Trust Guideline for the Management of Children Receiving Epidural Analgesia

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A Clinical Guideline recommended

For use in:	All clinical areas caring for children
By:	Anaesthetists, Nursing staff, Acute Pain Service staff
For:	Paediatric patients receiving epidural analgesia
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This guideline has been approved by the Trust's Clinical Guidelines Assessment Panel as an aid to the diagnosis and management of relevant patients and clinical circumstances. Not every patient or situation fits neatly into a standard guideline scenario and the guideline must be interpreted and applied in practice in the light of prevailing clinical circumstances, the diagnostic and treatment options available and the professional judgement, knowledge and expertise of relevant clinicians. It is advised that the rationale for any departure from relevant guidance should be documented in the patient's case notes. The Trust's guidelines are made publicly available as part of the

collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document.

Version and Document Control:

Version Number	Date of Update	Change Description	Author
3.1	11/11/2020	To add times due to the Pain team increased availability and change in equipment	Jasmine Kaur
4	09/05/2022	Post operative options as Buxton HDU, NICU or CCC. Epidurals are regarded as level 2 intervention and so not for Buxton ward postop. and removal of catheter in children with hip spicas in section 1.12	Jasmine Kaur

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Quick reference guidelines

Problem	Action
Respiratory Depression Defined as: <5 years – RR<18 breaths/minute >5 years – RR<10 breaths/minute Rate for guidance only, assess depth of respiration, respiratory effort, level of sedation, oxygen saturation Naloxone – dilute 400mcg ampoule up to 10mLs with 0.9% saline and administer 1mL/10kg body weight (=4 micrograms/kg)	**Nursing Staff** • **STOP** epidural infusion • Give oxygen by face mask at 5L/min • Monitor oxygen saturation continuously • Inform medical team • Record pain and sedation scores • Record a full set of observations • Record respiratory rate every 5 minutes until improvement is seen **Medical Staff** • Assess and document respiratory function • Consider naloxone 4mcg/kg intravenously • Contact Acute Pain Service (APS) on bleep 0571 during 0900-1700 weekdays and 0900-1300 Saturday, or duty anaesthetist (bleep 0900) at other times **IN RESPIRATORY ARREST** • **STOP** epidural infusion • Administer Basic Life Support • **Contact Paediatric Arrest Team (extension. 2222)** • Administer Naloxone 4mcg/kg

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Excessive Sedation	**Nursing Staff**
The administration of opiates can cause undue sedation that may precede respiratory depression. *Defined as:* *Sedation score of 3 – somnolent and difficult to rouse* *Sedation levels (see Trustdocs Id: 18247)* *0 – alert* *1 – mild, easy to rouse* *2 – easy to rouse, often drowsy* *3 – somnolent, difficult to rouse* *Assess respiratory rate, respiratory effort and oxygen saturation*	• **STOP** epidural infusion • Give oxygen by face mask at 5L/min • Monitor oxygen saturation continuously • Inform medical team • Consider other possible causes of sedation (e.g., hypoglycaemia / local anaesthetic toxicity) • Record a full set of observations • Record respiratory rate every 15 minutes until improvement is seen **Medical Staff** • Assess and document respiratory function • Consider naloxone 2 to 4 micrograms/kg IV • Contact the APS (bleep 0571) or duty anaesthetist (bleep 0900) to review and change pump programming or infusion to plain levobupivacaine, if necessary • Infusion can be restarted when sedation </=2

Hypotension *Defined as:* *0-2 years - <65mmHg SBP* *3-8 years - <75mmHg SBP* *>8 years - <85mmHg SBP* *Children under 8 years of age are unlikely to experience significant hypotension through the administration of epidural anaesthesia*	**Nursing Staff** • Lie patient flat (but not head down) • Record a full set of observations (temperature, pulse, respirations, blood pressure, level of consciousness (AVPU), oxygen saturations, and a Children's Early Warning Score. • Ensure fluid balance documentation completed • Contact the patient's medical team. **Medical Staff** • Consider other possible causes of hypotension e.g., haemorrhage, hypovolaemia or sepsis • Review fluid management including urine output • Ensure iv access is present and patent • Consider fluid bolus of 10mL/kg • Consider discussion of analgesia management with APS staff (bleep 0571) during 0900-1700 weekdays and 0900-1300 Saturdays, or duty anaesthetist (bleep 0900) at other times. • If dense sensory and, or motor block then intrathecal migration of catheter should be considered. Stop infusion immediately and contact APS or duty anaesthetist for urgent review.
Extensive Motor block	**Follow flow chart 1** (page11)
High Sensory block *Defined as a sensory block >T4 (above the nipple line), when tested with ice* *Symptoms include:* • *Numbness or tingling in hand* • *Weakness in hand* • *Difficulty breathing* • *Respiratory distress*	**Nursing Staff** • **STOP** epidural infusion • Give oxygen by face mask at 5L/min • Monitor oxygen saturation continuously • Inform medical team • Record a full set of observations **Medical Staff** • Assess and document respiratory function • Contact the APS (bleep 0571) or duty anaesthetist (bleep 0900) for urgent review

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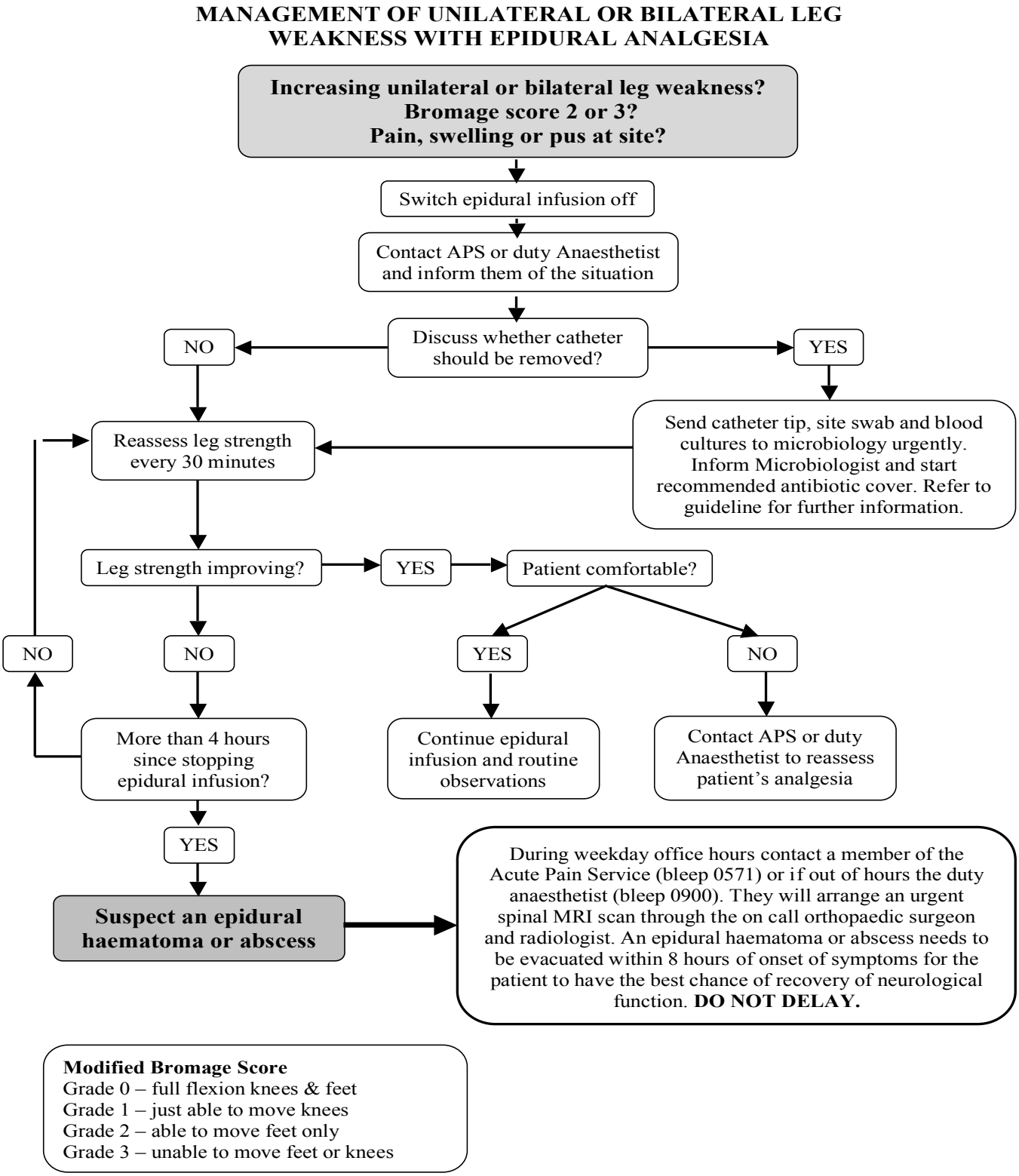
Suspected infection *Patients may complain of:* • ***back pain, increasing lower limb weakness / numbness or pyrexia****.* • *Signs of infection may also be present at the epidural site.* ***If any of the above are present, then follow the instructions ->*** *Risk factors for epidural abscess include:* • *impaired immunity (diabetes, malignancy, alcoholism and immune-suppressive therapy)* • *patients who have been in hospital for >48 hours prior to insertion* • *technical difficulty requiring multiple attempts* • *prolonged catheterisation (>48 hours)* • *anti-thrombotic drug therapy*	**Nursing Staff** • Check site for signs of infection (pain, swelling, pus or erythema). • Record a full set of observations (temperature, pulse, respiration rate, blood pressure, level of consciousness (AVPU), oxygen saturations and Early Warning Score). • Contact APS on bleep 0571 during 0900-1700 weekdays and 0900-1300 Saturdays, or duty anaesthetist (bleep 0900) at other times. Do not delay **Medical Staff** • Discuss with APS or duty anaesthetist whether catheter needs to be removed. Check anticoagulation status first. • Inform spinal surgeons of possible diagnosis. • Send catheter tip, site swab and blood cultures to Microbiology. Inform Microbiologist and start recommended antibiotic cover. • Send blood for Full Blood Count and C-Reactive Protein. • If leg weakness is present 4 hours after stopping the epidural infusion, then an urgent MRI scan should be arranged. Do not delay. • If there is no neurology, then an MRI should still be considered. The timing and appropriateness of this will need to be discussed with the duty radiologist.

