requested – see appendix)

PERSONNEL-IN-SCENARIO

ST1-3 trainee and/or
ST4-6 trainee
ED or paediatric nurse
Mollie’s mother

ADDITIONAL INFORMATION

Differential diagnosis for floppy/seizing neonate:
- Hypoglycaemia
- Sepsis
- Non-accidental injury
- Electrolyte disturbance
- Metabolic syndrome

(NB In this scenario, unable to get initial IV access so intraosseus route should be used).

Version 9 – May 2015
Editor: Dr Andrew Darby Smith
Original Author: Dr R Furr (adapted from Bristol Key Competencies)
PARTICIPANT BRIEFING

2-month-old Mollie has been brought to the Emergency Department by her mum who is worried because Mollie has been difficulty to settle and not feeding properly.

The triage nurse has asked you to review Mollie urgently.

FACULTY BRIEFING

‘VOICE OF THE MANIKIN’ BRIEFING

2-month old baby; very quiet and drowsy.

IN-SCENARIO PERSONNEL BRIEFING (MUM)

Mollie is your two-month old baby and you brought her to ED because you are worried she is getting floppier. She has been unsettled for the past day and has not been feeding well from her bottle.

If asked: Mollie was born at term by normal vaginal delivery and did not require special care after birth. Mollie has been well so far, with no medical concerns and no regular medications. She is due her first set of immunisations next week. You live with Mollie’s father (your boyfriend) and Mollie. You have no other children.

IN-SCENARIO PERSONNEL BRIEFING (NURSE)

You have just triaged Mollie who was brought into ED via taxi with her mum. You are very concerned about her because she is very quiet and floppy with a bulging soft spot.
CONDUCT OF SCENARIO

INITIAL STATE: LETHARGY

UNSUCCESSFUL IV CANNULATION – NEEDS IO

SEIZURE

APPROPRIATE MANAGEMENT

INAPPROPRIATE MANAGEMENT
OR PARTICIPANT REQUIRING CHALLENGE (ST 4-8)

PROLONGED SEIZURE

POST ICTAL

APPROPRIATE MANAGEMENT
## INITIAL STATE: LETHARGY

### VITAL SIGNS

<table>
<thead>
<tr>
<th>Rhythm</th>
<th>SR</th>
<th>HR</th>
<th>BP</th>
<th>Temp</th>
<th>AVPU</th>
<th>Pupils</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>130</td>
<td>68/34</td>
<td>35.7</td>
<td>V</td>
<td>3 ERL</td>
<td>Wt = 5kg; Mannequin dressed in vest and babygro</td>
</tr>
<tr>
<td>Resp rate</td>
<td>30</td>
<td>SaO₂</td>
<td>95%</td>
<td>ETCO₂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXPECTED OUTCOMES**

**Participants should:**
- Obtain brief history. Key features:
  - poor feeding
  - difficult to settle
- Full examination, exposing skin. Key features:
  - Very quiet
  - Bulging fontanelle
  - Hypotonic
- Apply monitoring
  - Note capillary refill 2-3 seconds but HR not tachycardic for baby of this age
- Attempt IV access
  - Unsuccessful – should move to IO access.
- Consider fluid bolus once IO/IV access obtained
  - Note floppy child with prolonged capillary refill

**Facilitators should:**
- After five minutes move to state ‘Seizure’
STATE: SEIZURE / PROLONGED SEIZURE

VITAL SIGNS

<table>
<thead>
<tr>
<th>Rhythm</th>
<th>SR</th>
<th>HR</th>
<th>170</th>
<th>BP</th>
<th>Unable to pick up (seizing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp rate</td>
<td>30</td>
<td>SaO₂</td>
<td>Poor signal</td>
<td>ETCO₂</td>
<td></td>
</tr>
<tr>
<td>Temp</td>
<td>35.7</td>
<td>AVPU</td>
<td>U</td>
<td>Pupils</td>
<td>3 ERL</td>
</tr>
<tr>
<td>Other</td>
<td>Mannequin in ‘seizure’ state</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ASSESSMENT

| Pulses | Normal | Cap refill | 2-3 sec | Skin | No rashes |
| Airway | Maintained | Breathing | Erratic pattern | Breath sounds | Reduced |
| Work of breathing | Normal | Recession | None | Neuro | Unresponsive |
| Other | Seizure is generalised; not focal. Still has bulging fontanelle. |

EXPECTED OUTCOMES

Participants should:

