

Local Anaesthetic Techniques Mini Series

Session 3: Advanced local anaesthetic techniques

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Advanced local anaesthetic techniques

Bullet points

Local techniques for the trauma patient – case study incorporating techniques from Webinar 2
Keeping your critical cases comfortable – case study incorporating analgesic management from Webinar 1
Mastering epidural anaesthesia
Using nerve location to improve success

Nerve Location

Electrical nerve locators are used to increase the accuracy and safety of local anaesthetic techniques. This relies on the nerve being stimulated having a motor component – stimulation of the nerve produces a response in the corresponding muscle. An electrical nerve locator (ENL) will stimulate muscular twitching at a close distance to the nerve without actually touching it; hence, providing greater accuracy for local anaesthetic deposition. Needles have an insulated shaft so the current comes from the tip. The needle is connected to the current meter and a syringe.

The further the needle is from the nerve the greater the current required to stimulate (Coulomb's Law). However, if the needle is in the nerve, a twitch may not be seen – only when the needle is moved away does a twitch appear. The aim is to get the needle as close as possible to the nerve without actually touching the nerve. The ENL is essentially a current generator – the output can be varied. For most blocks start at a current of 1mA. Once the nerve is located step down to 0.2mA in increments of 0.2mA – at this current no stimulation should occur. If stimulation does occur at 0.2mA the needle is too close to the nerve sheath and at this point injection could cause nerve damage. Reposition the needle in this case.



Once you are at a current of 0.2mA with no stimulus, go back up to 0.4mA at which point you should see the twitch resume. Aspirate & start the injection – the stimulation will cease – this is not the local working but the nerve being separated from the stimulating needle by the fluid injected.

Practical Tips

Move the needle forwards and backwards and not laterally. This may push the needle towards the nerve, but there may still be tissue in between the needle and the nerve. Investigate the area in an arc when searching for the nerve. Aspirate before every injection.

Nerve locators are available from Vygon, sponsors of this course.

Ultrasound-guided nerve location

Ultrasound in regional anaesthesia offers a new standard in nerve location and identification, allowing real-time imaging of nerves and direct needle guidance.

All needles show up equally well on ultrasound, but it is imperative that the needle tip is in the field of vision at all times.

The aim is not to touch the nerve but place the needle close to it; nerve identification can be confirmed by the combined use of peripheral nerve stimulation.

A successful block is one in which the local anaesthetic is seen to spread around the nerve under direct vision – referred to as the donut sign.

Ultrasound location offers the opportunity to improve success, reduce complications, and enhance teaching of regional anaesthesia.

Blocks in dogs and cats where this technique is used are the brachial plexus block (axillary approach), and the femoral-sciatic block. (Campoy et al., 2010).

For free to view videos of some of the techniques from today search Zero Pain Philosophy.

