

CENTRAL NEURAXIAL BLOCK (CNB) TECHNIQUES

Contraindications to CNB:

Parental Objection, allergy to drugs used, sepsis, meningitis, coagulopathy, raised intracranial pressure, anatomic malformations of the spine, infection at the puncture site.

Nursing issues may be a relative contraindication eg. lack of adequate nursing support/ monitoring facilities post-op

CAUDAL

The sacral hiatus, bound by the sacral cornu, lies at the tip of the equilateral triangle formed by the 2 posterior sacral iliac spines.

Using an aseptic technique, the sacrococcygeal membrane is pierced with a 23G needle / cannula.

Exercise caution in the presence of a sacral dimple. Check if an ultrasound or MRI has been done to exclude the presence of low lying dural sac or tethered cord. Explain adverse effects of hypotension (uncommon), motor block, urinary retention, intra-vascular injection, inadvertent dural puncture.

Concentration: 0.2 - 0.25% levobupivacaine generally used but calculate permissible dose to avoid toxicity. Concentration may need to be decreased if an increase in volume is required to achieve an appropriate level of block.

Volume of local anaesthetic & estimated level of block

0.5 ml/ kg	perineum or sole of feet
0.75- 1.0 ml/ kg	lumbosacral
1.0- 1.25 ml/ kg	thoracolumbar (up to T10)
1.25- 1.5 ml/ kg	mid thoracic

Takasaki: 0.06 ml / segment / kg or 0.7 ml / kg

- Maximum volume should not exceed 20mls.
- If a higher level of analgesia is needed, consider lumbar epidural.
- Suitable as sole anaesthetic technique for ex - premature infants at significant risk of post-operative apnoea.

Block Duration:

Duration of single-shot (SS) plain caudal block : 2-3 hr

CAUDAL blockade can be extended with ADDITIVES:

- Ketamine (preservative free) 0.5-1 mg / kg
 - Increasing evidence shows histopathological changes with ketamine adjunct use. Avoid if possible, especially in <1 yr old
 - If necessary, S-Ketamine is preferred over racemic ketamine, as it is less neurotoxic.
 - Prolongs analgesic effect to 8-12 hours
 - Side effect: psychomimetic, especially for dose $\geq 1\text{mg/kg}$

- Clonidine 1-2mcg / kg
 - Improves analgesic effect & prolongs duration of action to 4-6 hrs.
 - Side effects: hypotension (if >2 mcg / kg), bradycardia, post-operation sedation, blunts ventilatory response to rising CO₂
 - Avoid Clonidine in < 3 months due to risk of apnoea.
- Dexmedetomidine, suggested dose 1-2mcg/kg
 -
 - Dexmedetomidine, also alpha 2 agonist, has been described in more recent literature. It is seven times more selective than clonidine, which means its analgesic and sedative properties that are more potent too.
 - Safety considerations for dexmedetomidine use include the potential for hypotension and or bradycardia.
 - As toxicity data is limited, the minimum dose needed to achieve its effect should be used.
 -
 - Caution re hypotension and bradycardia with higher end of dose range
- Opioids
 - Morphine: 25-30 mcg / kg q12h
 - Fentanyl: 1-2mcg / kg q4h
 - Unsuitable for use in ambulatory setting
 - Side effects: N+V, pruritis, urinary retention, **respiratory depression**

- o Require close monitoring for 24 hrs post-operation
- o No narcotics should be given until at least 6h has elapsed

Caudals with additives **must** be reviewed by APS the next day.

Continuous caudal epidural analgesia

- Safe and effective in infants
- Single curve of the back < 2yrs = predictable threading even up to thoracic spine
- Ensure secure dressing with Steristrips® and Tegaderm®, covered with Hypafix® to avoid faecal contamination
- Tunneling of the catheter to avoid contamination is an option. Discuss with your consultant.
- Epidural bupivacaine or levo-bupivacaine infusion
 - o Neonates: NO additives and remove indwelling catheter within 48 hr (as accumulation of LA in plasma with no available lab monitoring capabilities may result in toxic doses)
 - o Refer to epidural infusion rates in CPS guidelines.

EPIDURAL

- Indications: thoraco-abdominal operations, some laparotomies, major urological procedures, major orthopaedic operations involving hip or knee etc.
- To be performed only under supervision by senior staff.
- IV access must be established prior.
- Sited under GA with at least ECG, SaO₂ and NIBP monitoring.
- Consider performing the block prior to paralysis to allow for detection of total spinal/cord injury.
- Full aseptic technique; cap, gown, mask and gloves must be donned and surgical scrub is mandatory.