- Gain IO access if not done already
- Once blood gas results available, give bolus 10% dextrose
- Give rectal diazepam 2.5mg or buccal midazolam if no IV/IO access
- Give intravenous/IO lorazepam 0.1mg/kg
- Give PR paraldehyde whilst IV phenytoin being prepared
- Could also give 0.9% saline bolus via IO and reattempt IV access

Facilitators should:

- If suboptimal management (e.g. hypoglycaemia not addressed), or if senior trainee requiring challenge, baby continues to have seizure.
- If no progression after 10 minutes, use ‘pause and perfect’ principle to help participant understand current state and treatment options, before restarting scenario and allowing them to instigate appropriate management.
- If appropriate management, seizure stops before phenytoin given. Progress to state ‘Post-Ictal’.
STATE: POST-ICTAL

### VITAL SIGNS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhythm</td>
<td>SR: 120</td>
</tr>
<tr>
<td>Resp Rate</td>
<td>30</td>
</tr>
<tr>
<td>Temp</td>
<td>36</td>
</tr>
<tr>
<td>BP</td>
<td>74/38</td>
</tr>
<tr>
<td>HR</td>
<td>130</td>
</tr>
<tr>
<td>O2</td>
<td>95%</td>
</tr>
<tr>
<td>ETCO₂</td>
<td></td>
</tr>
</tbody>
</table>

**Other:** Seizure terminated – no abnormal movements

### ASSESSMENT

**Pulses:** Normal  Cap refill: 2-3 sec  Skin: No rashes

**Airway:** Maintained  Breathing: Normal  Breath sounds: Normal

**Work of breathing:** Normal  Recession: None  Neuro: Responsive to pain

**Other:** Seizure terminated. Baby now floppy. Cries in response to pain.

### EXPECTED OUTCOMES

**Participants should:**

1. Recognise post-ictal state
2. Suggest bloods:
   - Ongoing BM/blood gas monitoring
   - U+E, FBC, Coagulation screen,
   - Serum amino acids, ammonia
   - Blood cultures
3. Suggest urine tests:
   - MC+S
   - Ketones
   - Amino and organic acids
4. Suggest radiology:
   - Cranial USS
   - CT head
   - ?Chest X-ray
   - ?Skeletal survey
5. Arrange transfer to ward/HDU

- If suboptimal management (e.g. hypoglycaemia not addressed), or if senior trainee requiring challenge, baby continues to have seizure.

- If no progression after 10 minutes, use ‘pause and perfect’ principle to help participant understand current state and treatment options, before restarting scenario and allowing them to instigate appropriate management.

- If appropriate management, seizure stops. Progress to state ‘Post-ictal’.
APPENDIX 1 – BLOOD GAS – SEIZURE

RADIOMETER ABL SIMULATION SERIES

ABL725 ICU
PATIENT REPORT
09:14 C0
09-01-2013
Syringe - S 195uL
Sample# 90396

Identifications
- Patient ID: 10183365
- Patient First Name: Mollie
- Patient Last Name: McGivern
- Date of Birth: 11/11/2012
- Sample type: Venous
- Operator: Emergency Department

Blood Gas Values

- pCO²: 8.10 kPa [4.70 - 6.00]
- pO²: 5.8 kPa [10.0 - 13.3]
- pO²(A-a)e

Oximetry Values

- cTb: 12.4 g/dL [12.0 - 16.0]
- sO²: % [95.0 - 98.0]
- fD¹Hb: % [94.0 - 99.0]
- fC OHb: % [0.2 - 0.6]
- fHHb: %
- fmetHb: %
- Hct: %

Electrolyte Values

- cK+: 4.4 mmol/L [3.0 - 5.0]
- cNa+: 137 mmol/L [136 - 146]
- cCa²+: 1.10 mmol/L [1.15 - 1.29]
- cCl⁻: 97 mmol/L [98 - 106]

Metabolite Values

- cGlu: 1.6 mmol/L [3.5 - 10.0]
- cLac: 6.7 mmol/L [0.5 - 1.6]

Oxygen Status

- ctO²c
- pSOc kPa

Acid Base Status

- cBase(Ecf)c: -5.9 mmol/L
- cHCO³-(P,st)c: 21.2 mmol/L
APPENDIX 2 – BLOOD GAS – POST-ICTAL

