

Regional Blocks – a practical guide:

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Please use this guide in conjunction with the previous tutorial (16/01/06) which describes the rules for performing blocks, the local anaesthetic drugs and equipment required for local and regional blocks. It also describes how to recognise and treat local anaesthetic toxicity.

Please remember that most children will require a general anaesthetic in addition, as they will not tolerate being awake for the surgical procedure. In this case the signs and symptoms of local anaesthetic toxicity may be difficult to see, and extra care must be taken to avoid this complication.

Drug doses: Never exceed the total safe dose of whichever local anaesthetic drug you are using. A more concentrated solution gives a denser block, but if a larger volume is required for spread of block dilute the drug to achieve this. Always aspirate before injecting to avoid intravenous injection.

Questions: think about these before reading the tutorial. Also go back and look at the previous tutorial on regional blocks (16/01/06):

1. What equipment do you need to do a regional block?
2. Why might you add adrenaline to a local anaesthetic solution? When would you NOT use adrenaline?
3. Look at the list of blocks in the “contents” section below, and before reading the tutorial write down the nerves involved in each block.
4. What blocks could you use for a circumcision:
5. List all the blocks you *could* use (even if not really practical) to stop pain in a broken great toe.
6. What complications can occur with an ilio-inguinal block?
7. Why might you use a smaller or larger *volume* of local anaesthetic?
8. How do you treat local anaesthetic toxicity?

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Trunk Blocks:

1. Ilioinguinal Block:

Indications: Inguinal surgery (inguinal / femoral hernias) including orchidopexy * (see notes)

Landmarks: Anterior Superior Iliac Spine (ASIS)

Nerves: Iliohypogastric (T12 /L1) and ilioinguinal (L1) from lumbar plexus, Intercostal nerves

Nerve Stimulator required: No

Needle: 50mm regional block needle, or blunted 22G injection needle

Volume: Up to 1.0 ml/kg. +/- Adrenaline 1:200,000

If bilateral blocks required use half the dose each side.

Some anaesthetists use half the dose for the block and leave the other half for surgical infiltration of hernia sac and skin if the block is unsuccessful.

About 80% of the volume should be injected around the ilioinguinal and iliohypogastric nerves, and the rest subcutaneously to block the intercostals nerves.

Technique: Supine position

Point of injection 1 child's finger width medial to ASIS, needle insertion perpendicular to skin

Pierce skin then bring needle tip back to skin as you can advance too far and miss the anatomy!

Iliohypogastric nerve:

Advance needle slowly until first "click" is felt as it passes through external oblique aponeurosis. The iliohypogastric nerve runs between the external oblique and internal oblique aponeuroses.

Ilioinguinal nerve:

Runs between internal oblique and the transversus abdominus muscle.

Can be blocked either by placing large volume in the same position as the Iliohypogastric nerve or insert the needle slightly deeper for a second click as the internal oblique is penetrated.

Intercostal nerves:

Fan-wise injection of local anaesthetic just under the skin, medial to needle insertion blocks the lower intercostals nerves. Infiltrate where incision will be (check the surgeon agrees first).

Complications: Intravascular injection, intraperitoneal injection (potential damage to abdominal contents). Femoral nerve block (causes a temporary weak leg. Warn the parents)

Notes: This block may not be enough to cover the peritoneum, especially in orchidopexy, therefore deepen anaesthesia at the time. Ask surgeon to infiltrate the scrotal incision (genito-femoral nerve). Additional analgesia may be required

2. Penile Block:

Indications: Circumcision / Meatoplasty

Landmarks: Symphysis pubis (SP), root of penis

Nerves: Dorsal nerve of penis, branches from Ilioinguinal and genitofemoral

Nerve Stimulator: No

Needle: 25 mm regional block needle, or blunted 22G injection needle

Volume: 1ml + 0.1ml/kg each side for Bucks fascia injection (max 5mls per side), 1- 5 mls for subcutaneous infiltration. DO NOT use adrenaline.

Technique: Supine position. Palpate symphysis pubis above root of penis.

Point of needle entry below SP either side of the midline: 0.5cm in infants and 1 cm in children AVOID midline itself as risk of damaging vessels and causing haematoma.

Insert needle until loss of resistance felt when Bucks fascia penetrated. Inject anaesthetic, then infiltrate subcutaneously underneath of the root of penis and also onto lateral side of scrotum. (Some anaesthetists do a superficial ring block not penetrating Bucks fascia. Beware obscuring surgical field).

Complications: Intravascular injection, corpus injection/haematoma

Notes: ADRENALINE contraindicated due to end arteries and risk of ischaemia.