- Surface mark spinous processes as landmarks are easily lost under drapes.
- Determine length of catheter in space. Tip should ideally be at the midpoint of segmental levels to be blocked.
- Position child in left lateral position with appropriate counter pressure by assistant when inserting epidural needle.

Paediatric set = 19G Touhy: recommended for children <10 kg.

Adult set = 18G Touhy: recommended for children >10kg.

Shorter (5 cm) needles available for younger children.

Continuous "loss-of-resistance" technique with saline or air.

Catheter must be labelled and taped securely in place once sited.

Dressing should include a transparent window to allow inspection of the entry site and catheter markings.

Specialised epidural securement devices are available upon request.

Pain Referral Form required, along with CLMM entry of epidural infusion prescription and other standard post-op analgesia medications.

Useful Information

Skin depth to ligamentum flavum: (1x BW in kg) millimeters.

Skin- Epidural distance in children. Bosenberg AT et al. Anaesthesia 1995

Skin- Epidural depth(mm): $9.0 + 0.62 \times \text{weight(kg)}$

Evaluation of epidural and subarachnoid space distance in young children using magnetic resonance imaging. Franklin AD et al. Reg Anesth Pain Med. 2015.

	Term Neonate	6mo	1 year
Dural Sac	S3	S2	S1
Spinal Cord	L4 / 5	L2 / 3	L1

Epidural Dosing (consider dermatomal spread and toxic limits)

- o Bolus: concentration - 0.1 - 0.25% L-bupivacaine
- o Volume : Load to achieve desired dermatomal coverage
0.5 – 0.75 ml / kg (max. 1.0ml/kg or 1.7mg/kg)

Infusion settings (refer to CPS guidelines)

Age	LA (%)	Infusion rate* (ml/kg/h)	Additive
Neonates – 6 months	L-bupivacaine 0.1%	0.1 - 0.2 (Not > 48h)	No additives (Strictly)
7 months – 1 year	L-bupivacaine 0.1 - 0.125%	0.1 - 0.3	Fentanyl 1 mcg/ml
> 1 year (Standard)	L-bupivacaine 0.1 - 0.125%	0.1 - 0.4	Fentanyl 2 mcg/ml or Clonidine 1 mcg/ml

Hydrophilic opiate (morphine) may be substituted as an additive to improve spread & quality of analgesia

Recommended infusion rate by mg/kg/hr according to ESRA/ASRA guidelines:

* Ropi/levo/bupivacaine 0.2-0.4mg/kg/h

Morphine as an Epidural additive is limited to 5 mcg / ml

Do NOT use concomitant IV sedative or opioid infusion if using epidural morphine additive; Ensure that epidural is definitely in & has documented efficacy/ dermatomal level before using this.

SPINAL

- Suitable as sole anaesthetic technique for ex - premature infants at significant risk of post-operative apnoea.
- Standard monitors in place before starting.
- IV access must be established.
- Full aseptic technique.
- Positioning of patient: lateral or sitting.
Avoid extreme neck flexion and potential airway compromise.
- If using the sitting position, back may be flexed but ensure adequate support for the head
- Recommended levels L4 / 5 or L5 / S1. Level should be marked before draping.
- Neonatal Spinal needle: 25G (0.51mm x 2.54cm).
- Dosage: Bupivacaine 0.5% without adrenaline

Weight	Dose	Volume
<2.0 kg	0.6mg / kg	0.12 ml / kg
2-5 kg	0.5mg / kg	0.10 ml / kg
>5 kg	0.4mg / kg	0.08 ml / kg

- Ascertain and record level of block.
- A pacifier with glucose solution can be given to the baby.
- Post-operatively, the baby should be monitored for apnoeic spells for 24 hours.