RADIOMETER ABL SIMULATION SERIES

ABL725 ICU 09:23 C0 09-01-2013
PATIENT REPORT Syringe - S 195uL Sample# 90396

Identifications
Patient ID 10183365
Patient First Name Mollie
Patient Last Name McGivern
Date of Birth 11/11/2012
Sample type Venous
Operator Emergency Department

Blood Gas Values
pH 7.29 [7.340 - 7.450]
pCO² 5.3 kPa [4.70 - 6.00]
pO² 5.8 kPa [10.0 - 13.3]
pO²(A-a)e kPa

Oximetry Values
cHb 12.4 g/dL [12.0 - 16.0]
sO² % [95.0 - 98.0]
FaO²Hb % [94.0 - 99.0]
FC O²Hb % [-]
FHb % [-]
FmetHb % [0.2 - 0.6]
Hctc %

Electrolyte Values
cK+ 4.4 mmol/L [3.0 - 5.0]
cNa+ 137 mmol/L [136 - 146]
cCa²+ 1.10 mmol/L [1.15 - 1.29]
cCl- 97 mmol/L [98 - 106]

Metabolite Values
cGlu 6.6 mmol/L [3.5 - 10.0]
cLac 4.2 mmol/L [0.5 - 1.6]

Oxygen Status
cO²c vo]%
pSO²c kPa

Acid Base Status
cBase(Ecf)c -4.9 mmol/L
cHCO³-(P,st)c 22.7 mmol/L
## APPENDIX 3 – EMERGENCY DRUG CALCULATOR

**Southampton Oxford Retrieval Team**

**DRUG CALCULATOR**

**WEIGHT**

**5 Kg**

**Enter weight and click calculate**

<table>
<thead>
<tr>
<th>Emergency</th>
<th>Respiratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline 1:10,000</td>
<td>Magnesium Sulphate</td>
</tr>
<tr>
<td>0.5 ml (0.1 ml/kg)</td>
<td>200 mg (40 mg/kg over 20 minutes)</td>
</tr>
<tr>
<td>Atropine 60 mcg/ml</td>
<td>Salbutamol Load</td>
</tr>
<tr>
<td>0.17 ml (20 mcg/kg, min 100 mcg)</td>
<td>75 mcg (15 mcg/kg over 10 minutes)</td>
</tr>
<tr>
<td>Atropine 100 mcg/ml</td>
<td>Hydrocortisone</td>
</tr>
<tr>
<td>1 ml (20 mcg/kg, min 100 mcg)</td>
<td>20 mg (4 mg/kg, max 100 mg)</td>
</tr>
<tr>
<td>Sodium Bicarbonate 8.4%</td>
<td>Aminophylline Load</td>
</tr>
<tr>
<td>5 ml (1 ml/kg)</td>
<td>25 mg (5 mg/kg over 20 minutes)</td>
</tr>
<tr>
<td>Calcium Gluconate 10%</td>
<td>Adrenaline 1:1000</td>
</tr>
<tr>
<td>2.5 ml (0.5 ml/kg)</td>
<td>2.5 ml (0.5 ml/kg, max 5 ml)</td>
</tr>
</tbody>
</table>

**Cardiac**

| Cardioversion (sync) | Nebulised |
| 5 joules (1J/kg) | Make up to 5 ml with saline |
| Shockable rhythm (async) | |
| Adrenaline | |
| 500 mcg (100 mcg/kg) | |
| Amiodarone Load | |
| 25 mg (5 mg/kg over 30 minutes to 4 hrs) | |

**Neuro**

| Lorazepam | Ketamine |
| 0.5 mg (0.1 mg/kg) | 10 mg (2mg/kg) |
| Midazolam/Buccal | Thiopentone |
| 0.5 mg (0.1 mg/kg) | 5 to 25 mg (1-5mg/kg) |
| Phenytoin | Fentanyl |
| 100 mg (20 mg/kg over 20 minutes) | 10 to 25 mcg (2-5mcg/kg) |
| Phenobarbitone | Morphine |
| 100 mg (20 mg/kg) | 0.5 mg (0.1 mg/kg) |
| Paraldehyde PI | Incuronium |
| 2 ml (0.4 ml/kg, mix 1:1 with water) | 5 mg (1mg/kg) |
| 2% Saline | Atropine |
| 15 ml (0.1 ml/kg) | 2.5 mg (0.5 mg/kg) |
| Mannitol 10% | Yucuronium |
| 25 ml (5 ml/kg, equivalent to 6.5g/kg) | 0.5 mg (0.1 mg/kg) |

