Practical Local Anaesthesia

Types of local anaesthesia

- Topical.
- Infiltration anaesthesia.
- Nerve blocks. Can be minor or major nerves - eg, femoral nerve block.
- Intravenous regional block (Bier's block).
- Haematoma blocks.
- Plexus block.
- Extradural and spinal anaesthesia.

Different local anaesthetics

- Lidocaine - duration of action 1-2 hours.
- Bupivacaine - duration of action more than three hours.
- Prilocaine.
- EMLA® cream - consists of a mixture of local anaesthetics (lidocaine and prilocaine).

The duration of action can be doubled with the addition of adrenaline (epinephrine). Adrenaline (epinephrine) leads to vasoconstriction and thus slows absorption of the local anaesthetic. It is often taught that adrenaline (epinephrine)-containing local anaesthetics should not be used in digits or appendages (eg, fingers, toes and penis), as vasoconstriction of end arteries might lead to tissue ischaemia and necrosis. However, careful analysis of the original reports (which mostly pre-date the 1950s) and subsequent studies has not corroborated this. Indeed the addition of dilute adrenaline (epinephrine) - 1:100,000-1:200,000 - can actually reduce the amount of anaesthetic needed and provide better pain control. A measure of caution should remain and the risk of intravascular injection weighed against these benefits.

Practical application of local anaesthesia

Safety points

- Use safe doses, starting with the lowest - this will be affected by the patient's age, weight and comorbidity.
- Monitor patients closely in the 30 minutes after injection, as this is when maximum systemic concentrations occur.
- Always pull back on the syringe before injecting to avoid inadvertent intravascular injection.
- Consider other effects of local anaesthesia in particular locations - eg, oral anaesthesia may impair swallowing.
- If you have any concerns regarding local anaesthesia, even if the procedure is small, delay the procedure and seek further advice.
- Resuscitation facilities and 'What to do in an emergency' charts should be available.

Topical

- Examples include EMLA® cream, tetracaine hydrochloride eye drops, ethyl chloride/dimethyl ether spray.
- EMLA® cream is commonly used in children and occasionally in some adults.
- The EMLA® cream is put, for example, on the back of the hand before cannulation.
- EMLA® cream should be covered with a non-absorbable adhesive.
- However, post-administration it requires at least 60 minutes to take effect.
- Studies suggest that tetracaine hydrochloride gel has a faster onset of action and may be superior to EMLA® cream.
- Local anaesthetic eye drops usually work within a minute after a few seconds of discomfort on application. Their numbing effect can then allow removal of foreign bodies.
- Local refrigerants (eg, ethyl chloride/dimethyl ether spray) essentially freeze the skin.
- Local refrigerants should be sprayed until the skin goes white and then the procedure should be performed immediately.
- Local refrigerants are useful for superficial procedures such as lancing a boil. They are also useful for cannulation in children and adults if there is no time to wait for EMLA® to work.

Infiltration anaesthesia

In all cases of infiltration anaesthesia avoid inadvertent intravascular injection.
Most commonly, this is into the skin. The skin should be prepared adequately to begin with - eg, with iodine.
Inject with the smallest needle, first producing a bleb in the skin; then the needle size can be increased and further anaesthetic infiltrated in the same area.
Wait a few minutes (some say at least 5-10 minutes) before starting the procedure.
Always check that the area is anaesthetised before starting.[4]

Nerve blocks
- Can be minor or major nerves - eg, ring block or femoral nerve block.
- A ring block involves anaesthetising the main nerves of the fingers or toes.
- This involves injecting local anaesthetic at the base of the finger on its lateral and medial sides. This will provide anaesthesia of the whole finger, for example.
- Major nerve blocks and plexus blocks involve injecting fairly large volumes into the nerve plexus - eg, brachial plexus.
- The addition of midazolam may lead to quicker anaesthesia.[5]
This should only be performed in experienced hands and resuscitation facilities should be available.