3. Rectus sheath block:

Indications: midline incisions, umbilical operations

Landmarks: edge of rectus abdominus muscle

Nerves involved: intercostal nerves at level of block

Nerve stimulator: No

Needle: regional block needle or blunted 22G injection needle

Volume: up to 1 ml/kg +/- adrenaline 1:200,000. Inject half the volume each side. A larger volume will spread to involve more nerves above and below the point of injection.

Technique: Supine position.

Locate edge of rectus muscle. Insert needle 0.5cm medial to this. Advance slowly until "click" felt as needle passes through rectus sheath. Inject half the dose of anaesthetic and repeat on opposite side.

Complications: Intravascular injection, intraperitoneal injection.

Notes: this may not be enough for a peritoneal incision and further analgesia may be needed.

Central Blocks

4. Caudal Epidural (Single shot):

Indications: Surgery below umbilicus: e.g penile, groin and lower limb surgery.

Contraindications: Infection near the site of the needle insertion, pilonidal cyst or abscess. Coagulopathy or anti coagulation. Congenital abnormalities of the lower spine or meninges.

Unsuitable: if child needs to walk soon after operation and is too big to carry.

Landmarks: Sacral cornua, sacral hiatus, follow line of femur to where crosses spine.

Nerves Involved: Lumbosacral plexus up to low thoracic according to volume of anaesthetic used.

Nerve Stimulator: No

Needle: 24G (neonates), 22-18G (older children) cannula or needle.

Volume: Dilute maximal dose of anaesthetic to appropriate volume.

Penile and leg surgery (lumbosacral block) 0.5 ml / kg, groin surgery (thoracolumbar block) 1.0ml/kg

Technique: Patient in lateral position with hips flexed and knees bent (as for lumbar puncture).

ENSURE patient connected to ECG before administering your dose of local anaesthetic.

Aseptic technique must be employed (Chlorhexidine, towel/drape, sterile gloves).

Locate sacral hiatus. This is the small depression above the coccyx, between the sacral cornua. Also found by following line of femur. (Most common problem is going too low).

Insert the cannula at 30° in the saggital plane until "pop" felt as penetrate sacro-coccygeal membrane.

Advance cannula off needle and watch for blood or CSF for 30 seconds before injecting anaesthetic.

Inject slowly, aspirating every few mls for the same reasons to confirm safe placement.

There is a characteristic “feel” of correct placement during injection i.e. it should be easy. Resistance means wrong placement
Watch for subcutaneous injection or ECG for IV injection (ST changes, arrhythmias, bradycardia).

Complications: Intravascular injection, dural puncture/subarachnoid injection (headache, total spinal block), cauda equina damage, weak legs (older children may not like this), urinary retention for duration of block.

Notes: absent fusion of posterior sacral vertebrae (associated with anorectal anomalies) may make sacral hiatus appear higher, so greater risk of subarachnoid injection and damage to cauda equina.

Upper Limb Blocks

5. Wrist Block:

Indications: Hand surgery

Landmarks: Flexor retinaculum (palmar crease)
Median nerve - Palmaris Longus (PL), flexor carpi radialis (FCR) tendons.
Ulnar nerve - Ulnar artery, flexor carpi ulnaris (FCU) tendon.
Superficial radial nerve - Radial Styloid

Nerves involved: Median (C6 – T1), Ulnar (C7 – T1), Radial (C5 – T1)

Nerve Stimulator: Yes, preferable with median and ulnar blocks as nerves easily damaged.
Needle: 25G 25mm insulated needle

Volume: see individual blocks.

Technique:

Median Nerve: Identify PL and FCR by making patients hand into a fist. Point of injection distal to palmar crease between these tendons. Direction 45 ° to skin towards wrist, depth: 5 to 10 mm.
Stimulation: Thumb movement
Dose: up to 0.1 ml/kg
* Palmar cutaneous branch of nerve blocked by subcutaneous infiltration towards flexor retinaculum.

Ulnar Nerve Block:

Identify FCU. Point of injection distal to palmar crease under medial side of FCU tendon. Inject towards radial border of wrist under FCU. Depth: 5 to 10 mm
Stimulation: Flexion 3rd, 4th and 5th fingers
Dose: up to 0.1 ml/kg
*Dorsal cutaneous branch of nerve blocked by subcutaneous infiltration over ulnar aspect of wrist

Radial Nerve Block: Find radial styloid on dorsum of wrist. Infiltrate subcutaneously from radial styloid over dorsum of wrist to mid point.
Stimulation not required. Dose: 0.1-0.2 ml/kg

Notes: additional analgesia may be required intra-operatively for tourniquet pain.

