Anesthesia for dermatological surgery

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ABSTRACT

Knowledge of local anesthesia is critically important to perform dermatological surgery. Local anesthetics when used judiciously are extremely safe and allow dermatologists to perform a variety of procedures. This article aims to provide an updated review of local anesthesia and local anesthetic drugs. Side effects of local anesthetics and techniques of regional anesthesia are discussed and some commonly used nerve blocks are explained. A detailed knowledge of the pharmacology of local anesthetics aids in optimal therapeutic use, and in prevention, early diagnosis and management of their toxicities by the clinician.

Key Words: Local anesthesia, Lidocaine, Bupivacaine, EMLA cream

INTRODUCTION

An understanding of local anesthesia is an essential prerequisite to develop a successful dermatological surgery practice. Hence, it is necessary that the dermatologist becomes aware of all options available to him and acquaints herself or himself with other methods such as nerve blocks, sedatives, hypnotics and general anesthesia.

LOCAL ANESTHESIA

A local anesthetic agent is a chemical capable of blocking nerve conduction when applied locally to nerve tissues, without causing permanent nerve damage.

Mechanism of Action of Local Anesthesia

The nerve membrane consists of a bimolecular framework of phospholipid and protein that is punctuated by non-specific channels, one permeant to sodium ions and the other to potassium ions that are controlled by voltage-dependent gates. There is a resting potential of -70 mV on the outside of the membrane which rises to above -55 mV, the firing threshold, before it jumps up to +40 mV to form an action potential, when depolarized. This is associated with movement of sodium ions inwards and potassium ions outwards through their respective channels. During recovery, the ions reverse the direction of their movement across the cell membrane.[1]

Local anesthetic (LA) agents prevent depolarization of the nerve membrane. As the concentration of LA increases, the height of the action potential is reduced, the firing threshold is elevated, the spread of impulse conduction is slowed and the refractory period lengthened. Finally, the nerve conduction is fully blocked. It is thought that LA drugs exert their effect by bonding to the internal mouth of the sodium channel.
and prevent the opening of the channel.

In a myelinated nerve, the site of action is the node of Ranvier. Two or three adjacent nodes must be affected to prevent conduction. At least 6 mm and perhaps 10 mm of nerve fiber must be exposed to the LA agent for it to be effective.

**Local anesthetic agents**

Local anesthesia may be produced by many tertiary amine bases, certain alcohols and a variety of other drugs and toxins. However, all the currently available clinically useful agents are either amino-esters or amino-amides [Table 1]. LAs consist of a lipophilic group, usually a benzene ring, separated from a hydrophilic group, usually a tertiary amine by an intermediate chain that includes an ester or amide linkage. Ester-linked drugs are degraded by hydrolysis in the plasma by plasma cholinesterase and amides by oxidative dealkylation in the liver.\[^2\]

**Choosing a local anesthetic agent**

A relatively small group of local anesthetics is available in the Indian market and is used in dermatology. The choice of LA and its concentration should be dictated by the type of procedure contemplated [Table 2]. A simple procedure such as skin biopsy requires an agent that has a rapid onset of action. Alternatively, if the procedure is complex, then an anesthetic with a longer duration of action is needed [Table 3]. If a large area of skin needs to be anesthetized, a more dilute concentration of the anesthetic must be used. Higher concentrations of the drugs are reserved for nerve blocks.

For most dermatological surgical procedures, 1% lidocaine with epinephrine is an excellent LA if prolonged anesthesia is desired. Bupivacaine should be considered if nerve blocks are being used.\[^2\] Agents which are commonly used in clinical dermatology, are discussed below.