Local anaesthetic toxicity *Signs of toxicity include:* • *Tingling of mouth and lips* • *Irritability / agitation* • *Confusion / sedation* • *Loss of consciousness* • *Seizures* • *Hypotension* • *Cardiovascular collapse, bradycardia, arrhythmias and/or asystole*	**Nursing Staff** • **STOP** epidural infusion • Give oxygen by face mask at 5L/min • Begin basic life support if necessary • Monitor oxygen saturation, ECG, and blood pressure continuously • **This is a life-threatening emergency. Alert the paediatric arrest team via switch on 2222.** **Medical Staff** • Cardiac arrest associated with LA toxicity may be refractory to conventional treatment and require lipid emulsion (Intralipid 20% kept on the arrest trolley in theatres and in pharmacy) ○ Refer to AAGBI guidance on management of severe local anaesthetic toxicity
Inadequate pain relief	Follow flow chart 2 (page12)
Nausea and Vomiting *This can be related to epidural opioid use*	**Nursing Staff** • Administer anti-emetics as prescribed • Aspirate NG or gastrostomy tube if appropriate. • Contact medical team if persists 1 hours after treatment **Medical Staff** • Consider prescribing further anti-emetics if patient remains symptomatic. • If persistent despite above, contact APS (or the duty anaesthetist out of hours) to consider reducing epidural infusion rate or changing to an opiate-free infusion if pain relief is adequate.

Pruritus (Itching) *This is usually related to epidural opioid use*	**Nursing Staff** • Contact medical team if pruritus troublesome **Medical Staff** • Administer naloxone 0.5mcg/kg intravenously and repeat at 10min intervals till relieved or a maximum of 4 doses have been given. • If no improvement, consider prescribing chlorphenamine. This antihistamine has sedative properties, so check level of sedation prior to administration and closely monitor afterwards. • If intractable, contact APS (or the duty anaesthetist out of hours) to consider using plain bupivacaine (removing opioids from the infusion)
Urinary retention *We recommend that children receiving epidural analgesia should have a catheter in situ. This should be inserted in theatre around the time of the epidural.* *Urinary catheters should not be removed until the epidural infusion is discontinued.*	**Nursing Staff** • Commence fluid balance charting. • If patient is not catheterised and no urine passed for 12 hours check fluid intake and perform bladder scan. • Inform paediatricians **Medical Staff** • Consider intravenous naloxone 0.5mcg/kg (up to 2mcg/kg in 10 min intervals) if opioid related retention is suspected. • Consider catheterisation
Filter disconnection *Reconnection may only be performed by an anaesthetist or a member of the APS, in exceptional circumstances*	**Nursing Staff** • DO NOT reconnect. • Stop the infusion. • Wrap the connector and catheter in a dry, STERILE non-adhesive dressing or paper towel. • Contact the APS on bleep 0571 during 0900-1700 weekdays and 0900-1300 saturdays or the duty anaesthetist on bleep 0900 out of hours.

Leaking epidural *A small amount of leakage under the dressing is common with epidurals especially in younger children*	**Nursing Staff** • If the patient is comfortable (suggesting the epidural is providing adequate analgesia) the dressing should be reinforced, and the amount of leakage monitored • If the patient is in pain or the epidural dressing needs changing contact the APS on bleep 0571 during 0900-1700 weekdays and 0900-1300 Saturdays or the duty anaesthetist on bleep 0900 out of hours.
Inadvertent catheter removal	**Nursing Staff** • Put a plaster over the entry site. • Ensure the whole catheter has been removed (check blue tip present) • Stop the infusion pump • Contact the APS on bleep 0571 during 0900-1700 weekdays and 0900-1300 Saturdays or the duty anaesthetist on bleep 0900 out of hours to prescribe alternative analgesia • Continue epidural observations for at least 8hours
Pump occlusion *The catheters used are very fine and can easily occlude. Infusions need to run a higher pressures than for intravenous lines*	**Nursing Staff** • Stop the infusion • Check the catheter is not kinked or trapped. • Check the administration set is not clamped. • Check whether the pump is faulty • Restart the infusion • If the pump continues to occlude Contact the APS on bleep 0571 during 0900-1700 weekdays and 0900-1300 Saturdays or the duty anaesthetist on bleep 0900 out of hours

Flow Chart 1


MANAGEMENT OF UNILATERAL OR BILATERAL LEG WEAKNESS WITH EPIDURAL ANALGESIA
Increasing unilateral or bilateral leg weakness?
Bromage score 2 or 3?
Pain, swelling or pus at site?
Switch epidural infusion off
Contact APS or duty Anaesthetist and inform them of the situation
Discuss whether catheter should be removed?
NO
YES
Send catheter tip, site swab and blood cultures to microbiology urgently. Inform Microbiologist and start recommended antibiotic cover. Refer to guideline for further information.
Reassess leg strength every 30 minutes
Leg strength improving?
YES
Patient comfortable?
NO
NO
YES
NO
More than 4 hours since stopping epidural infusion?
Continue epidural infusion and routine observations
Contact APS or duty Anaesthetist to reassess patient's analgesia
YES
Suspect an epidural haematoma or abscess
During weekday office hours contact a member of the Acute Pain Service (bleep 0571) or if out of hours the duty anaesthetist (bleep 0900). They will arrange an urgent spinal MRI scan through the on call orthopaedic surgeon and radiologist. An epidural haematoma or abscess needs to be evacuated within 8 hours of onset of symptoms for the patient to have the best chance of recovery of neurological function. DO NOT DELAY.
Modified Bromage Score
Grade 0 – full flexion knees & feet
Grade 1 – just able to move knees
Grade 2 – able to move feet only
Grade 3 – unable to move feet or knees