**Infusions**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Infusion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopamine (central)</td>
<td>75 mg in 50ml of 0.9% Saline or 5% Glucose 1 ml/hr = 5 mcg/kg/min</td>
</tr>
<tr>
<td>Dopamine (peripheral)</td>
<td>7.5 mg in 50ml of 0.9% Saline or 5% Glucose 1 ml/hr = 0.5 mcg/kg/min</td>
</tr>
<tr>
<td>Adrenaline</td>
<td>15 mg in 50ml of 0.9% Saline or 5% Glucose 1 ml/hr = 0.1 mcg/kg/min</td>
</tr>
<tr>
<td>Noradrenaline</td>
<td>1 ml/hr = 0.1 mcg/kg/min</td>
</tr>
<tr>
<td>Milrinone</td>
<td>10 mg in 50ml of 0.9% Saline or 5% Glucose 0.75 ml/hr = 0.1 mcg/kg/min</td>
</tr>
<tr>
<td>Dinoprost (Prostin E2)</td>
<td>50 mcg in 50ml of 0.9% Saline or 5% Glucose 1.5 ml/hr = 5 mg/kg/min</td>
</tr>
<tr>
<td>Morphine</td>
<td>5 mg in 50ml of 0.9% Saline or 5% Glucose 1 ml/hr = 20 mcg/kg/hr</td>
</tr>
<tr>
<td>Midazolam</td>
<td>10 mg in 50ml of 0.9% Saline or 5% Glucose 1 ml/hr = 20 mcg/kg/hr</td>
</tr>
<tr>
<td>Salbutamol</td>
<td>10 mg in 50ml of 0.9% Saline or 5% Glucose 1.5 ml/hr = 1 mcg/kg/hr</td>
</tr>
<tr>
<td>Aminophylline</td>
<td>250 mg in 250ml of 0.9% Saline or 5% Glucose 5 ml/hr = 1 mg/kg/hr</td>
</tr>
</tbody>
</table>

*It is the prescriber's responsibility to ensure the correct dose is prescribed*  Compiled by Tom Bennett - May 2012
# Treatment of prolonged seizures

## Definition of prolonged seizures
- Generalised seizure for ≥ 5 mins

## Definition of status epilepticus
- Generalised seizure lasting for ≥ 30 mins
- Two or more seizures over a 30min period without full recovery between them

## Causes
- Cerebro-vascular event (infarct or bleed),
- Space occupying lesion,
- Blocked VP shunt,
- Overdose (accidental or self harm),
- Hypoxia,
- Metabolic problem
- Fever
- Known epilepsy
- CNS infection,
- Hyponatraemia, hypoglycaemia,
- Head injury (acute or previous),

## Issues
- Hypoventilation post benzodiazepines
- Failure to recognise on-going seizures
- Failure to identify and treat cause
- Refractory status epilepticus

## Management principles
- Maintain ABCD
- Administer high flow oxygen
- Stop seizures as soon as possible
- Find and treat cause

## Urgent interventions
- Glucose aim for 4-6 mmols/L
- Hyponatraemia
  - If Na < 125 mmols/L
  - Give bolus 3 mls/kg 3% NaCL
- Keep temp <37°C
- Bacterial Meningitis
  - Cefotaxime 80 mg/kg IV
- Encephalitis add Acyclovir
- Check ammonia in neonate

## Indications for CT scan
- Refractory seizures
- Focal signs
- New focal seizure
- Trauma / NAI
- Suspect space occupying lesion
- VP shunt in-situ
- Suspected raised ICP

## Remember to request a contrast enhanced scan if suspicion of venous sinus thrombosis

## Management of refractory seizures: Discuss urgently with SORT
- Commence Midazolam infusion
- 100 mcg/kg bolus and start at 100 mcg/kg/hr
- Repeat 100 mcg/kg bolus every 5 minutes and increase infusion rate by 100 mcg/kg/hr until seizures controlled
- Consider further half load of phenytoin or loading with phenobarbital
- Consider Thiopentone infusion
- Obtain central access as hypotension will develop and vasopressors may be required
- Find and treat cause