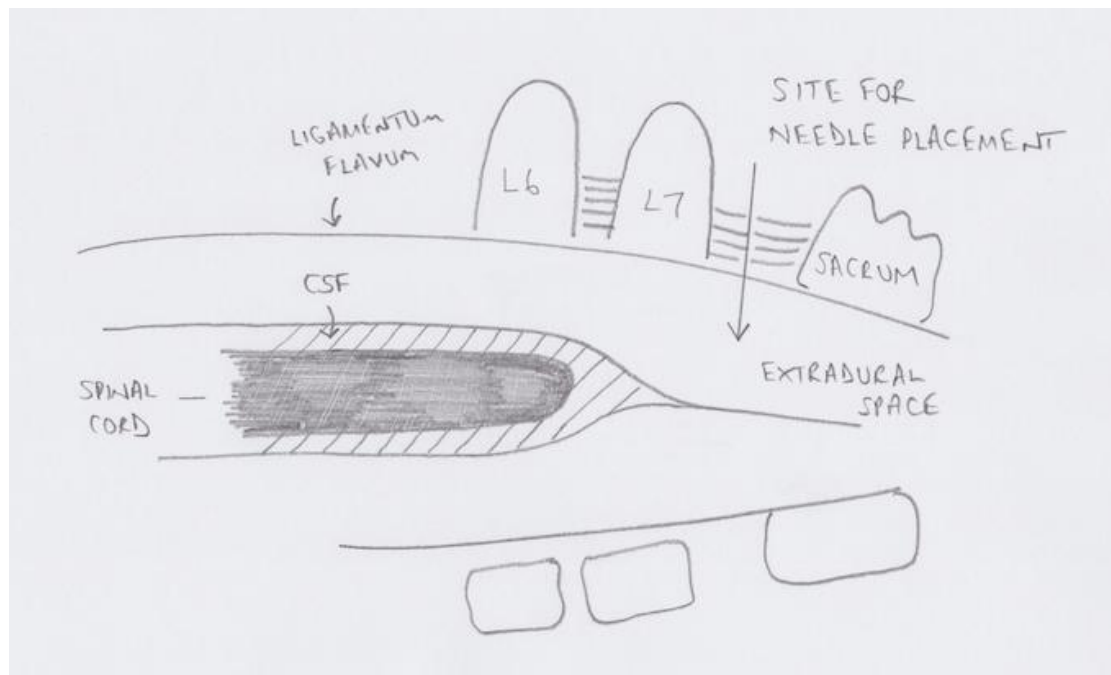
Epidural analgesia

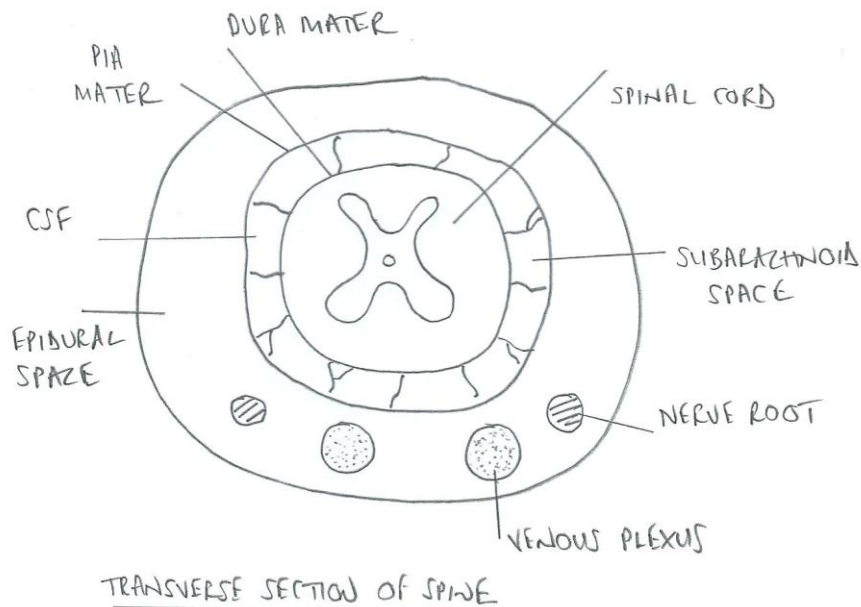
Note – nurses are not permitted to perform epidurals as this constitutes entering a body cavity.

Epidural analgesia (or more anatomically, extradural) is used to provide analgesia to the hind limbs but will also afford analgesia to the caudal abdomen, perineal region and at appropriate doses, the thoracic region.

The technique described is that adopted by the author. There are several techniques and these are widely described in the literature.

The transverse section below is at the level of L5. In the sagittal section the spinal cord actually ends a little further forward – you can perform an epidural between L6/L7 without danger of hitting the spinal cord in an adult animal. Note that in young animals the spinal cord can extend to the sacrum. It is therefore often more likely to perform an intrathecal injection in younger animals (or if you aspirate CSF redirect (withdraw) the needle to inject extradurally.)