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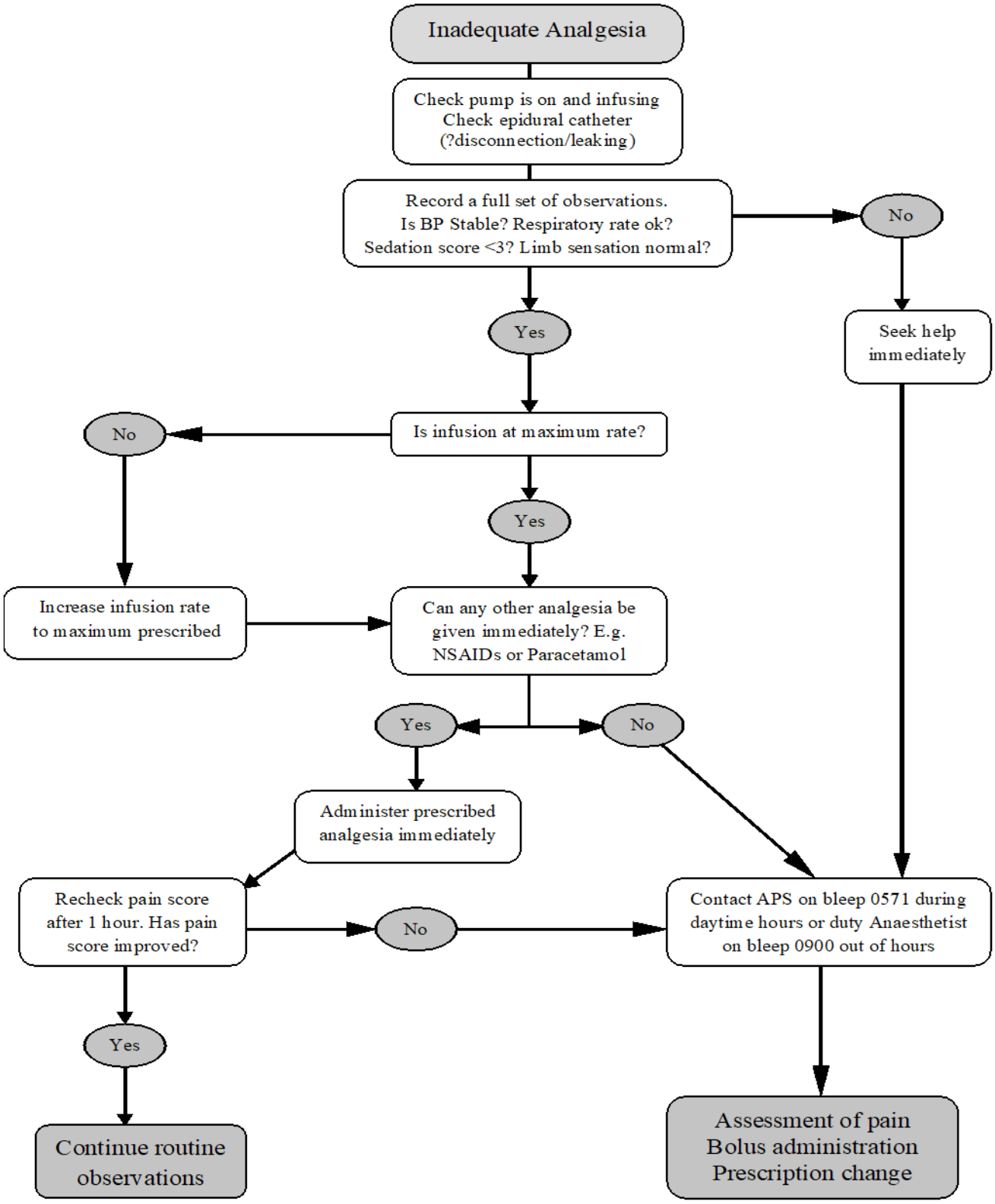
Flow Chart 2

Management of Inadequate Epidural Analgesia



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Objective of Guideline

To facilitate the effective and safe use of epidural analgesia, using step-by-step flow charts and tables to outline optimal management of complications and side effects. This guideline refers to epidurals sited for the relief of acute pain and not those used in obstetrics, chronic pain or palliative care settings. The guideline also details:

- Patient selection
- Epidural insertion and catheter management
- Prescription
- Patient monitoring
- Removal of the epidural catheter

Rationale for the recommendations

Epidural analgesia can provide effective pain relief in a wide variety of situations. However, there are also a number of side effects that may limit its effectiveness and result in significant morbidity.

Well-designed studies for the management of complications from epidural analgesia are lacking, and there are no randomised clinical trials in this area. The publication by the Royal College of Anaesthetists of the 3rd National Audit Project (NAP 3) on major complications of central neuraxial block and the National Paediatric Epidural Audit has helped define their incidence. These guidelines are based on a review of the literature, consensus from pain specialists and anaesthetists and guidelines from Great Ormond Street Hospital and the Pain Society.

The guidelines should be considered within the context of the Acute Pain Service terms of reference.

Broad recommendations

For any technical or pain related problems, please contact the Acute Pain Service (APS) on bleep 0571 during 0900-1700 weekdays and 0900-1300 on saturdays, or duty anaesthetist (bleep 0900) at other times.

1.1 Background

Epidural (or extradural) analgesia may be defined as the continuous infusion of a solution of local anaesthetic and/or opioid into the epidural space to provide pain relief.

The epidural space is situated between the dura mater (the outer layer of the meninges) and the vertebral canal. It extends from the cranium to the sacrum and contains loose connective tissue, fat, lymph vessels, blood vessels and nerves.

Analgesics administered into the epidural space, exert an effect on the nerve roots as they emerge from the spinal cord and diffuse across the dura and the subarachnoid space binding to receptors located in the substantia gelatinosa in the dorsal horn of the spinal cord. They are also absorbed systemically from the epidural blood vessels and may be distributed throughout the subarachnoid space in the cerebrospinal fluid (CSF).

Epidurally administered analgesics are usually given as close as possible to the dermatomes involved in the surgical procedure/painful area in order to maximise their effect. A fine plastic epidural catheter is placed in the epidural space so that drugs can be continuously infused for the duration of treatment. The catheter is usually inserted while the child or young person is anaesthetised.

In babies under six months or weighing less than 5kg the epidural catheter is sometimes inserted via the sacral hiatus (caudal) and threaded up the epidural space until the appropriate level has been reached because this is technically easier than direct placement at higher levels in very small infants.

Local anaesthetics may be administered with or without an opioid or other suitable analgesics; these may be given either as a single dose (one shot) or as an infusion. Patients who receive an epidural or caudal infusion should have observations as detailed in this document.

1.2 Indications

Epidural infusions are indicated where pain or anticipated pain is:

- Of moderate to severe intensity
- Below the T4 dermatome
- To have an expected duration of more than 24 hours

The anaesthetist will consider the effectiveness of epidural analgesia for the type of surgery or pain and consider the benefits and risks of an epidural for each individual patient

1.3 Contraindications

Absolute contraindications to epidural analgesia are:

<u>Lack of consent</u>

Absence of parental consent or consent of a ‘competent’ patient.

<u>Allergy</u>

Known sensitivity to any drug that will be used in the epidural.

Lack of safe nursing environment for placement and subsequent care.

Nurses with specific training and skills in the supervision of epidural analgesia and management of its complications must be present on the ward and on every shift. Staffing levels and expertise should be sufficient to enable adequate monitoring and care to be given to all patients receiving epidural analgesia.

Inexperienced operator

Insufficient experience in paediatric epidural placement by the anaesthetist.

Raised intra-cranial pressure

Because of the risk of accidental dural puncture leading to brainstem herniation, raised intracranial pressure is a contraindication to attempted epidural placement. Consequently, epidural analgesia should be avoided in any patient with a recent

history of a closed head injury in which raised intracranial pressure is suspected.

Coagulopathy

A patient's coagulation status must be considered before insertion or removal of an epidural catheter. These guidelines and timings should also be observed if any adjustments to catheter length or depth are planned. Anti-coagulation should be managed according to Trust Guidelines on http://intranet/ClickforClots/index.htm and see Regional Anaesthesia Patients Venous Thromboprophylaxis with Anticoagulant and Antiplatelet Drugs Document Trustdocs ID 1193, which should be consulted if there is any doubt. Below is a quick reference guide to aid management.

- Patient on prophylactic Low Molecular Weight Heparin (LMWH) e.g. Dalteparin/Enoxaparin/Tinzaparin. Wait 12 hours after dose of LMWH before siting an epidural. After insertion, a period of 4 hours must elapse before subsequent administration of a LMWH dose.
  - Whenever possible, all prophylactic LMWH should be administered at 18.00 hours, which would enable safe epidural siting and removal to occur between 06.00 and 14.00. Epidurals sited later than 14.00 will necessitate changes in the timing of subsequent LMWH.
- Patients on subcutaneous Unfractionated Heparin (UFH) 8-12 hourly. The last dose of UFH should be at least 4 hours prior to insertion/removal of epidural catheter. Subsequent administration of UFH should not occur within 1 hour of epidural siting.
- Patients on intravenous heparin. Stop heparin for 6 hours and ensure aPTTr <1.5 prior to insertion/removal of epidural catheter
- Patients on warfarin. Stop 4 days prior to insertion and convert to intravenous heparin or LMWH. Ensure INR is <1.5 prior to insertion/removal of epidural catheter.
- Patients on anti-platelet drugs. Aspirin, NSAIDs and dipyridamole when used alone represent no added risk. Clopidrogel and other thienopyridine derivatives should be stopped for 7 days prior to insertion and must ***not be*** restarted until the epidural catheter has been removed. If these are given in error before the catheter is removed, please seek advice from the on call haematologist.

Regardless of compliance to the above criteria, epidural catheter insertion or removal should not be undertaken in the presence of abnormal coagulation. Ideally the following criteria should be met:

- Platelet Count >80 x 10^9/L
- INR<1.5
- aPTTr <1.5

Relative contraindications to epidural analgesia include:

Infection

Skin infection close to the site of puncture is a contraindication to epidural placement because of the risk of iatrogenic meningitis and epidural abscess formation. The use of epidural analgesia should also be considered carefully in patients at an increased risk of infection due to location of the catheter insertion site, which in children can be within the nappy area, or in situations of reduced immunity such as leukaemia or HIV.

Systemic sepsis (including MRSA)

Due consideration should be given to the monitoring and management of haemodynamic instability subsequent to the sepsis and any additional sympathetic blockade resulting from epidurally infused local anaesthetics. Children under 8 years of age are unlikely to experience significant hypotension through the administration of epidural local anaesthetic.

Untreated hypovolaemia:

The effects of hypovolaemia are likely to be exacerbated by the infusion of epidural local anaesthetic, so hypovolaemia that is untreated is a contraindication to epidural analgesia.

