SHORT REPORT

A users guide for reducing the pain of local anaesthetic administration

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Local anaesthetics (LAs) are used by medical practitioners in a number of clinical settings. The choice of agent and mode of administration is influenced by their experience, speciality and knowledge of the evidence base.
Patients often express concern about the discomfort experienced during injection. Although short lived, the pain of LA administration in some patients is severe enough for them to decline future surgery. Methods to minimise the pain of LA administration relate to (1) the patient, (2) the LA, and (3) the injection technique (table 1). This article aims to provide a practical guide to doctors of all specialities who use LAs.

FACTORS RELATING TO THE PATIENT

1. Reassurance and distraction

Explanation, encouragement, and reassurance play a key role in reducing the pain of LA administration. A calm, unhurried and confident manner in the administrator is helpful. Many practitioners will distract the patient using conversation or music. Some advise patients to concentrate on deep, slow breathing. Others distract patients by rubbing or pinching the skin close to the injection site in order to stimulate larger A-fibres to inhibit the stimuli from C-fibres conveying pain to the spinal cord.[1] More recently, Melzac (1999), emphasised the importance of genetic, behavioural, and cognitive factors in the evoked experience of pain.[2]

Sedation is sometimes necessary but not recommended on a routine basis.

2. Prior application of topical anaesthetic

Desensitisation of the skin or mucous membranes by topical anaesthesia prior to injection of LA reduces pain. Several studies have shown reduced pain when topical anaesthesia is used prior to LA administration in dental procedures,[3 4] cannulation,[5 6] carpal tunnel release,[7] skin grafting,[8 9] and ear surgery.[10]

EMLA cream, a eutectic mixture of the local anaesthetics prilocaine and lignocaine, is one of the most commonly used preparations available. AMETOP, a topical amethocaine, which is faster acting and longer lasting,[11] may also be used, although there is a slightly higher incidence of allergy and minor skin irritation. These need to be applied for at least half an hour prior to the procedure to ensure maximum efficacy. Ethyl Chloride spray is also effective as a superficial anaesthetic to 'freeze' the skin prior to needle puncture.[12]

However, Lal *et al*, found that cognitive-behavioural distraction therapy by an experienced child play specialist was just as effective in reducing pain as topical application of EMLA during venepuncture in children.[13]

FACTORS RELATING TO THE LA

3. Warming

Several studies have shown that warming of LA solution prior to injection reduces pain. However, other studies have suggested little or no effect. Arndt *et al*, claim no significant benefit between LA warmed to body temperature (37°C) compared with that at room temperature (21°C).[14] Bell *et al* (1996) and Alonso *et al* (1993), however, have shown benefit in warming the solution to 37°C and 42°C in prospective blinded randomised control studies.[15 16] With new policies of refrigerating LA at 4°C, particularly those containing adrenaline, there may indeed be a benefit to warming the solution to near body temperature.

LA activity is strongly pH dependent, being higher at raised (alkaline) pH when more of the particles are in the unionised state. It is postulated that warming and buffering (see below) may reduce the pain of LA by shifting the dissociation constant so that a greater proportion of particles are in the uncharged state. Uncharged particles diffuse more readily into the nerve, leading to more rapid and effective inhibition of nerve conduction.[17]

4. Buffering

Several double blind randomised control trials have shown benefit in pain reduction when LA solutions are buffered.[18 19] This particularly applies to the amide group of LAs such as lignocaine and bupivacaine. Addition of 8.4% sodium bicarbonate to LA solution regardless of presence of adrenaline and LA concentration is enough to buffer the solution without risk of precipitation.[20]

Research has shown that the advantages of buffered LA are still evident in terms of speed of onset, duration of action, and anaesthetic effect for up to 1 week of storage. However, most units dispose of any opened vials of LA at the end of each day. 1 ml of bicarbonate (8.4%) can be added to every 9 ml of LA solution.

Table 1 Methods to minimise pain of LA administration

THE PATIENT
1. Reassurance, distraction
2. Topical anaesthesia prior to infiltration
THE LA AGENT
3. Warming – 37–42°C
4. Buffering – 8.4% Sodium Bicarbonate (1 ml/9 ml LA)
THE INJECTION TECHNIQUE
5. Fine (27–30 gauge) and long (>1 inch) needles
6. Slow injection
7. Use smallest volume of solution necessary
8. Infiltrate through wound edges
9. Inject from 'looser' subdermal to 'tighter' dermal
10. Block individual nerves

LA, local anaesthetic.

Abbreviations: LA, local anaesthetics

FACTORS RELATING TO THE INJECTION TECHNIQUE

5. Type of needle – fine and long

It is known that the finer a needle is, the less pain is caused on injection.[21] It is common for most practitioners to use a 25 gauge needle. Dental syringes often have finer needles (27 and 30 gauge). It is therefore recommended that at least a 27 gauge needle is used for infiltration.

Part of the pain of LA administration occurs at the initial penetration of the skin. A long needle allows a wider area to be infiltrated below the surface with a single skin puncture thereby limiting the number of needle punctures required.

Diabetic syringes with short 30 gauge needles may be used to infiltrate a small amount of LA initially before a larger needle is introduced through the same area.

6. Injecting slowly

Pain can also be experienced due to the expansion of subcutaneous tissues during the infiltration of LA. Injecting slowly therefore has an important role in minimising pain.[14 22 23] Greater control and accuracy of the rate of injection can be gained by using the smallest volume syringe available for the amount of LA needed. All too often doctors use a 10ml syringe to inject 3–4 mls of solution.

7. Use smallest volume of solution necessary

Many procedures require no more than 1–2 mls of LA for effective anaesthesia. Using low volume syringes also reduces the chance of an excessive volume being used. Use of the smallest volume necessary for anaesthesia is preferable as an excess volume is unlikely to be of benefit and may cause more pain.

8. Infiltrate through wound edges

It is obvious that, where possible, infiltration should be performed through the wound edges in lacerated or incised wounds. This has been shown to be of benefit in randomised blinded trials.[24]

9. Inject from 'looser' subdermal to 'tighter' intradermal skin

It is well known clinically that injection into 'tighter' tissues such as the lips or tip of the nose can be very painful. Arndt *et al*, showed that infiltration at a deeper subdermal level was less painful than at a superficial intradermal injection, although slower to work.[14]

10. Block nerves where possible

A good knowledge of the anatomy of the peripheral nerve supply is advantageous to successfully administer regional anaesthesia. This is particularly useful where areas contain a high density of sensory nerve endings, which may make local infiltration very painful. Examples include an infra-orbital nerve block to anaesthetise the very sensitive upper lip, or a ring/metacarpal block to anaesthetise the finger.

Combinations of nerves may be advantageously blocked to avoid the need for large volumes of injected LA - for example median, radial and ulnar nerves in the 'wrist block' or the lower limb equivalent, the ankle block.

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