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**Table 1: Chemical classification of local anesthetics**

<table>
<thead>
<tr>
<th>Type</th>
<th>Esters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amino esters</td>
<td>1. Benzoic acid esters: Cocaine, piperoxide</td>
</tr>
<tr>
<td></td>
<td>2. Amino-benzoic acid esters:</td>
</tr>
<tr>
<td></td>
<td>a. Soluble: Procaine, chloroprocaine, tetracaine</td>
</tr>
<tr>
<td></td>
<td>b. Limited solubility: Benzocaine</td>
</tr>
<tr>
<td></td>
<td>3. Para-ethoxy-benzoic acid: Intracaine</td>
</tr>
<tr>
<td></td>
<td>4. Carbamic acid esters: Diathane</td>
</tr>
<tr>
<td></td>
<td>5. Complex synthetics</td>
</tr>
<tr>
<td>Amines</td>
<td>1. Straight chain acid derivatives of xylidine:</td>
</tr>
<tr>
<td></td>
<td>a. Acetic acid: Xylocaine</td>
</tr>
<tr>
<td></td>
<td>b. Propionic acid: Propitocaine</td>
</tr>
<tr>
<td></td>
<td>2. Piperolic derivatives of xylidiide: Mepivacaine, bupivacaine</td>
</tr>
<tr>
<td></td>
<td>3. Oxycinchronic acid: Dibucaine</td>
</tr>
<tr>
<td>Alcohols</td>
<td>1. Ethyl alcohol</td>
</tr>
<tr>
<td></td>
<td>2. Aromatic alcohols: Benzyl alcohol</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1. Quinoline derivatives: Eucupine</td>
</tr>
<tr>
<td></td>
<td>2. Ammonium compounds: Tetra ethyl ammonium</td>
</tr>
</tbody>
</table>

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**Table 2: Clinical utility of local anesthetic agents**

<table>
<thead>
<tr>
<th>Amino esters</th>
<th>Topical</th>
<th>Uses</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine</td>
<td></td>
<td>Tophical</td>
<td>Limited use because of addictive potential</td>
</tr>
<tr>
<td>Procaine</td>
<td>Infiltration, spinal</td>
<td></td>
<td>Limited use because of slow onset, short duration, allergic potential</td>
</tr>
<tr>
<td>Chloroprocaine</td>
<td>Peripheral nerve blocks (PNB), obstetric epidural block</td>
<td>Fast onset, short duration, low systemic toxicity</td>
<td></td>
</tr>
<tr>
<td>Amino amides</td>
<td>Lidocaine*</td>
<td>Infiltration, intravenous regional anesthesia (IVRA), peripheral nerve blocks, epidural and spinal blocks, topical anesthesia</td>
<td>Versatile agent</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>Infiltration, peripheral nerve blocks, surgical epidurals</td>
<td>Versatile agent</td>
<td></td>
</tr>
<tr>
<td>Prilocaine</td>
<td>Infiltration, IVRA, PNBs, surgical epidurals</td>
<td>Metahemoglobinemia at high doses, least systemic toxicity</td>
<td></td>
</tr>
<tr>
<td>Bupivacaine*</td>
<td>Infiltration, PNBs, epidurals, spinal</td>
<td>Sensory or motor separation</td>
<td></td>
</tr>
<tr>
<td>Etidocaine</td>
<td>Infiltration, PNBs, surgical epidurals</td>
<td>Profound motor block</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Benzocaine*</td>
<td>Topical</td>
<td>Limited use</td>
</tr>
</tbody>
</table>