Closed plaster with lower limb fracture

There is a risk of masking a potential compartment syndrome. If compartment syndrome is a risk, consideration should be given to the use of regular compartment pressure monitoring and breakthrough pain in a patient with a previously well-working epidural should be carefully assessed.

The anaesthetist may also choose to avoid the use of an epidural in the case of some diseases of the central nervous system to minimise the risk of exacerbating the condition and in the case of spinal deformity where threading of the catheter may be a problem.

1.4 Initiation of epidural

Patient selection for epidural analgesia should be based on careful risk/benefit analysis for each patient.

Consent process:

Continuous epidural analgesia is a significant procedure with specific and potentially serious complications; therefore, informed consent (from a parent or competent child) should always be obtained before siting an epidural.

An anaesthetist will discuss the epidural with the patient and family prior to theatre and obtain verbal consent for the procedure. This conversation should be documented on the anaesthetic chart unless an epidural is the sole procedure in which case a consent form

should be signed by the patient or the parent/carer

Patients or the parents/carers should be informed of the advantages and disadvantages of the procedure, with reference to alternative forms of analgesic provision. Undesirable but normal effects of e1.3 epidural usage should also be discussed, for example, 'heavy' legs, itching, paraesthesia and the requirement for bladder catheterisation.

Possible complications of placement are failure, post-dural puncture headache, infection, epidural haematoma and neuropraxia. The Anaesthetic National Audit Project 3 looking at epidural analgesia and the national paediatric epidural audit both show that serious complications arising from perioperative paediatric epidurals are rare.

Information leaflets are available and should be given to the patient or parent/care in advance of epidural placement. See Epidural pain relief after surgery ttps://www.rcoa.ac.uk/sites/default/files/documents/2022-06/05-EpiduralPainRelief2020web.pdf

The patient and family should be prepared for the epidural. The nursing staff and/or play specialist should explain the epidural at pre-admission clinic whenever possible. If the family have any questions that staff feel unable to answer, they should contact the APS on bleep 0571.

Placement

An epidural must only be sited by an anaesthetist who has experience of the technique in the paediatric age group or by a senior trainee under direct supervision of the aforementioned anaesthetist.

- Baseline data

  Prior to transfer to theatre nursing staff should record the minimum following observations: heart rate, blood pressure, respiratory rate, temperature and oxygen saturations. A baseline pain assessment should also be carried out, using a validated pain assessment tool suitable for the child's age and level of cognitive development.

  Any abnormal sensation or limb weakness should be reported to the anaesthetist and documented in the patient's medical notes.

  Location

  Epidurals should be sited in an appropriate clinical environment, which must include trained assistance and immediate access to advanced resuscitation equipment. Anaesthetic rooms represent the ideal location.

  - Intravenous access

Suitable intravenous access should be established and checked as patent before attempting epidural placement. **Intravenous access must be present and patent for as long as the epidural is in situ.**

- Use of sedation

  Epidural insertion in the paediatric population should be conducted in an anaesthetised patient in all but very cooperative older children.

- Monitoring

  Continuous ECG, pulse oximetry and regular blood pressure monitoring should be in use during epidural placement. As the patient is most likely to be anaesthetised, capnography and anaesthetic gases and ventilation monitoring will also be required.

- Sterile technique

  Maximal barrier precautions must be observed during insertion as mandated in guidelines published by the Association of Anaesthetists of Great Britain and Ireland (AAGBI). The 2008 document “Infection Control in Anaesthesia” states “maximal barrier precautions involve full hand washing, the wearing of sterile gloves and gown, a cap, mask and the use of a large sterile drape”. These precautions are repeated in the 2004 AAGBI document “Good practice in the management of continuous epidural analgesia in the hospital setting” and in the 2009 NAP3 publication and should be considered mandatory.

  The following precautions whilst not mandatory should be considered. Personnel in the anaesthetic room should be kept to a minimum during insertion. Masks should be worn by all personnel in the anaesthetic room during epidural insertion. Masks become ineffective after 15 minutes and so should be changed each time a new central neuraxial block is performed. The anaesthetic room doors should be locked, if possible, to prevent intrusions and disturbances during this time.

  The skin entry site should be cleaned with a 0.5% Chlorhexidine gluconate in 70% denatured ethanol B solution (or alcoholic povidone-iodine solution if allergic to chlorhexidine). Two applications should be applied, and it should be allowed to dry between applications and before proceeding with epidural insertion. It may be applied by spraying or by painting using the swab sticks provided in the packs.

  With whichever method is used, sufficient care must be taken to ensure that the antiseptic solution does not contaminate the contents of the epidural pack. Contamination of epidural equipment or proceeding before the solution has dried have both been cited as possible causes of adhesive arachnoiditis. The solution should not be allowed to pool under the patient as this may cause a chemical burn. Chloraprep (2% chlorhexidine gluconate in 70% ethanol) is not licensed for central neuraxial blocks and should not be used.

- Siting considerations

  An epidural must only be sited by an anaesthetist who has experience of the technique in the paediatric age group or by a senior trainee under direct supervision of the aforementioned anaesthetist.

  The epidural should be sited at a level appropriate to the dermatomes involved in

the intended surgery. In babies under six months or weighing less than 5kg the epidural catheter is sometimes inserted via the sacral hiatus (caudal) and threaded up the epidural space until the appropriate level has been reached because this is technically easier than direct placement at higher levels in very small infants.

- Equipment

  The appropriate equipment should be gathered prior to insertion. This includes:

  - Appropriate alcohol-based skin preparation solution (e.g., 0.5% Chlorhexidine)
  - Sterile gown and gloves
  - 0.9% sodium chloride for injection
  - Sterile, occlusive, hypoallergenic, transparent dressing e.g., Opsite™
  - Adhesive dressing, e.g., Mefix™
  - An epidural pack (containing a sterile field, swab sticks, a galley pot/tray, a filter needle, a selection syringes and hypodermic needles, a microfilter, a catheter connector, a loss of resistance (LOR) syringe, a yellow epidural label and an epidural (Touhy) needle and corresponding catheter). There is a choice of 4 epidural packs available, containing different size epidural needles and catheters.

- 16G, 8cm needle and 20G multiport side hole catheter
- 18G, 8cm needle and 20G multiport side hole catheter
- 20G, 5cm needle and 24G multiport side hole catheter

  The appropriate pack should be chosen according to the size of the patient. The 19G needle and catheter should only be used in neonates and young infants. The single end orifice catheter has a higher incidence of blockage. **The 20G, 5cm needle will be used for the majority of paediatric patients.**

- Insertion technique

  - Full aseptic precautions (as outlined above) should be used throughout.
  - Position the patient curled on their side
  - Locate the appropriate space and clean and drape the area (as outlined above)
  - The epidural space should be identified by using the loss of resistance to normal saline technique with a continuous pressure on the syringe.
  - The approximate distance between the skin and the epidural space is:
    - 0.5cm in neonates
    - 0.75cm in infants and
    - 1-2cm by 5-7 years of age.

- Using a weight-based calculation; the epidural space generally lies at a distance of

approximately 1mm/kg from the skin between the ages 6 months and 10 years.

- Multiple attempts at siting an epidural is not recommended and if difficulties in placement persist alternative analgesic strategies should be used.
- The catheter is threaded to the appropriate dermatomal level, leaving at least 3cm in the epidural space.
- The (yellow plastic) epidural catheter connector should be attached.
    - The catheter should be held below the level of the patient and also aspirated to check the tip is not intravenous of intrathecal. The catheter should be flushed with 0.9% sodium chloride and may be briefly held above the level of the patient to check the meniscus drops, confirming the tip is in a low resistance space.
    - The epidural microfilter should then be attached along with a yellow epidural label

- Catheter attachment

  Once in situ, the catheter should be secured with a clear adhesive dressing e.g., Opsite™ over the entry site (to allow daily inspection of the insertion site) and tape e.g. Mefix™ covering the rest of the catheter up to the patients shoulder.

  The dressings should be applied by the anaesthetist whilst still scrubbed to maintain sterility. A bacterial filter must be used at all times.

1.5 Prescription

The prescription will be provided by the anaesthetist responsible for the initiation of the epidural and will be prescribed on the inpatient prescription chart.