Site of action of epidurally administered drugs

For local anaesthetics the site of action is the spinal nerves. For pelvic limb blockade the area from L3 to S1 must be covered. For the abdominal wall, this extends forwards to T11-L3. Solutions injected at L7 flow primarily cephalad but there is some loss of solution through intervertebral foraminae.

What affects spread?

Volume & concentration

Actual mass (dose) of drug is the most important factor influencing spread rather than absolute volume.

Injection speed/pressure

Administer slowly over 1-2mins. Rapid injection can cause bradycardia/apnoea/asystole thought to be due to changes in CSF pressure.

Site of injection

More cranial injection gives more cranial spread. Drug volumes quoted given assume lumbosacral injection.

Direction of needle bevel

Most relevant when a Tuohy needle is used – less concern with a Quincke needle.

Patient position

Most local solutions are hypobaric so a head up position encourages cranial spread. Hyperbaric bupivacaine is used in man (spinals are performed seated) to encourage the local to 'sit' at the base of the spine where its effects are desired. The solution is made 'heavy' (hyperbaric) by addition of glucose 8%. This is only relevant with spinal injections, not epidurals.

Fat in the epidural space

May affect spread giving a patchy block.

Venous plexuses

Venous engorgement is reported to affect spread by decreasing the epidural space. This is the case in pregnant patients plus those with increased intra-abdo pressure. During pregnancy in animals it is reported that onset of blockade is more rapid – use lower volumes in these cases.

Age

The dura mater is more permeable to local anaesthetics in old age – use lower doses – there are more arachnoid villi in the dura. Decreased numbers of myelinated fibres may allow local to penetrate the nerves more readily.

What to use for epidural analgesia

Local anaesthetics will provide total sensory (and motor) blockade. Opioids used epidurally reduce sensation however do not totally block sensation. The combination of local anaesthetics and opioids provides the advantage of excellent analgesia during the procedure with a long lasting effect.

Agent	Dose	Onset	Duration	Remarks
Lidocaine	4mg/kg	5 mins	1-2hrs	Risk of motor blockade Care not to exceed toxic dose
Bupivacaine or Levobupi	1mg/kg	10-20mins	4-8hrs	Risk of motor blockade Care not to exceed toxic dose
Ropivacaine	1mg/kg	10-20mins	4-8hrs	Risk of motor blockade Care not to exceed toxic dose
Morphine	0.1mg/kg Use 0.2mg/kg for thoracic spread	30-60mins	6-24hrs	Onset slow Risk of urinary retention – monitor post op – express bladder before recovery.
Morphine + bupivacaine/levobupi	0.1mg/kg + 1mg/kg	10-15mins	16-24hrs	Rapid onset, long duration
Morphine + lidocaine	0.1mg/kg + 4mg/kg	5-10mins	16-24hrs	Rapid onset for surgical benefit without longer term motor blockade
Methadone	0.3mg/kg	20-30mins	4hrs	

Some authors advocate using a limited volume (1ml/5kg) whilst others use the calculated dose. Doses may be reduced with older (fibrous tissue in epidural space), pregnant(engorged vasculature in epidural space) and obese(more fat in epidural space) patients. Preparations should be **preservative-free and local anaesthetics adrenaline-free**.

Doses ml/kg for dogs – injection site lumbosacral

Drug	Dermatome	Volume ml/kg
Bupi 0.25%	L3	0.2 (pelvic limb sx)
Bupi 0.5%	T10-L1	0.3
Bupi 0.25%	T9	0.4 (for abdo sx)

Doses ml/kg for cats – lumbosacral injection

Drug	Dermatome	Volume ml/kg
This study used methylene blue to test spread – likely that 0.5% bupi produces similar spread	L1-L2	0.2
	T7	0.3
	T6-10	0.4

A common volume for injection is 0.2ml/kg and we can expect lumbar spread. Therefore if using an epidural for analgesia during abdominal surgery we should use a greater volume such as 0.4ml/kg. We must still remain within our safe dose.