Haematoma blocks
- This can be used for fractures.
- It involves infiltrating the fracture site with an anaesthetic - eg, lidocaine.
- It should only be performed by experienced specialists.

Intravenous regional block (Bier’s block)
- Provides anaesthesia for the distal arm or leg.[6]
- A cannula is inserted in a distal vein of the limb - eg, the back of the hand.
- A tourniquet is applied to the top of the limb - eg, the arm or thigh, usually in the form of an inflated blood pressure cuff. It is essential that the cuff does not leak and this can be helped by having a second inflated cuff on the arm. There should also be another member of staff on hand whose only job is to maintain the cuff pressure throughout the procedure.
- The patient's blood pressure should be measured before and the cuff pressure is set at least 50 mm Hg above this level.
- The anaesthetic is injected in the cannula.
- This leads to mottling of the skin.
- Then the procedure can be performed.
- The tourniquet should not be released for at least 15 minutes - even if the procedure finishes beforehand, as systemic absorption occurs and toxicity can ensue.[7]
- This procedure should only be performed in a specialist setting by an experienced doctor.
- It should not be used if the procedure is likely to take 15 minutes or less.

Extradural and spinal anaesthesia
Epidural anaesthesia involves injecting anaesthetic agent into the epidural space (ie the space outside the dura mater). The local anaesthetic, most often lidocaine or bupivacaine, leads to inhibition of conduction at the intradural nerve roots arising from the spine. Vascular absorption can vary and enhanced block can occur in the elderly and in pregnant women.

On the other hand, in spinal anaesthesia the anaesthetic is introduced to the cerebrospinal fluid (CSF). The effect is similar to that of extradural anaesthesia but the onset and duration of action are longer, meaning that lower doses can be used.

Practically, these procedures require the patient to curl up in the fetal position and thus are not appropriate in the presence of spinal disease. The procedure involves:
- Antisepsis of the skin.
- The skin being anaesthetised by local infiltration.
- A spinal needle being introduced into an appropriate interspinous space.
- For spinal anaesthesia, the spinal needle being secured in place (which is once CSF appears).
- Injection of anaesthetic.
- Epidural (extradural) blocks are more difficult to perform. However, they are preferred to spinal blocks, as they can be used for prolonged periods of time - eg, labour.

Side-effects of local anaesthesia[8]

Local side-effects
- Pain - this can be reduced by using a smaller needle, pre-warming the local anaesthetic, buffering with sodium bicarbonate and injecting very slowly.
- Allergy, redness of skin.

Systemic side-effects and complications
These usually result from the inadvertent administration of the anaesthetic into the systemic circulation or from rapid absorption:
- CNS toxicity - results in dizziness, visual disturbances, tinnitus, generalised convulsions and eventual coma. Circumoral paraesthesiae is a common early neurotoxic sign.
- Haemodynamic instability - may also occur if cardiovascular toxicity occurs. Intravenous lipid emulsion may be a useful antidote for refractory cardiovascular collapse.
Anaphylaxis may also occur.

For extradural and spinal anaesthesia, see separate Important Complications of Anaesthesia article. The main complications of spinal anaesthesia are:

- Pain - 25% of patients still experience pain despite spinal anaesthesia.
- Post-dural headache from CSF leak.
- Hypotension and bradycardia through blockade of the sympathetic nervous system.
- Limb damage from sensory and motor block.
- Epidural or intrathecal bleed.
- Respiratory failure if a block is 'too high'.
- Direct nerve damage.
- Hypothermia.
- Damage to the spinal cord - this may be transient or permanent.
- Spinal infection.
- Aseptic meningitis.
- Haematoma of the spinal cord - enhanced by use of low molecular weight heparin (LMWH) pre-operatively.
- Anaphylaxis.
- Urinary retention.
- Spinal cord infarction.

Further reading & references

3. EMLA or amethocaine (tetracaine) for topical analgesia in children; Best Evidence Topics
8. British National Formulary (BNF); NICE Evidence Services (UK access only)

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