References:



1. Regional Anesthesia in Infants, Children and Adolescents. Dalens B. Ed. 1st Edition.1993, William & Wilkins.
2. Pediatric Regional Anesthesia, Polaner D, Suresh S, Cote CJ *in* A Practice of Anesthesia for Infants and Children. Cote CJ, Todres ID, Goudsouzian NG, Ryan JF. 3rd Edition, 2000, WB Saunders Co.
3. Armitage EN. Regional anaesthesia in Paediatrics. Clinics in Anaesthesiology 1985; 3: 553.
4. Lönnqvist, P.-A. (2012), Toxicity of local anesthetic drugs: a pediatric perspective. Pediatric Anesthesia, 22: 39–43
5. Jean-Xavier Mazoit. Local anaesthetics and their adjuncts. Pediatric Anesthesia 2012; 22: 31-38.
6. Giorgio Ivani, Santhanam Suresh, Claude Ecoffey et al. The European Society of Regional Anaesthesia and Pain Therapy and the American Society of Regional Anesthesia and Pain Medicine Joint Committee Practice Advisory on Controversial Topics in Pediatric Regional Anesthesia. Reg Anesth Pain Med 2015;40: 00–00.
7. Suresh S, Ecoffey C, Bosenberg A, Lonnqvist PA, de Oliveira GS Jr, de Leon Casasola O, de Andrés J, Ivani G. The European Society of Regional Anaesthesia and Pain Therapy/American Society of Regional Anesthesia and Pain Medicine Recommendations on Local Anesthetics and Adjuvants Dosage in Pediatric Regional Anesthesia. Reg Anesth Pain Med. 2018 Feb;43(2):211-216.

KKH Guidelines on Regional Anaesthesia and Central Neuraxial Blocks in Patients on Antiplatelets, Anticoagulants and Coagulopathy

Patients on antiplatelet or anticoagulant agents are at increased risk of bleeding complications. While coagulopathy is a contraindication to such techniques, it is possible that it develops post-operatively. As such, the risks and benefits of regional techniques and central neuraxial blocks should be carefully thought through and discussed with the primary team.

Deep peripheral nerve blocks (PNB) should be avoided in the presence of coagulopathy. (see table below)

Relative risk related to neuraxial and peripheral nerve blocks in patients with abnormalities of coagulation.

	Block category	Examples of blocks in category
	Higher risk	
	Epidural with catheter	
	Single-shot epidural	
	Spinal	
	Paravertebral blocks	Paravertebral block Lumbar plexus block Lumbar sympathectomy Deep cervical plexus block
	Deep blocks	Coeliac plexus block Stellate ganglion block Proximal sciatic block (Labat, Raj, sub-gluteal) Obturator block Infralavicular brachial plexus block Vertical infraclavicular block Supraclavicular brachial plexus block
	Superficial perivascular blocks	Popliteal sciatic block Femoral nerve block Intercostal nerve blocks Interscalene brachial plexus block Axillary brachial plexus block
	Fascial blocks	Ilio-inguinal block Ilio-hypogastric block Transversus abdominis plane block Fascia lata block
	Superficial blocks	Forearm nerve blocks Saphenous nerve block at the knee Nerve blocks at the ankle Superficial cervical plexus block Wrist block Digital nerve block Bier's block
	Local infiltration	
Normal risk		

When reviewing the patient, consider the following:

- 1) If your patients are currently not on the agents but might be started on them after the operation, communicate with the primary team/ surgeons.
- 2) If your patient is on any of these medications, know the reason for him/her being on the medication as well as the urgency of restarting antiplatelet or anticoagulants post-operatively.
- 3) Existing coagulation status :
 - a. Platelet levels should be $\geq 80K$
 - b. INR should be ≤ 1.4
 - c. Any suggestion of coagulopathy, clinical or otherwise, should be discussed with your consultant. It may need further investigation prior to surgery.
- 4) New onset post-operative coagulopathy :
 - a. Assess and document neurological status and function. Discuss with the Pain Consultant regarding the need for referral to other specialists or imaging.
 - b. Increased frequency (Q2H) of neurological monitoring required.
 - c. Consider stopping epidural infusion with a view to remove catheter as soon as is viable. If so, convert to appropriate alternative analgesia eg. Continuous morphine infusion.
 - d. Ascertain cause and degree of coagulopathy and correct as far as possible.
 - e. Remove catheter at earliest and safest opportunity, bearing in mind the coagulation status may fluctuate between the time of the laboratory reading and the time of catheter removal.

Antiplatelets and Anticoagulants

If your patient is on any of these, take note:

Thrombolytics:

1. There is insufficient data to support specific recommendations regarding a safe time period for neuraxial puncture to take place after receiving thrombolytics thus we **do not recommend** regional or central neuraxial blocks in patients with recent thrombolytic therapy (<10days).
2. Patients should not be started on thrombolytic therapy if a catheter is in-situ.