---

**APPENDIX 4 – SORT GUIDELINE – PROLONGED SEIZURE**

**Treatment of prolonged seizures**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Management of refractory seizures: Discuss urgently with SORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10 Min</td>
<td>Intravenous access: YES</td>
</tr>
<tr>
<td>10 – 20 Min</td>
<td>Lorazepam IV 0.1mg/kg</td>
</tr>
<tr>
<td>20 – 40 Min</td>
<td>Lorazepam IV 0.1mg/kg</td>
</tr>
<tr>
<td>60 Min</td>
<td>Intravenous access: NO</td>
</tr>
<tr>
<td>40 – 60 Min</td>
<td>Diazepam PR 0.5mg/kg OR Midazolam buccal 0.2mg/kg</td>
</tr>
<tr>
<td>20 – 40 Min</td>
<td>Paraldehyde PR 0.4ml/kg</td>
</tr>
<tr>
<td>40 – 60 Min</td>
<td>IO if still no IVI access</td>
</tr>
<tr>
<td>60 Min</td>
<td>Is the child normally on phenytoin?</td>
</tr>
<tr>
<td>YES</td>
<td>Phenobarbital IV 20mg/kg</td>
</tr>
<tr>
<td>NO</td>
<td>Phenobarbital IV 20mg/kg</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• Give over 20 mins</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• Extravasation risk</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• PR Paraldehyde if not already given</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• Give over 20 mins</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• Watch for hypotension</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• PR Paraldehyde if not already given</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>Thiopeptone 3 – 5 mg/kg and short acting muscle relaxant</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>ANAESTHETISE TO TERMINATE SEIZURE: INTUBATE/VENTILATE</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>Thiopentone 3 – 5 mg/kg and short acting muscle relaxant</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>REASSESSMENT</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• If seizures persist see management of refractory seizures</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• Remember if muscle relaxed will need to assess HR, BP and pupillary reactions to determine if seizures controlled</td>
</tr>
<tr>
<td>0 – 10 Min</td>
<td>• If seizures controlled, wake up and consider extubation</td>
</tr>
</tbody>
</table>

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Editor: Dr Andrew Darby Smith
Original Author: Dr R Furr (adapted from Bristol Key Competencies)
APPENDIX 5 – INTRAOSSEUS NEEDLE GUIDANCE (SORT)

Intraosseous needle (IO) observation chart and guidance

**Patient Label**

<table>
<thead>
<tr>
<th>Time/Date</th>
<th>Sites inserted</th>
<th>Sites attempted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R Tibial</td>
<td>R Tibial</td>
</tr>
<tr>
<td></td>
<td>L Tibial</td>
<td>L Tibial</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>

**Guidance**

There should only be one attempt at insertion in each bone.
The IO needle should be secured without bandaging the limb so that the limb can be seen and monitored.
One nurse must be solely responsible for monitoring the IO needle at all times.

**Observation Chart – to be completed every 15 minutes**

<table>
<thead>
<tr>
<th>Time</th>
<th>Capillary refill time in distal limb (secs)</th>
<th>Colour of limb</th>
<th>Visible swelling of limb Y/N</th>
<th>Limb feels firm Y/N</th>
<th>Suspect extravasation if CRT &gt; 4 secs / colour is 2 or 3 / limb swelling / limb firmness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Colour of limb</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pink = 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pale = 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Blue/White = 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Colour of limb</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pink = 1</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pale = 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Blue/White = 3</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Visible swelling of limb Y/N</td>
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<td>Visible swelling of limb Y/N</td>
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<td>Y/N</td>
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<td></td>
<td>Suspect extravasation if CRT &gt; 4 secs / colour is 2 or 3 / limb swelling / limb firmness</td>
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</tbody>
</table>

**Actions if suspected infiltration**

- Stop infusion (s) immediately
- Remove IO needle
- Call senior orthopaedic doctor to consider immediate fasciotomy
- Orthopaedic registrar at Southampton or Oxford available for advice if none available locally

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DEBRIEFING

POINTS FOR FURTHER DISCUSSION

• Hypoglycaemia and another underlying cause for seizures may co-exist (e.g. NAI, meningitis) so treatment of hypoglycaemia may not be enough to stop seizure.

• Important to recognise Human Factors in high-stress, high-noise environment when a child beings to have seizure.

• Is everyone on team comfortable with giving PR diazepam, buccal midazolam, PR paraldehyde? Often the team member nearest the child (e.g doctor) will be handed the syringe – important to know how to give it to prevent under-dosing.

• Important to remember benzodiazepines may have been given by parents or ambulance staff. If so, do count this dose in algorithm and progress onto paraldehyde/phenytoin after 2nd benzodiazepine (including pre-hospital dose(s)). Risk of significant respiratory depression if you do not take these pre-hospital doses into account.