Information on the prescription chart should include:

- Interspace (spinal level insertion site)
- Depth of loss of resistance (cm)
- Catheter marking at skin (cm)
- Drug choice
- Details of desired rate range (minimum and maximum rates in mL/hour)
- Starting rate (mL/hour)

Drugs

All drugs given via the epidural route must be preservative-free to prevent neurological complications

Drug	Action
Levobupivacaine Available in strengths of: ○ 0.125% for continuous infusion ○ 0.25% for initial dose only ○ 0.5% & 0.75% is available,**but is not usually given via the epidural route in children or young people.**	A local anaesthetic with a half-life of between 1.5 and 5.5 hours Works by blocking the sodium channels on the nerve axon It must NOT be given intravenously
Fentanyl Available pre-mixed with levobupivacaine in epidural infusion bags in concentrations of ○ 2 micrograms/mL - standard ○ 4 micrograms/mL – occasional use **Avoid in neonates, infants <5kg and patients with an increased risk of respiratory complications**	A more lipophilic opioid than morphine, which binds to opioid receptors in the CNS and acts synergistically with levobupivacaine to inhibit pain signal transmission. It offers a number of advantages over morphine for epidural analgesia, including a lower incidence of side effects and reduced risk of delayed onset respiratory depression. Prolonged epidural infusions of fentanyl may result in high systemic concentrations not dissimilar to an intravenous infusion.
Naloxone Available in ampoules of 20mcg/mL or 400mcg/mL Should be prescribed for all patients receiving epidural opioids to allow swift treatment of opioid-induced respiratory depression	Reverses the (desirable and undesirable) effects of fentanyl Can provide instant reversal of opioid-induced respiratory depression/arrest when given intravenously. Also suitable for intramuscular use Has a half-life of 30 minutes and consequently doses may need repeating

Intra-operatively a dose of 0.5 – 0.75 mL/kg of 0.25% levobupivacaine is suitable for surgical analgesia. 0.125% levobupivacaine is suitable for postoperative analgesia. All epidural drug administration must be recorded on the anaesthetic record or the inpatient prescription chart.

The standard epidural solution used for infusion is: 0.1% levobupivacaine with 2 micrograms/mL of fentanyl. This may be varied at the discretion of the supervising anaesthetist to 0.1% levobupivacaine with 4 micrograms/mL fentanyl or plain 0.125%

levobupivacaine.

Drugs must NOT be added to the pre-prepared epidural infusion bags by any staff.

In neonates, infants under 5kg, and patients with a sensitivity to fentanyl or an increased risk of respiratory complications, a plain 0.125% levobupivacaine infusion should be used.

Infusion rates

The epidural solution is infused at between:

- 0.1 – 0.3 mL/kg/hour for infants <5kg (unto 0.4mL/kg/hour with 0.1% levobupivacaine)
- 0.1 – 0.4 mL/kg/hour for all other patients (up to 0.5mL/kg/hour with 0.1% levobupivacaine) maximum of 15mL/hour

The maximum volume that may be administered in a four hourly period is:

- 1.2 - 1.6 mL/kg (with 0.1% / 0.125% respectively) for neonates and infants <5kg
- 1.6 - 2 mL/kg (with 0.1% / 0.125% respectively) for all other patients to a max of 60mL.

It is recommended that infusions of epidural levobupivacaine are reduced to the minimum level that ensures the patient is comfortable, to minimise the risk of local anaesthetic toxicity. The risk of toxicity is higher in the neonatal population and infants under 5kg; therefore, the maximum infusion rate is lower in this group.

Concurrent Prescriptions

If the epidural solution includes an opiate, no other form of opiate analgesia should be administered for the duration of use of the epidural.

All patients receiving opioids should have naloxone and anti-emetics prescribed, to allow the swift treatment of side effects.

Multimodal analgesia offers optimal analgesia whilst minimising side effects. Unless contraindicated, all patients receiving epidural analgesia should have concurrent prescriptions for paracetamol and an NSAID such as ibuprofen or diclofenac. Please see Paediatric BNFc for appropriate age ranges and dosages.

1.6 Equipment

An epidural infusion pump with dedicated epidural giving sets will be available from Recovery or the Equipment Library. A bacterial filter must be used at all times. The giving set and filter need not be replaced unless instructed by the APS or supervising anaesthetist.

The dedicated epidural pump and corresponding yellow giving set is the only

infusion device to be attached to the epidural catheter.

1.7 Setting up

Initial programming of pumps may only be undertaken by an anaesthetist, appropriately trained recovery staff or members of the APS. Staff must be familiar with the equipment used and epidural care.

Epidural bags will be stored according to the Trust's Controlled Drug Procedure in a dedicated locked cupboard in Main Theatre Recovery. Trained staff will oversee the programming and priming of the epidural pump according to the prescription.

The documentation and checking procedure should be performed according to the Norfolk and Norwich University Trust's Policy for the (October 2003).

For recommended epidural infusion rates see section 1.5 Prescription – Infusion rates above.

All practitioners commencing an epidural infusion should ensure the patient has patent **intravenous access**.

All patients with an epidural infusion must have an epidural observation chart and epidural catheter risk assessment tool completed. Epidural / PVB / PCA Observations Chart Trustdocs Id: 18247

All patients receiving opioids should have naloxone and anti-emetics prescribed, along with a concurrent prescription for paracetamol and NSAIDs (unless contra-indicated).

1.8 Designated Clinical Areas and Standards of Monitoring

All children receiving epidural analgesia should be nursed on Buxton HDU ward, the Neonatal Intensive Care Unit or the Critical Care Complex.

All patients receiving epidural infusions must be supervised by a registered nurse, doctor or ODP who has undergone specific training in the care of a child or young person receiving an epidural.

At least 70% of the registered nurses in areas caring for patients receiving epidural analgesia should have attended an epidural study day within the last 3 years and be able to demonstrate regular experience in nursing these patients.

General Monitoring Considerations

Most children and young people receiving epidural medication will have undergone surgery and will require appropriate, regular, nursing observations as part of their post operative care; however, the presence of an epidural will require specific observation to

assess efficacy and to ensure any complications are detected and treated expediently.

This will include assessment and recording of:

- Pain score (as an indication of efficacy)
- Level of sedation
- Respiratory function (rr and spo2)
- Blood pressure & pulse
- Urinary output
- Temperature

These should be monitored and recorded hourly for the first eight hours after initiation of an epidural, two hourly for the next 48 hours and four hourly until discontinuation of the epidural.

Pulse oximetry should be used continuously in the following 'high risk' patients:

- Sedation score >3,
- Infant < 6 months,
- Significant cardiorespiratory impairment,
- History of sleep apnoea,
- Receiving concurrent sedative drugs
- Receiving supplemental oxygen
- Pulse oximetry records <94% on routine monitoring.

Epidural specific observations include (frequency as outlined):

- Nausea (4 hourly, increased to 1-2 hourly if troublesome)
- Pruritus (4 hourly, increased to 1-2 hourly if troublesome)
- Sensory block (dermatome assessment) (6 hourly, plus see notes below)
- Motor block (bromage score) (2 hourly, plus see notes below)
- Epidural site inspection (4 hourly and when turning the patient)
- Epidural pump infusion rate (at least 2 hourly)
- Indications of local anaesthetic toxicity

Care in the Immediate Post-operative Period

Before leaving theatre **and at any subsequent handover,** it should be checked that:

- The drug being administered corresponds with what has been prescribed

- Any epidural related complications experienced have been resolved
- The patient's pain is being managed effectively.
- The patient is not excessively sedated.
- The level of sensory nerve block is not above T4.
- The Bromage score is <3 (lumbar epidural) or absence of upper limb motor block (thoracic epidural).
- The epidural section of the prescription chart has been completed correctly. This provides details of the epidural solution, insertion position of the epidural, minimum and maximum infusion rate and the current infusion rate.
- NALOXONE has been prescribed correctly, if the epidural solution contains fentanyl.

Incidence of side effects and complications

In adults, frequent complications include hypotension, respiratory depression (opioid use), motor block, urinary retention, inadequate analgesia and pruritus (opioid use).

Infrequent but well recognised complications include cardiovascular collapse; respiratory arrest; unexpected development of high block, e.g. catheter migration, intrathecal injection; local anaesthetic toxicity; post dural puncture headache syndrome (including sub-dural haematoma); drug administration errors (especially wrong route); pressure sores; superficial infection around catheter; epidural haematoma or abscess; meningitis; spinal cord ischaemia; permanent harm, e.g., paraplegia, nerve injury (RCOA 2010).

National audit of safety of epidural use in children and young people suggests an incidence of long-term injury of 1 in 10,000 patients (Llwellyn & Moriarity 2007).

The patient will be reviewed at least once a day by the nurses on the APS (weekdays and Saturdays)

Incidence of side effects and complications

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Prevention, detection and treatment of side effects, complications or technical problems
(Adapted from Great Ormond Street Hospital guidelines)

Respiratory Depression

The administration of opioids may cause respiratory suppression.

The patient's respiratory rate should be monitored and recorded hourly to two hourly while the epidural infusion is in progress and for eight hours after it has been discontinued. The frequency should be increased if the patient is excessively sedated or their condition deteriorates.

Respiratory depression has been defined in these guidelines as:

<5 years – RR<18 breaths/minute
>5 years – RR<10 breaths/minute

This rate is for guidance only and health professionals should also take into account depth of respiration, respiratory effort, level of sedation, oxygen saturation.

Manage as outlined in quick reference guide on page 4

Sedation Level

The administration of fentanyl can cause undue sedation, which may precede respiratory suppression.