Unfractionated Heparin:

Intravenous Heparin (Therapeutic Dose)

1. Stop heparin 4 hours and check coagulation status (APTT should be normal) prior to block & catheter placement & removal.
2. Heparin may be started 4 hours after neuraxial block.
3. Heparinization in the presence of an indwelling catheter increases risk*. Monitor neurological status closely.

* AAGBI Guidelines 2013 advises caution

Subcutaneous Heparin (Prophylactic Dose)

1. Stop heparin 4 h prior.
2. Heparin may be started 1h after neuraxial block.
3. Heparinization in the presence of an indwelling catheter increases risk*. Monitor neurological status closely.

* AAGBI Guidelines 2013 advises caution

4. Remove the catheter 2-4h after the last dose.
5. The next S/C Heparin dose can be administered 1 hour after catheter removal.
6. For patients receiving S/C Heparin > 4 days, check PLATELET level before catheter removal (grade 1C).

LMWH:

Prophylactic Dose (Once daily dose):

1. Wait 12 hours from the last dose of thromboprophylactic LMWH.
2. After needle or catheter placement, wait 4-6 h before the first dose of LMWH.
3. Subsequent dose should only be given 24 h after the first.
4. Drug administration in the presence of an indwelling catheter increases risk*. Monitor neurological status closely.

* AAGBI Guidelines 2013 advises caution

Therapeutic Dose (Twice daily dose):

1. Wait 24 hours from the last "treatment" dose of LMWH.
2. Wait 24 hours before restarting LMWH after single shot regional / neuraxial block
3. Wait 4-6 h after catheter removal before starting LMWH
4. DO NOT administer a therapeutic dose of LMWH until the catheter is removed.

Warfarin:

1. Discontinue chronic Warfarin therapy 4-5 days before neuraxial blocks and evaluate INR.
2. INR should be ≤ 1.4 at time of regional/ neuraxial block.
3. After operation, daily INR assessment. Keep INR ≤ 1.4 prior to catheter removal.
4. If INR is >1.4 , consult a senior.
5. Neurologic examinations should continue for 24 hours after catheter removal.

Novel Oral Anticoagulant (NOAC) Agents:

1. Rivaroxaban and Dabigatran are renally excreted. Appropriate length of time for stopping before regional or CNB depends on CrCl. (Range 2-4 days)**
2. Administration of drug with spinal/ epidural catheter in situ is not recommended.
3. All drugs (Rivaroxaban, Dabigatran and Apixaban) can be restarted at least 6h after block performance or catheter removal.

**Refer to AAGBI Guidelines 2013

Antiplatelet:

1. Stop Clopidogrel 7 days before neuraxial block.
1. Stop Ticlopidine 14 days before neuraxial block.
2. No restrictions on regional, CNB, catheter insertion and removal in patients receiving Aspirin and other NSAIDS.
3. Administration of other antiplatelets with spinal/ epidural catheter in situ is not recommended.

Thrombin Inhibitors: (Desirudin, Lepirudin, Bivalirudin, Argatroban):

1. Insufficient data. Regional and central neuraxial techniques NOT recommended.

References:

1. Regional anaesthesia in the patient receiving antithrombotic and antiplatelet therapy. BJA 107 (S1): i96- i106 (2011) T. T. Horlocker
2. Regional anaesthesia and patients with abnormalities of coagulation. *Anaesthesia* 2013, 68, 966- 972
3. Guidelines from the American Society of Regional Anesthesia and Pain Medicine
4. The risk of spinal haematoma following neuraxial anaesthesia or lumbar puncture in thrombocytopenic individuals. BLH 2009. Joost J van Veen et al.
5. Association of Anaesthetists of Great Britain and Ireland, Obstetric Anaesthetists' Association and Regional Anaesthesia UK. Regional anaesthesia and patients with abnormalities of coagulation. *Anaesthesia* 2013; **68**: pages 966-72.
6. Suresh S, Ecoffey C, Bosenberg A, et al. The ESRA/ASRA recommendations on local anesthetics and adjuvants dosage in pediatric regional anesthesia. *Reg Anesth Pain Med.* 2018;43: 211–216.
7. *Reg Anesth Pain Med.* 2018 Nov;43(8):895-896. doi: 10.1097/AAP.0000000000000855.
8. Maximum Recommended Dosage of Ropivacaine and Bupivacaine for Pediatric Regional Anesthesia. Tsui BCH1, Boretsky K, Berde C.