• In baby having seizure with hypoglycaemia and difficult IV access, the priority should be to correct hypoglycaemia. Investigation of hypoglycaemia is less crucial at that stage, especially if obtaining blood samples is difficult.

DEBRIEFING RESOURCES

SORT (Southampton Oxford Retrieval Service) Emergency Drug Calculator

SORT guideline and obs chart for IO needles
KEY POINTS

• Hypoglycaemia and another underlying cause for seizures may co-exist (e.g. NAI, meningitis) so treatment of hypoglycaemia may not be enough to stop seizure.

• Important to remember benzodiazepines may have been given by parents or ambulance staff. If so, do count this dose in algorithm and progress onto paraldehyde/phenytoin after 2nd benzodiazepine (including pre-hospital dose(s)). Risk of significant respiratory depression if you do not take these pre-hospital doses into account.

• Unlike with IV infusions, PR or buccal medications are often administered by the person closest to the patient – which may be you! Make sure you are happy with how to give buccal and PR medications safely and effectively.

FURTHER RESOURCES

SORT (Southampton Oxford Retrieval Service) Emergency Drug Calculator

SORT guideline and obs chart for IO needles
### RELEVANT AREAS OF THE CURRICULUM

**Level One**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1_GEN_STA_02</td>
<td>Effective responses to challenge, complexity and stress in pediatrics</td>
</tr>
<tr>
<td>L1_GEN_STA_03</td>
<td>Advanced neonatal and paediatric life support skills</td>
</tr>
<tr>
<td>L1_GEN_STA_05</td>
<td>Effective skills in paediatric assessment</td>
</tr>
<tr>
<td>L1_GEN_STA_06</td>
<td>Skills in formulating an appropriate differential diagnosis in pediatrics</td>
</tr>
<tr>
<td>L1_GEN_STA_07</td>
<td>Effective initial management of ill-health and clinical conditions in pediatrics seeking additional advice and opinion as appropriate</td>
</tr>
<tr>
<td>L1_GEN_STA_09</td>
<td>Safe practical skills in pediatrics</td>
</tr>
<tr>
<td>L1_GEN_STA_15</td>
<td>Knowledge of common and serious paediatric conditions and their management</td>
</tr>
<tr>
<td>L1_GEN_STA_29</td>
<td>Effective communication and interpersonal skills with colleagues</td>
</tr>
<tr>
<td>L1_GEN_STA_30</td>
<td>Professional respect for the contribution of colleagues in a range of roles in paediatric practice</td>
</tr>
<tr>
<td>L1_GEN_STA_32</td>
<td>Effective handover, referral and discharge procedures in pediatrics</td>
</tr>
<tr>
<td>L1_GEN_STA_34</td>
<td>Ethical personal and professional practice in providing safe clinical care</td>
</tr>
<tr>
<td>L1_GEN_STA_35</td>
<td>Reliability and responsibility in ensuring their accessibility to colleagues and patients and their families</td>
</tr>
<tr>
<td>PAED_L1_ENDO_ACU_HYPO_01</td>
<td>Know the causes, complications and treatment of hypoglycaemia in the neonatal period and beyond</td>
</tr>
<tr>
<td>PAED_L1_ENDO_ACU_HYPO_02</td>
<td>Know that blood glucose is an urgent investigation in patients with impaired conscious level</td>
</tr>
<tr>
<td>PAED_L1_NEURO_GEN_10</td>
<td>Understand the life-threatening nature of acute neurological deterioration and when to call for help</td>
</tr>
<tr>
<td>PAED_L1_NEURO_GEN_11</td>
<td>Be able to recognise, initiate diagnostic tests and outline the management of common (neuro) disorders</td>
</tr>
<tr>
<td>PAED_L1_NEURO_SEIZ_01</td>
<td>Know the common causes of seizures in newborn babies and children</td>
</tr>
<tr>
<td>PAED_L1_NEURO_SEIZ_07</td>
<td>Be able to initiate treatment for acute continuing seizures</td>
</tr>
<tr>
<td>PAED_L1_NEURO_SEIZ_08</td>
<td>Be able to form a differential diagnosis in continuing seizures</td>
</tr>
<tr>
<td>PAED_L1_NEURO_SEIZ_09</td>
<td>Work effectively with the multidisciplinary team (in continuing seizures)</td>
</tr>
</tbody>
</table>