\[^2\]Currently available in India

**Table 3: Local anesthetics used in dermatology**

<table>
<thead>
<tr>
<th>Type of local anesthetic</th>
<th>Relative Potency</th>
<th>Onset of action</th>
<th>Duration of action (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low potency – Short duration</td>
<td>Procaine</td>
<td>Amino-ester 1</td>
<td>Slow</td>
</tr>
<tr>
<td>Intermediate potency and duration:</td>
<td>Chloroprocaine</td>
<td>1</td>
<td>Fast</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>Amino-amide 2</td>
<td>Fast</td>
<td>120-240</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>2</td>
<td>Fast</td>
<td>120-240</td>
</tr>
<tr>
<td>Lignocaine*</td>
<td>2</td>
<td>Fast</td>
<td>90-200</td>
</tr>
<tr>
<td>High potency – Long duration</td>
<td>Tetracaine</td>
<td>Amino-ester 8</td>
<td>Slow</td>
</tr>
<tr>
<td>Bupivacaine*</td>
<td>Amino-amide 8</td>
<td>Intermediate</td>
<td>180-600</td>
</tr>
<tr>
<td>Etidocaine</td>
<td>6</td>
<td>Fast</td>
<td>180-600</td>
</tr>
<tr>
<td>Dibucaine</td>
<td>12</td>
<td>Slow</td>
<td>220-600</td>
</tr>
</tbody>
</table>

\[^2\]Products currently available in India
**Lidocaine**

Lidocaine is a synthetic compound that can be sterilized by boiling. Lidocaine is not irritating to the tissues even at a concentration of 88%. It is 5 times less toxic than cocaine and 1.5 times more than procaine. It is 3 times more potent than procaine. Lidocaine in a concentration of 5% produces surface anesthesia, but this is not satisfactory other than in urology. Lidocaine 1% solution provides anesthesia for 45 min to 1 h. For infiltration anesthesia the penetrability of lignocaine is excellent. The recommended maximum dose is 200-400 mg. A dose of 4.5 mg/kg body weight should not be exceeded for lidocaine. A concentration of 0.5% lidocaine is required for infiltration, 1% for a small nerve block, and 1.5-2% for a large nerve block.

**Bupivacaine**

Bupivacaine is a synthetic homologue of mepivacaine and was first prepared by Ekenstam in 1957. The base is sparingly soluble, but the hydrochloride salt is readily soluble in water. Bupivacaine is also highly stable and can withstand repeated autoclaving. Bupivacaine is 3-4 times more potent than lidocaine or mepivacaine. It provides analgesia for 120-240 min, which is 2-3 times longer than lidocaine. It is reliable for infiltration and for nerve block anesthesia. The total dose of bupivacaine should not exceed 200 mg; the maximum dose in 24 h is 400 mg.

**EMLA cream**

Eutectic (easily melted) Mixture of Local Anesthetics (EMLA) cream consists of a 1:1 mixture of 2.5% lidocaine and 2.5% prilocaine in oil in water emulsion. Most mucous membranes provide a weak barrier to local anesthetic penetration, leading to a rapid onset of action. However, intact skin requires a high water concentration for its penetration and a high concentration of lipid soluble local anesthetic base to ensure analgesia. Hence this eutectic mixture found its way into clinical practice. Dermal analgesia sufficient for beginning an intravenous line requires a contact time of at least 1 hour under occlusive dressing. The maximum depth of analgesia achieved is 5 mm. The depth of penetration, duration of action (usually 1-2 h) and amount of drug absorbed depend on application time, dermal blood flow, keratin thickness and the total dose administered. Typically, 1-2 g of cream is applied per 10 cm² area of skin, with a maximum application area of 2000 cm² in an adult and 100 cm² in a child weighing less than 10 kg.

EMLA cream is effective in decreasing the pain of needle sticks and veni-puncture. It can be used as a LA or as a ‘pre-numbing’ medication before infiltration in various dermatological procedures (e.g. curettage of molluscum contagiosum; intraleosional injection of a corticosteroid for alopecia areata, facial acne cysts, keloids, and hypertrophic scars; cryotherapy for verruca vulgaris; debridement of ulcers; and incision and drainage of abscesses). Split-thickness skin graft harvesting, laser removal of port wine stains, and circumcision have been successfully performed using EMLA cream.

Side effects include skin blanching, erythema and edema. EMLA cream should not be used on mucous membranes or broken skin, or in infants less than 1 month old as in each case a large amount of prilocaine (usually more than 600 mg) if absorbed into the circulation will get metabolized in the liver to o-toluidine, which causes methemoglobinemia. If significant methemoglobinemia occurs, it can be treated with intravenous administration of methylene blue.