6. Digit Block / Webspace Block:

Indications: Finger surgery distal to base of proximal phalanx

Landmarks: Either side of proximal phalanx base

Nerves: Dorsal and ventral digital nerves

Nerve stimulator: No
Needle: 25g injection needle

Volume: up to 0.1 ml/kg for both injections. DO NOT use adrenaline.

Technique:

Either: insert needle and inject anaesthetic both sides of base of finger from palmar to dorsal surfaces
Or: In the horizontal plane inject into the webspace between the fingers towards the knuckle.

Complications: neuro-vascular compromise due to pressure from excessive volume of infiltration.
Vascular puncture/haematoma formation. Nerve damage from needle.

Notes: NEVER USE ADRENALINE CONTAINING LOCAL ANAESTHETIC SOLUTIONS FOR END ARTERIES DUE TO RISK OF ISCHAEMIA

Lower Limb Blocks

7. Lumbar Plexus Block:

Indication: Analgesia for hip, femoral shaft and knee surgery. Combined with Sciatic can provide analgesia for whole of lower limb.

Landmarks: Posterior superior iliac spine (PSIS), line joining iliac crests (Tuffiers line)

Nerves: lumbar plexus ventral rami of L1, L2, L3 and L4.
Blocks femoral, lateral cutaneous and obturator nerves.

Nerve Stimulator: Yes
Needle: 100mm insulated needle

Volume: 0.5ml/kg – 0.8ml/kg

Technique: Lateral position, operative side uppermost.

Draw line from the PSIS parallel to the spinous processes. Inject where this line crosses Tuffiers line. Insert needle perpendicular to skin, advance slightly caudad until hit the transverse process. Redirect to pass above or below transverse process

Stimulation: Quadriceps contraction (If the hamstrings contract you are too medial or caudad).

Complications: Essentially this is an intra muscular injection into the psoas compartment. Beware absorption toxicity or overdose especially if combining with sciatic nerve block.
Epidural spread (especially if injection too medial i.e. paravertbral).
Intravascular injection (know anatomy as structures such as aorta and kidney can be hit if needle advanced too far).

8. Femoral Nerve Block:

Indications: Femoral shaft and knee surgery only. Combine with sciatic block for knee and lower leg.

Landmarks: Inguinal ligament, femoral artery (Remember NAV nerve, artery, vein lateral to medial).

Nerves: L2, L3 and L4

Nerve stimulator: Ideally yes
Needle: 25mm - 50mm insulated needle

Volume: 0.5ml/kg. Larger volumes more likely to block the lateral cutaneous nerve ("2 in 1" block)

Technique: Point of injection 0.5 to 1cm below the inguinal ligament, lateral to femoral artery
Insert needle 45° angled cephalad. Two pops may be felt as pass through fascia lata and fascia iliaca. (Key sign if not using nerve stimulator e.g. as analgesia for awake patient with femoral fracture)
Stimulation: Patella twitch

Complications: Intravascular injection, haematoma

Notes: Keep point of injection close to inguinal ligament as femoral nerve divides below this.
If sartorius twitches injection too superficial.

9. Sciatic nerve Blocks:

Indications: Lower limb, ankle or foot surgery.
Combine with femoral or lumbar plexus to block whole leg

Landmarks: Greater trochanter (GT), ischial tuberosity (IT), posterior superior iliac spine (PSIS) and sacral hiatus (SH)

Nerves: L4, L5, S1, S2, and S3 (Sciatic divides to tibial nerve and common peroneal nerve)

Nerve Stimulator: Yes

Needle: 50-100mm insulated

Volume: 0.5ml/kg

Complications: Nerve damage

Notes: **DO NOT use adrenaline containing solutions near the sciatic nerve as blood supply may be compromised causing ischaemia. Beware LA toxicity if combining with femoral or lumbar plexus blocks.**

a. Inferior Approach (RAJ)

Technique: Position patient supine then lift operative leg so that the hip flexed to 90°. Identify the greater trochanter and the ischial tuberosity, draw a line connecting these two points. Point of injection is halfway between GT and IT in groove between hamstring and adductor muscles. Direction of injection is perpendicular to skin, slightly medial.
Stimulation: Plantar flexion of foot (tibial nerve). If get dorsiflexion of foot (common peroneal nerve), move needle more medially.

b. Posterior Approach (Labat)

Technique: Position patient laterally with operative side up. Flex hip and knee to 90° (knee in line with PSIS and GT)
Draw line connecting PSIS and GT. Draw a perpendicular line from the midpoint of first line. Point of injection where 2nd line crosses line joining the sacral hiatus and GT
Stimulation: Plantar flexion of foot/toes (tibial nerve) If get dorsiflexion/eversion of foot (common peroneal nerve) move needle medially. If difficulty stimulating sciatic nerve move along perpendicular line.