**Level Two (as above plus):**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>L2_GEN_STA_02</td>
<td>Increasing credibility and independence in response to challenge and stress in pediatrics</td>
</tr>
<tr>
<td>L2_GEN_STA_03</td>
<td>Leadership skills in advanced neonatal and paediatric life support</td>
</tr>
<tr>
<td>L2_GEN_STA_04</td>
<td>Responsibility for conducting effective paediatric assessments and interpreting findings appropriately</td>
</tr>
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</table>
### Level Two

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>L2_GEN_STA_06</td>
<td>Improving skills in formulating an appropriate differential diagnosis in paediatrics</td>
</tr>
<tr>
<td>L2_GEN_STA_09</td>
<td>Effective skills in performing and supervising practical procedures in paediatrics ensuring patient safety</td>
</tr>
<tr>
<td>L2_GEN_STA_15</td>
<td>Extended knowledge of common and serious paediatric conditions and their management</td>
</tr>
<tr>
<td>L2_GEN_STA_29</td>
<td>Skill in ensuring effective relationships between colleagues</td>
</tr>
<tr>
<td>L2_GEN_STA_32</td>
<td>Effective skills in ensuring handover, referral and discharge procedures in paediatrics</td>
</tr>
<tr>
<td>L2_GEN_STA_34</td>
<td>Sound ethical, personal and professional practice in providing safe clinical care</td>
</tr>
<tr>
<td>L2_GEN_STA_35</td>
<td>Continued responsibility and accessibility to colleagues, patients and their families</td>
</tr>
<tr>
<td>PAED_L2_ENDO_ACU_HYPO_01</td>
<td>Know when to consider rare causes of hypoglycaemia and what investigations to perform during the hypoglycaemic episode</td>
</tr>
<tr>
<td>PAED_L2_ENDO_ACU_HYPO_02</td>
<td>Be able to treat hypoglycaemia safely and effectively with intravenous glucose or glucagon where appropriate</td>
</tr>
<tr>
<td>PAED_L2_NEURO_SEIZ_04</td>
<td>Be able to refer to intensive care teams appropriately and maintain patient safety until that team takes over (acute continuing seizures)</td>
</tr>
<tr>
<td>PAED_L2_NEURO_SEIZ_05</td>
<td>Be able to decide initial and continuing anticonvulsant therapy in babies and children</td>
</tr>
</tbody>
</table>

### Level Three (as above plus):

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>L3_GEN_STA_02</td>
<td>Responsibility for an effective response to complex challenges and stress in paediatrics</td>
</tr>
<tr>
<td>L2_GEN_STA_03</td>
<td>Leadership skills in advanced neonatal and paediatric life support</td>
</tr>
<tr>
<td>L3_GEN_STA_06</td>
<td>Effective skills in making safe decisions about the most likely diagnoses in paediatrics</td>
</tr>
<tr>
<td>L3_GEN_STA_07</td>
<td>Leadership skills in the management of common and complex conditions in general paediatrics and paediatric subspecialties seeking additional advice and opinion as appropriate</td>
</tr>
<tr>
<td>L3_GEN_STA_09</td>
<td>Expertise in a range of practical procedures in paediatrics specific to general and sub-specialist training</td>
</tr>
<tr>
<td>L3_GEN_STA_15</td>
<td>Detailed knowledge of common and serious paediatric conditions and their management in General Paediatrics or in a paediatric subspecialty</td>
</tr>
<tr>
<td>L3_GEN_STA_29</td>
<td>Positive and constructive relationships form a wide range of professional contexts</td>
</tr>
<tr>
<td>L3_GEN_STA_32</td>
<td>Effective leadership skills in the organisation of paediatric team-working and effective handover</td>
</tr>
<tr>
<td>L3_GEN_STA_34</td>
<td>Exemplary professional conduct so as to act as a role model to others in providing safe clinical care</td>
</tr>
<tr>
<td>L3_GEN_STA_35</td>
<td>Responsibility for ensuring their own reliability and accessibility and that of others in their team</td>
</tr>
<tr>
<td>PAED_L3_NEURO_SEIZ_01</td>
<td>Work effectively with the multidisciplinary team and lead the care maintaining patient safety until that team takes over (acute continuing seizures)</td>
</tr>
</tbody>
</table>
**Treatment of prolonged seizures**