Sedation levels and appropriate actions are:
0 – alert
1 – mild, easy to rouse
2 – easy to rouse, often drowsy – REASSESS HOURLY, MONITOR SPO2 CONTINOUSLY
3 – somnolent, difficult to rouse - STOP INFUSION, ASSESS RESPIRATORY FUNCTION,
CONTINOUS SPO2, MANAGE AS OUTLINED IN QUICK GUIDE page 6

Hypotension

Local anaesthetic affects the nerves supplying blood vessels, so blood pressure drops slightly when an epidural is used. Children under 8 years of age are unlikely to experience significant hypotension through the administration of epidural anaesthesia. Significant hypotension in this guideline is defined as:

0-2 years - <65mmHg SBP
3-8 years - <75mmHg SBP
>8 years - <85mmHg SBP

Manage as outlined in quick reference guide on page 6

Regular blood pressure monitoring is essential as peripheral vasodilatation may mask the visual signs of hypovolaemia. For this reason, all children and young people with an epidural infusion must have intravenous access maintained and intravenous fluids prescribed.
Fluids should be administered to treat hypotension as directed on intravenous fluid infusion prescriptions.

Children and young people do not need to lie flat during the epidural infusion. They should be advised to sit or stand up slowly while the epidural is in progress as postural autoregulation of blood pressure may be slightly delayed. It must be explained to the family that children and young people should not attempt to stand or walk unaccompanied during the epidural infusion.

Motor Block

The patient's motor nerve block should be assessed and documented on the lower limbs for a lumbar epidural and also in the upper limbs for a thoracic epidural. This should be undertaken every hour for the first 8 hours, 2 hourly for the next 48 hours and 4 hourly thereafter until 8hours after discontinuation of the epidural. If a bolus is given or the rate is increased motor block should be assessed within the hour. Motor block should also be assessed immediately before patients mobilise or if the patient complains of pain or paraesthesia.

It is important to assess motor block

- To assess the risk of pressure ulcers
- To ensure the patient is safe to ambulate
- To detect for the early signs of complications such as a high block, epidural abscess or haematoma.

Cord compression as a result of an epidural haematoma or abscess is a neurosurgical emergency that will need urgent drainage. An unduly high motor block is indicated by loss of power, voluntary movement or sensation.

To assess motor nerve block in the lower limbs you should

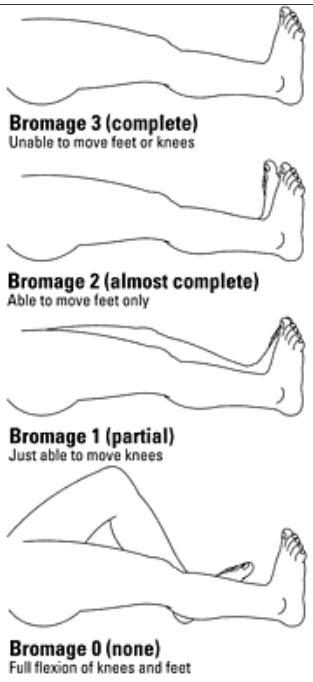
- Explain the procedure to the child

- Ask them to move their feet and bend their knees

- Compare the movement observed and rate it using the Bromage score (see figure below)

- Assess for any paraesthesia (loss of sensation/numbness/tingling)

Bromage Score (Bromage 1987)

	3	STOP INFUSION & CALL PAIN TEAM
	2	CALL PAIN TEAM
	1	OBSERVE HOURLY
	0	NO INTERVENTION REQUIRED Patient may mobilise with supervision

The degree of motor nerve block is indicated by loss of movement. Observe for motor nerve block on both legs and document the degree of motor nerve block in the patients' medical notes.

If the Bromage score is 2 or more stop the infusion and contact the APS or duty anaesthetist urgently. See flow chart 1 on page 11

To assess motor nerve block in the upper limbs:

- Explain procedure to the child or young person.
- Ask the patient to grip your hand, then to raise their arms.
- Assess for any paraesthesia (loss of sensation/numbness in the hands or arms).
- **A high motor block is indicated by loss of power, movement or sensation.**
- Observe for motor nerve block on both arms.
- Document the degree of motor nerve block in clinical records
- If there are any signs of paraesthesia (sensation of tingling, pricking, or numbness) or loss of motor function, stop the infusion and contact the pain team.

Reduction in motor function and sensation predisposes patients to problems with pressure area perfusion. The patient may be encouraged to mobilise if their condition allows. Bromage score should be 0 before mobilisation is attempted. Patients should be accompanied at all times while mobilising. Older children and young people should be warned that initially they may experience some dizziness when mobilising. If on bed rest or reluctant to mobilise, regular pressure area care should be given and the patient repositioned regularly

Sensory Block

Local anaesthetics work by blocking nerve impulses on sensory, motor and autonomic nerve fibres. The smallest diameter fibres are most sensitive to the effects of local anaesthetics which means autonomic fibres will be blocked first then sensory fibres and lastly motor fibres.

Pain and temperature nerve fibres are similarly affected by local anaesthetic drugs, so changes in temperature perception indicate the area where the epidural is working. The area of sensory block should be assessed using cold sensation (e.g., ice) to establish which dermatome levels are covered. Both left and right sides need to be assessed.

It is important to assess sensory block to ensure the epidural is covering the patient's pain and to ensure the block is not too extensive, which may increase the risk of complications.

To assess sensory block you should:

- Explain procedure and purpose to the patient making sure they know that you wish to ascertain what they really feel rather than what they think they should feel.

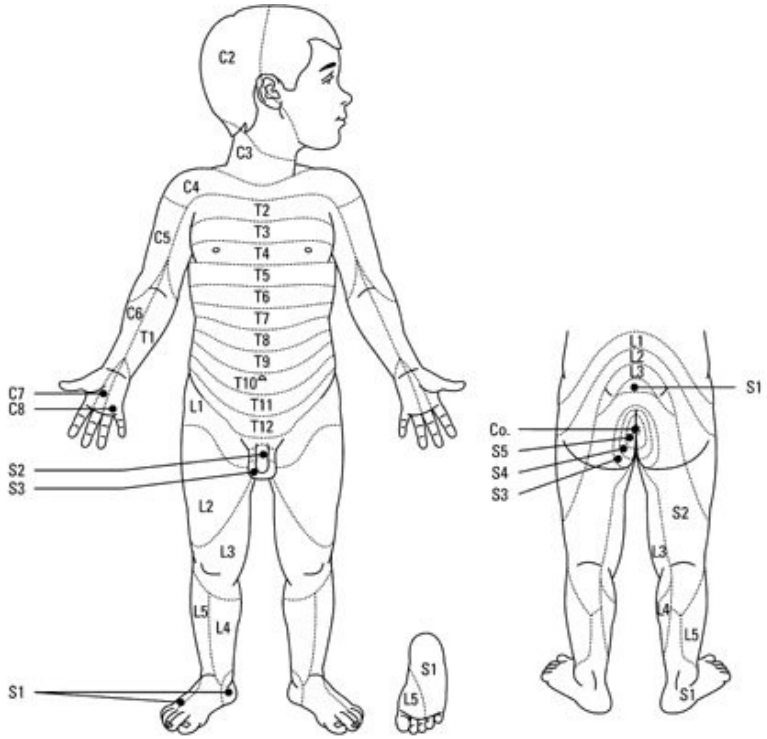
- Wrap an ice cube in tissue/paper towel or latex-free glove.

- Place ice on an area well away from the possible dermatome cover (e.g., face or forearm) and ask the child or young person to tell you how cold it feels to them.

- Apply the ice to an area likely to be blocked on one side of the body and ask the patient "Does this feel the same cold as your face/arm or different?" Blockade is indicated by altered sensation.

- Apply the ice to areas above and below this point until it's clear at which level the top and the bottom of the block is. Repeat the procedure on the opposite side of the body

- Document the blocked dermatomes on the observation chart. Record both the upper and lower limits of the block e.g. T7-L1 L=R or R:T7-L1 L:T10-L2



If the block is higher than T4 stop the infusion and contact the APS on bleep 0571. The APS should also be contacted if there is no evidence of a block or if the patient is in pain despite the appearance of an adequate sensory block. See page 6.

Assessment in infants or non-verbal patients may be more challenging but it may be possible by carefully observing flinching and facial expression in response to ice on presumed blocked and unblocked dermatomes. Assessment of the effectiveness of the regional blockade can also be achieved by observing the patient's response to movement and gentle palpation of the operative site.

If full assessment is not possible, particular attention should be paid to the child or young person’s blood pressure, and pain scores.

Suspected Infection

Infection of the epidural space is extremely rare with an estimated occurrence in 1 in 100,000 patients; however localised infection at the skin site is more common.

Risk factors for epidural abscess include:

- Impaired immunity (diabetes, malignancy and immune-suppressive therapy)
- Patients who have been in hospital for >48 hours prior to insertion
- Technical difficulty requiring multiple attempts at insertion
- Prolonged catheterisation (>48 hours)

Signs and symptoms of epidural abscess include back pain, increasing lower limb weakness or numbness and pyrexia. Signs of infection may also be present at the epidural site. If epidural infection is suspected follow the guidance on page 7.