10. Popliteal Block

Indications: Ankle and foot surgery

Landmarks: Semimembranosus, biceps femoris, and popliteal crease

Nerves involved: L4, L5, S1, S2 and S3. (tibial and common peroneal nerves)

Nerve Stimulator: Yes

Needle: 25 – 50mm insulated

Volume: 0.5 ml/kg

Technique:

Patient may be prone, or supine with knee and hip flexed to 90° (get your assistant to support the leg!)

Draw the popliteal fossa boundaries (landmarks as above)

Point of injection almost at apex of popliteal fossa triangle, 0.5 – 1cm lateral to the midline.

Stimulation: Tibial nerve: plantar flexion of foot, common peroneal nerve: dorsiflexion/ eversion of foot

Complications: Nerve damage, vascular puncture and injection

Notes: The sciatic nerve can divide into the tibial and common peroneal within the popliteal fossa at different levels. If having problems stimulating both nerves go higher into the apex of fossa. (Beware vascular puncture)

11. Saphenous Nerve Block (at knee):

Indications: Surgery to anteromedial aspect of leg. Ankle and foot surgery in combination with sciatic block

Landmarks: Tibial tubercle, medial condyle of tibia

Nerves: Saphenous L2, L3 and L4

Nerve Stimulator: No

Needle: 25G 25mm uninsulated

Volume: 0.25 – 0.5 ml/kg

Technique: Infiltration subcutaneously along line between tibial tubercle and medial condyle of tibia.

Complications: Bleeding from long saphenous vein

12. Ankle Block:

Indications: Forefoot and toe surgery

Landmarks: Dorsalis pedis and posterior tibial arteries, medial malleolus.

Nerves: Deep peroneal (also known as deep fibular), superficial peroneal (superficial fibular), tibial nerve, sural nerve, sural nerve

Nerve Stimulator: yes for tibial nerve block, not for others

Needle : 25g 25mm uninsulated and 25mm insulated needles

Volume: maximum total dose 1.0ml/kg. DO NOT use adrenaline.

Technique:

Deep Peroneal Nerve: Palpate the dorsalis pedis artery. Inject to bone 1-2mls each side of artery.

Superficial Peroneal Nerve: From above point of injection infiltrate up to 10 mls anaesthetic laterally and medially across dorsum of foot.

Sural Nerve: Infiltrate up to 5mls from lateral malleolus to lateral border of Achilles tendon

Tibial Nerve: Use insulated 25mm needle. Point of injection posterior to the posterior tibial artery

Stimulation: plantar flexion of toes

Use up to 8mls

Complications: Intravascular injection. Overdose (multiple injections, calculate maximum volume allowed for the child's weight).

Notes: this is essentially a ring block of the ankle. DO NOT use adrenaline. Additional analgesia may be required for tourniquet pain.

Reference: Abbott pocket guide to practical peripheral nerve blockade. Nicholls, Conn, Roberts.

Answers:

1. This depends on the block you are doing.
The minimum of local anaesthetic drug, syringe/needle, method of cleaning skin, (and a knowledge of anatomy) will be enough for peripheral nerves e.g. digit blocks.
For more central blocks you may need a longer needle to reach the nerve, a nerve stimulator to identify the nerve, and ECG/SaO₂/BP monitoring to ensure intravenous injection is recognised and treated rapidly should it occur.
2. Adding adrenaline makes a block last longer by causing vasoconstriction. This slows the absorption of local anaesthetic away from the area. NEVER use adrenaline on an end-organ, where this is the only blood supply to the area, e.g. a finger, toe or penis, as this may cause a failure of the blood supply to that area.
3. See tutorial
4. Penile or caudal block.
5. Digit, ankle, popliteal, sciatic nerve blocks, caudal. Whilst most of these would not be practical, remember that the nerves to an area can be blocked anywhere from locally to centrally.
6. Failure of block, damage to nerve (pain, loss of sensation), bleeding, infection, damage to any nearby abdominal structures if needle inserted too far (bowel, bladder).
7. Using a larger volume allows a greater spread of the block. e.g. in a caudal block a small volume will not spread far enough to block the groin area for a hernia repair, and a larger volume is needed. For a digit block only a small volume is necessary, so a more concentrated solution can be used, giving a denser block.
8. Early recognition, stop injection, oxygen, CPR. See previous tutorial (16/01/06)