**Definition of prolonged seizures**
- Generalised seizure for ≥ 5 mins

**Definition of status epilepticus**
- Generalised seizure lasting for ≥ 30 mins
- Two or more seizures over a 30min period without full recovery between them

**Causes**
- Cerebro-vascular event (infarct or bleed),
- Space occupying lesion,
- Blocked VP shunt,
- Overdose (accidental or self harm),
- Hypoxia,
- Metabolic problem
- Fever
- Known epilepsy
- CNS infection,
- Hyponatraemia, hypoglycaemia,
- Head injury (acute or previous),

**Issues**
- Hypoventilation post benzodiazepines
- Failure to recognise on-going seizures
- Failure to identify and treat cause
- Refractory status epilepticus

**Management principles**
- Maintain ABCD
- Administer high flow oxygen
- Stop seizures as soon as possible
- Find and treat cause

**Intravenous access: YES**
- Lorazepam IV 0.1mg/kg

**Intravenous access: NO**
- Diazepam PR 0.5mg/kg OR Midaolam buccal 0.2mg/kg
- Paraldehyde PR 0.4ml/kg

**0 – 10 Min**
- Lorazepam IV 0.1mg/kg

**10 – 20 Min**
- Lorazepam IV 0.1mg/kg

**20 – 40 Min**
- **NO**
  - Phenytoin IV 20mg/kg
    - Give over 20 mins
    - Extravasation risk
    - PR Paraldehyde if not already given
  - **YES**
    - Phenobarbitone IV 20mg/kg
      - Give over 20 mins
      - Watch for hypotension
      - PR Paraldehyde if not already given

**REASSESSMENT**
- If seizures persist see management of refractory seizures
- Remember if muscle relaxed will need to assess HR, BP and pupillary reactions to determine if seizures controlled
- If seizures controlled, wake up and consider extubation

**ANAESTHETISE TO TERMINATE SEIZURE: INTUBATE/VENTILATE**
- Thiopentone 3 – 5 mg/kg and short acting muscle relaxant

**ANO**
- IO if still no IVI access

**Urgent interventions**
- **Glucose** aim for 4-6 mmols/L
- **Hyponatraemia**
  - If Na < 125 mmols/L
    - Give bolus 3 mls/kg  3% NaCL
  - Keep temp <37°C
- **Bacterial Meningitis**
  - Cefotaxime 80 mg/kg IV
- **Encephalitis add Acyclovir**
- **Check ammonia** in neonate

**Indications for CT scan**
- Refractory seizures
- Focal signs
- New focal seizure
- Trauma / NAI
- Suspect space occupying lesion
- VP shunt in-situ
- Suspected raised ICP

Remember to request a contrast enhanced scan if suspicion of venous sinus thrombosis

**Management of refractory seizures: Discuss urgently with SORT**
- Commence Midazolam infusion
- 100 mcg/kg bolus and start at 100 mcg/kg/hr
- Repeat 100 mcg/kg bolus every 5 minutes and increase infusion rate by 100 mcg/kg/hr until seizures controlled
- Consider further half load of phenytoin or loading with phenobarbitone
- Consider Thiopentone infusion
- Obtain central access as hypotension will develop and vasopressors may be required
- Find and treat cause

**SORT May 2012 Review 2014**

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PARTICIPANT REFLECTION

What have you learned from this experience? (Please try and list 3 things)

How will your practice now change?

What other actions will you now take to meet any identified learning needs?
PARTICIPANT FEEDBACK

Date of training session:...............................................................................................................................

Profession and grade:........................................................................................................................................

What role(s) did you play in the scenario? (Please tick)

Primary/Initial Participant
Secondary Participant (e.g. ‘Call for Help’ responder)
Other health care professional (e.g. nurse/ODP)
Other role (please specify):

Observer

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td>I found this scenario useful</td>
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<tr>
<td>I understand more about the scenario subject</td>
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<tr>
<td>I have more confidence to deal with this scenario</td>
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<tr>
<td>The material covered was relevant to me</td>
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Version 9 – May 2015
Editor: Dr Andrew Darby Smith
Original Author: Dr R Furr (adapted from Bristol Key Competencies)
Please write down one thing you have learned today, and that you will use in your clinical practice.

How could this scenario be improved for future participants? This is especially important if you have ticked anything in the disagree/strongly disagree box.
What went particularly well during this scenario?

What did not go well, or as well as planned?

Why didn’t it go well?

How could the scenario be improved for future participants?