Duration of sensory blockade w local anaesthetics in dogs

Drug	Duration of sensory blockade (mins)
Lido 2% 4.4mg/kg	120
Ropi 0.75% 0.14mg/kg**	100
Levobupi 0.5% 1mg/kg	180 – shorter than expected

** note very low dose

Sensory blockade tends to last longer than motor blockade. The lidocaine and levobupivacaine doses are clinical doses and therefore we can expect our epidural to last these lengths if local alone is used. Duration of action can be extended by incorporating morphine.

Another method of calculating the volume used is occiput-coccygeal length (L_{oc}) (crown rump length). The epidural anaesthetic volume for ropivacaine or bupivacaine can be calculated as follows;

0.05mL/cm L_{oc} will block 30-35% L_{oc}

0.1mL/cm L_{oc} will block 55-60% L_{oc}

0.15mL/cm L_{oc} will block 70-75% L_{oc}

Technique-

The area should be aseptically prepared, the operator gloved and the site draped. Animal positioned in sternal with the limbs drawn forwards. A spinal needle is used, which is advanced perpendicular to the skin until a popping sensation is felt as the ligamentum flavum is penetrated. The stylet is then removed and a 2mL syringe is attached to aspirate and check for inadvertent intra-thecal injection (denoted by the presence of CSF). A test injectate of saline (Irripods – from your supplier) is injected. The solution to be injected is attached and with very gentle pressure the injection begins. Administration should be over 2 minutes. The needle is then withdrawn.

You may prefer to position the animal in lateral recumbency.

Confirming correct needle placement-

- No CSF aspirated
- Popping sensation felt once ligamentum flavum is penetrated
- Lack of resistance to injection (a test injectate of saline may be used)
- Hanging drop technique (epidural space is under slight negative pressure). Only works in sternal.
- Loss of resistance (LOR) technique. A low resistance syringe is attached to the spinal needle. Pressure is applied as the needle is advanced. LOR is noted when the needle enters the epidural space. LOR may occur (false positive) if the needle is in fat. If the needle is blocked false negatives can occur.
- Electrolocation
- **If you aspirate CSF reduce dose by 1/5-1/2 this is therefore an intrathecal technique.**

Contraindications

Absolute

- Infection at injection site
- Coagulopathies
- Hypovolaemia/hypotension – avoid local anaesthetics – opioids ok.

Relative

- Distortion of anatomy- ie pelvic fractures
- Obesity – unable to locate landmarks

Risks of epidurals

- hypotension
- motor blockade (only w local, not opioids)
- urinary retention – always express bladder post sx)
- slow hair regrowth (11%)

Cardiovascular Effects

Negative CV effects usually the result of preganglionic SNS blockade.

Vasodilation produces hypotension. These fibres maintain vascular tone in blood vessels and blocking them causes vasodilation. Blood pools in the venous circulation, reduces venous return, this cardiac output, hence hypotension. Fluid therapy should be provided to counteract this. Some authors advocate a bolus of 10ml/kg Hartmann's when performing an epidural. Secondly, a vasoconstrictor such as ephedrine 0.2mg/kg IV may be required.

If cardioaccelerator fibres serving the heart (T1-T4) are blocked bradycardia can occur. Treatment is with atropine 0.01mg/kg IV or glycopyrrolate 0.01mg/kg IV (slower onset than atropine though).

Spinal Analgesia

- onset more rapid than epidural
- placement confirmation more obvious – CSF issues from the needle hub
- profound anaesthesia
- risk of cardioaccelerator blockade much higher than epidural administration

Doses

Morphine 0.01-0.03mg/kg

Bupivacaine 0.5% 0.05ml/kg blocks up to L3 dermatome

Inadvertent spinal injection of an epidural dose can have profound, fatal consequences so care with confirmation of needle placement and dose calculation is advised

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