The epidural catheter entry site should be observed when turning the patient and at least four-hourly. Contact the Acute Pain Service if:

- The entry site becomes red or swollen.
- The child or young person complains of tenderness at the site of insertion.
- The catheter has become displaced.
- The dressing has fallen off.
- The patient has a pyrexia of unknown origin.

These observations must be recorded in the child or young person's health care records along with any actions taken

Local Anaesthetic Toxicity

Local anaesthetic toxicity is rare. It is most likely to occur in the following situations:

- If the drug is accidentally administered intravenously
- In neonates and babies if high rates are infused for long periods
- In patients with renal failure

Toxicity may be indicated by:

- confusion, increased anxiety, irritability, loss of consciousness
- tingling mouth and lips.
- excessive sedation
- hypotension, cardiovascular collapse including bradycardia, arrhythmias, asystole

If the patient is experiencing any of these symptoms:

- Stop the epidural infusion.

- Initiate Basic Life Support if required and contact clinical emergency team on ext. 2222.
- Contact the APS on bleep 0577 and the anaesthetist (bleep 0900 out of hours)

The Association of Anaesthetists of Great Britain & Ireland (2010) provides guidance for managing severe local anaesthetic toxicity.

Cardiac arrest associated with LA injection may be refractory to conventional treatment and require treatment with lipid emulsion. Intralipid® 20% is kept in main theatre recovery arrest trolley.

Ensuring Effective Analgesia

Supplementary analgesia, e.g., paracetamol and either diclofenac or ibuprofen where appropriate, should be given regularly if the oral or intravenous or rectal route is available. Opioid drugs may be prescribed in addition, if the epidural solution contains no fentanyl and is plain local anaesthetic (e.g., 0.125% levobupivacaine only)

Determine the effectiveness of the analgesia by:

- Recording pain scores 1-2 hourly using a validated pain assessment tool suitable for the child or young persons' age and cognitive ability. Document score on the patients' assessment chart.
- Identify the type and location of pain whenever possible.
- Reassess level of pain at an appropriate interval after any interventions.

If patient is in pain:

- Administer prescribed simple analgesics, e.g., paracetamol and either diclofenac or ibuprofen as appropriate
- Review the level of epidural sensory block by using ice to assess the level of sensory block (see above) to ascertain if the epidural is effective in the appropriate area.
- It may help to reposition the patient.
- Administer prescribed co-analgesics as appropriate, e.g., anti-spasmodic drugs.
- Involve family and play specialist if the pain could be anxiety related.
- If pain score is 2 or above, for more than an hour, contact the APS on bleep 0571(or out of hours the on-call anaesthetist on bleep 0900), who may adjust rate and/or administer bolus medication.
- Consider seeking surgical review if there is potential that a surgical complication may be exacerbating pain experienced.

- **See flow chart 2 on page 12**

Nausea and Vomiting

The patient should be assessed for nausea and/or vomiting at least four hourly and one- to two-hourly if they feel nauseated or has vomited. All children and young people receiving opioid drugs should have anti-emetics prescribed.

If the patient complains of nausea or has been vomiting:

- Administer an anti-emetic as prescribed.
- Aspirate nasogastric or gastrostomy tube if appropriate.
- Consider the use of an alternative anti-emetic if nausea/vomiting is not reduced.
- Consider a reduction on the rate of epidural infusion (if it contains fentanyl and if pain control is acceptable).

Pruritus (Itching)

Administration of opioids, particularly by the epidural root may predispose to pruritus. The patient should be assessed for pruritus (itching) at least four hourly and one- to two-hourly if itching is troublesome.

Pruritus should be treated by administering intravenous naloxone (0.5mcg/Kg). A maximum of four doses may be administered at 10-minute intervals. This may be repeated after one hour.

If naloxone is not effective, an antihistamine, e.g., chlorphenamine, may be prescribed, however antihistamines have sedative properties and may exacerbate sedation caused by epidural opioids. The patient's sedation status should be assessed prior to administering.

If pruritus continues despite the above actions, contact the APS (or duty anaesthetist out of hours) who may reduce the epidural rate or remove the opiate.

Urinary Retention

All patients with an epidural should have a urinary catheter in situ. The epidural affects the nerves that supply the bladder, so a urinary catheter (tube) will usually be inserted in theatre at the time of epidural insertion. The catheter will normally be left in until after removal of the epidural. Bladder function returns to normal after the epidural wears off.

Nursing care of the patients includes:

- Record the patient's urine output and fluid intake
- If the patient (without a urinary catheter) has not passed urine twelve hours after surgery or has a palpable bladder or bladder discomfort, an ultrasound assessment of the bladder may be helpful in diagnosing urine retention.

Trust Guideline for the Management of Children Receiving Epidural Analgesia

If opioid induced retention is suspected, the following is indicated:

- Administer intravenous naloxone as prescribed (0.5mcg/kg). Four doses may be given at 10-minute intervals.
- Repeat the four doses of naloxone if the patient has not passed urine after one hour.
- Contact the APS to reduce the epidural infusion rate if the patient is pain free.
- If no diuresis occurs after the repeated doses of naloxone and the patient has a full bladder, the patient needs to be catheterised (record residual volume drained)

If the patient has a urinary catheter this should NOT be removed until the epidural has been discontinued

Filter disconnection

The epidural catheter should be removed, and alternative analgesia prescribed if the disconnection was not witnessed or thought to have occurred more than hour before or if the catheter has been contaminated. This should be recorded in the patient's notes.

Reconnection may be performed by an anaesthetist or a member of the APS, in exceptional circumstances (for example if alternative analgesia is inappropriate). See page 9.

- This must be done under aseptic conditions.
- The catheter should be cleaned with an alcoholic chlorhexidine impregnated swab (e.g., Clinell®) and allowed to dry fully, before cutting the end off and reconnecting.

Leaking Epidural

Leaking of the epidural solution at the entry site is common, particularly in younger children.
If leaking occurs:

- observe the entry site more frequently - one- to two-hourly if possible.
- if in pain call the APS or duty anaesthetist.

If the dressing starts to peel off:

- place a new sterile transparent dressing over the top.
- do not remove the dressing
- contact the pain control service for assistance.

If the dressing falls off:

- put a new sterile transparent occlusive hypoallergenic dressing on immediately
- contact the Acute Pain Service (bleep 0571). The APS practitioner will review the position of the catheter and compare the external markings on the catheter with the known initial positioning. The practitioner may: redress the site or remove the epidural and arrange alternative analgesia.

Inadvertent epidural catheter removal

If the epidural catheter is pulled out inadvertently:

- Reassure the patient and family
- Put a spot plaster over the entry site.
- Ensure the whole catheter has been removed (check blue tip). If in doubt, keep the catheter for the APS to review.
- Stop the infusion pump.
- Contact the APS on bleep 0571 to instigate an appropriate pain management plan
- Record the incident in the child or young person's health care records

Pump occlusion

If the pump occludes:

- Stop the infusion.
- Check that the catheter is not kinked or trapped.
- It may help to reposition the patient.
- Ensure that the correct administration set is being used.
- Check the administration set is not clamped.
- Check whether the pump is faulty - if so it will need to be replaced and returned to biomedical engineering with a label describing the fault
- Restart the infusion.
- If the pump continues to occlude contact the APS on bleep 0571 or duty anaesthetist (bleep 0900).

The following interventions must only be attempted by the APS or anaesthetist.

- Check the filter to ensure the connection is not too tight.
- Open the Perifix® catheter connector NRFit®:
    - Open connector and then examine the catheter for kinking or stretching.
    - Ensure the catheter is inserted as far as it can go into the connector as the clamping mechanism may obstruct catheters not fully inserted.
- Attempt to flush the catheter from the filter with 2mLs of 0.9% sodium chloride for injection in a 10mL syringe.
- Observe the epidural catheter entry site and re-dress if necessary
- If the catheter is kinked under the skin, it may be possible for the APS to correct this

by pulling back the catheter a few millimetres, provided the catheter is known to be threaded at least 3cm in the epidural space.

- If these interventions are unsuccessful the epidural may need to be removed and alternative analgesia prescribed.

Staff must ensure that faulty pumps are reported and returned to biomedical engineering.

Long-term management of epidural complications

The following complications are rare, but should be investigated thoroughly:

- Patients with a persistent motor or sensory block should be referred to a neurologist. Nerve damage following epidural is rare (one in every 10,000 patients) but can result in permanent injury.
- In the presence of persistent neurological deficit beyond the time frame attributable to the local anaesthetic an early EMG study is indicated.
- Any child or young person with residual problems thought to be related to the presence of an epidural must be reported to the APS and anaesthetist that sited the epidural to ensure appropriate follow up is undertaken.

1.09 Changing Epidural Rate

Changes must only be made by an epidural trained practitioner, an anaesthetist or the APS. All changes to epidural rates must be documented on the epidural observation chart and in the patient's notes.

All changes should be agreed with a second checker and be within prescribed limits.

Decreasing infusion rates

A reduction in the epidural infusion may be considered if the patient is experiencing side effects, or if assessment of sensory block indicates that there is scope to make a reduction safely.
To change the rate:

- Check the prescribed running rate on the prescription chart
- Decrease rate by 0.1ml/kg/hour unless otherwise indicated (e.g., Side-effects)
- Document the change

Increasing infusion rates

An increase in the epidural rate may be considered if the patient is in pain.
Only increase the epidural rate if:

- The patient's pain score is 2 or more on NNUH pain scale (i.e., Moderate pain)
- The epidural block is below dermatome level T3
- Other analgesic measures have been ineffective
- Pain is related to the surgical procedure.

If the pain could be indicative of surgical complications or some other cause, contact the surgeons or the APS for advice.

To change the rate:

- Check the range prescribed on the prescription chart
- Increase the epidural rate by no more than 0.1mL/kg/hour
- Ensure any increase is within prescribed limits and does not exceed 15mls/hour
    - Document the change

1.10 Epidural Bolus Doses

If pain is severe, the APS or anaesthetist may administer additional doses of epidural solution, via the "clinician bolus" facility.

Only administer an additional epidural bolus dose if:

- The patient's pain score is 2 or more on NNUH pain scale
- Epidural block is less than dermatome level T4
- Other analgesic measures have been ineffective
- Pain is related to the surgical procedure

Any additional bolus dose must not exceed the maximum dose range of 2.5mg/kg (2mg/kg in neonate) in a four-hour period. When using a solution of 0.125% levobupivacaine (1.25mg/mL), this equates to maximum four-hourly allowance of:

- Neonates: 1.6mLs/kg of levobupivacaine 0.125% in any four-hour period
- All other patients: 2mLs/kg of levobupivacaine 0.125% in any four-hour period

Additional boluses should be based on a dose of 0.1mL/kg - not exceeding 5mLs.
To administer an additional bolus:

- Check the prescription chart
- Access bolus facility on the pump.
- Programs and initiate additional bolus dose

- Document additional bolus dose on prescription chart and the epidural obs chart
- Closely monitor patient and reassess pain score and sensory nerve block after 20 minutes

All changes should be agreed with a second checker and be within prescribed limits. Particular care must be taken in the early post-op period (i.e., initial four hours) to assess, and make allowance for, the dose of 0.25% levobupivacaine (2.5mg/mL) solution administered in theatre (this being twice as concentrated as the 0.125% infusion solution).

For example: if a 10kg patient, aged one year, received:

- 5mL 0.25% levobupivacaine in theatre at 2pm (containing the same quantity of levobupivacaine as 10mL of 0.125% solution) and
- 0.125% solution running at 3mL/hour for three hours, between 3pm and 6pm (9mL total)

He will have received the equivalent of 19mL of 0.125% levobupivacaine in the last 4 hours.
With a maximum four hourly limit of 2mL/kg (20mL) of 0.125% solution, he could receive one additional bolus of 0.1mL/kg (1mL) if required.

1.11 Bag Changing

Bag changing will only be undertaken by staff that have been trained and assessed as competent

1.12 Discontinuation and Removal

- The epidural infusion must normally only be discontinued after discussion with a member of the APS or anaesthetist, however the infusion may be stopped by the nurse (without Discussion) In The Following Situations:
- Motor Block (Bromage Score 2 Or More)
- Over Sedation
- Respiratory Depression Or Respiratory Arrest
- Pump Malfunction
- Concern About Potential Levobupivacaine Toxicity
- Displacement Of The Epidural Catheter
- Disconnection Of The Catheter From The Filter

- Pump Occlusions

In all of the above situations, the APS or duty anaesthetist should be contacted immediately to allow for patient review.

The epidural infusion may be continued for a maximum of 5 days (3 days in neonates) under the instructions and monitoring of the APS or the prescribing anaesthetist. However, the lowest incidence of epidural abscess is associated with catheters removed within 48 hours. Epidurals should therefore be used for the shortest appropriate period only. If simple analgesia and oral opioids are not sufficient or are contra indicated after the maximum duration, a PCA/NCA should be prescribed and provided.

Only epidural trained nurses, anaesthetists or members of the APS may remove epidural catheters.

Removal of epidural catheters in children with hip spica may be challenging. Lying the child on pillows and gently leaning them forward aid's safe removal. In case of difficulty please seek orthopaedic and anaesthetic assistance. Traction on catheter beyond insertion point risks the catheter snapping and a part of catheter being retained.

Special considerations apply if the child or young person has a coagulopathy or is receiving anticoagulation therapy. The epidural catheter risk assessment tool Trustdocs Id: 1191
must be completed before the catheter is removed. If any of the criteria regarding anticoagulation are met, then the catheter must not be removed, and advice must be sought from the APS or duty anaesthetist.

Suitable alternative analgesia must be prescribed and available before the epidural infusion is stopped. The epidural infusion should be stopped for 4 hours before the catheter is removed to ensure the patient is able to manage with alternative analgesia. If pain control proves difficult, it may be possible to restart the epidural infusion and continue it for longer, if the maximum duration is not exceeded, under the guidance of the APS or the paediatric anaesthetist.

If the patient is comfortable 4 hours after stopping the infusion and there are no contraindications, remove the epidural catheter as follows:

- Prepare the patient involving the play specialist and family as appropriate prior to the elective removal of the epidural catheter
- Put on plastic apron and perform a clinical hand wash.
- Position child or young person comfortably either on their side or sitting upright.
- Remove the dressing (using plaster remover if necessary)
- Put on gloves.
- Gently pull the catheter out.
- Check that the catheter is intact.

- Place a small plaster over the site.
- Dispose of used equipment according to the hospital's Waste Management, NNUH Trustdocs Id: 609

The epidural catheter tip should NOT routinely be sent for culture, however, if there is any indication of local infection around the epidural site (reddening, purulent discharge, induration or if there is suspicion of sepsis) the tip should be sent to Microbiology in a sterile pot for microscopy, culture and sensitivity and the APS and consultant paediatric anaesthetist informed promptly.

Epidural observations should be continued for 8 hours after the removal of the epidural catheter.

With the adoption of recommendations incorporated in the Regional Anaesthesia Patients Venous Thromboprophylaxis with Anticoagulant and Antiplatelet Drugs Document Trustdocs ID 1193, LMWH will be administered at 18.00 for most patients. In these patients, the ideal time for removal of the catheter will be 10.00 to 14.00 on the following day. No further dose of LMWH should be administered within 4 hours of epidural removal. No further dose of unfractionated heparin should be administered within 1 hour of epidural removal.

After the catheter is removed the patient should be given a copy of Epidural - Discharge Advice for Patients Trustdocs Id: 374. This details symptoms and signs of potential complications and gives instructions about who to contact if there are any concerns.

Clinical Audit Standards

The following standards should be monitored:

- Efficacy and management of inadequate analgesia
- Incidence and management of complications of epidural analgesia
- Completeness of epidural monitoring
- Adequacy of training for epidurals

Any patients with inadequate analgesia are referred via the online system or via bleep 0571 to the Acute Pain Service or duty anaesthetist via bleep 0900. Any patients with suspected complications should also be referred this way. Reason for referral and action taken needs to be filled in for each entry and all data from this can be analysed. Members of the Acute Pain Service review patients with epidurals every day except Sunday. A welfare form is filled in when patients are seen and includes data on adequacy of analgesia, observations, the condition of the epidural site and any complications. The data from these forms is collected on an electronic database, which can be analysed for the above standards.

The standard for nurse training is that 70% of staff in areas where epidurals are used should have completed the relevant training. The Acute Pain Service and the Training department undertake monitoring of this.

Summary of development and consultation process undertaken before registration and dissemination

The authors listed drafted these guidelines on behalf of the NNUH department of anaesthesia and pain management. The guidelines are derived from those adopted by other national groups and suggested by the Pain Society. During its development, it has been circulated for comment to anaesthetists, paediatricians, paediatric surgeons, ward staff, surgical and theatre nurses, Nursing Practice Department and Acute Pain Service Nurses.

This version has been endorsed by the Anaesthetic directorate, Paediatric Pain Group and the Clinical Guidelines Assessment Panel.

Distribution list / dissemination method

Theatre recovery
Paediatric wards
NICU
Anaesthetic Department
Trust intranet

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Source documents

Epidural /PVB / PCA Observation Chart Document ID: 18247 Trustdocs Id: 18247

Adult Patients Receiving Epidural, Paravertebral and Interscalene Brachial Plexus Analgesia
Trustdocs Id: 1191

Epidural - Discharge Advice for Patients Trustdocs Id: 374

Regional Anaesthesia Patients Venous Thromboprophylaxis with Anticoagulant and Antiplatelet Drugs Document Trustdocs ID 1193,

Trust's Controlled Drug Procedure Trustdocs Id 423

Waste Management, NNUH Trustdocs Id: 609