**OTHER TOPICAL ANESTHETICS**

Compounded 30-40% lidocaine cream in an emollient base can be used as topical anesthetic. But the commercial preparations of the same are not available.

Four per cent amethocaine gel has a rapid onset and a longer duration of action than lidocaine cream. Adverse effects include erythema, edema, and pruritus. Cetacaine and benzocaine are also useful for decreasing the pain of cutaneous procedures.

**Potentiation of action**

The duration of action of the LA is proportional to the time the drug is in contact with the nerve fibers. For this reason, epinephrine (1:200,000 or 5 µg/ml) is added to LA solutions to produce vasoconstriction. This limits systemic absorption and reduces toxicity by one-third, and prolongs the duration of conduction blockade by 50%. However, the impact of epinephrine
in prolonging the duration of conduction blockade and decreasing the systemic absorption of bupivacaine is less than that observed with lidocaine, presumably because the greater lipid solubility of bupivacaine makes it bind avidly to tissues.

Epinephrine along with lidocaine is contraindicated for local infiltration of skin flaps and for blocks of acral parts like the digits/toes or penis where it may cause excessive vasoconstriction and ischemia of the tissues. Epinephrine administered in the presence of inhaled anesthetics causes enhanced cardiac irritability and dysrhythmias. Its systemic absorption may accentuate systemic hypertension and is therefore used with caution in patients with hypertension. Low molecular weight dextran 40 added to LA solutions in a ratio of 1:1 prolongs the duration of action of the latter, sometimes to as long as 36 hours, as dextran decreases the systemic absorption of local anesthetics. This can be used as an alternative adjunct to LA when adrenaline is contraindicated.

**Combination of local anesthetics**

Local anesthetics may be combined in an effort to produce a rapid onset (e.g. chloroprocaine and lignocaine) and a prolonged duration of action (e.g. 3% chloroprocaine with 0.5% bupivacaine). However, the toxicity of combinations of LA drugs is additive rather than synergistic.

**Side effects**

Local anesthetics are extremely safe if one uses them properly and within the recommended dosage. Their principal side effects are allergic reactions and systemic toxicity. Systemic toxicity is due to excessive plasma and tissue concentrations of the LA. It is estimated to result in seizures in 1 to 4 per 1000 patient exposures to local anesthetics, with bupivacaine being most likely to be associated with this adverse response. The factors influencing LA toxicity are quantity of drug, concentration of drug, presence or absence of adrenaline, vascularity at the site of injection, rate of absorption and rate of destruction of the drug, and age, physical status and weight of the patient.

1. **Allergies**

Allergic reactions are rare. They may take the form of bronchospasm, urticaria or angioneurotic edema. They are well documented in association with the use of amino-esters (like cocaine, procaine, chloroprocaine) as these are derivatives of para-aminobenzoic acid, which is known to be allergenic. No cutaneous reactions occur following the use of amino-amide drugs (like lidocaine, prilocaine, bupivacaine). An allergic reaction after the use of a LA may also be due to methylparaben or similar substances used as preservatives in commercial preparations. These preservatives are structurally similar to para-aminobenzoic acid.

Documentation of allergy to a LA is based on the clinical history and the use of intradermal testing. The occurrence of rash, urticaria and laryngeal edema, with or without hypotension and bronchospasm is highly suggestive of a LA-induced allergic reaction. Conversely, hypotension associated with syncope or tachycardia when an epinephrine–containing LA solution is administered suggests an intravascular injection of drug.

Allergic reactions can be detected by an intradermal test with 0.02 to 0.04 ml of the drug and noting the response in 15-20 min. The reaction includes wheal and erythema around the injection site. Intradermal injections of aminoesters in patients without a presumptive history of local anesthetic allergy results in positive skin reactions in only about 30 per cent of the patients, but no cutaneous reactions occur following the use of aminoamides. No signs of systemic anaphylaxis occur in any of the patients. Treatment of allergic reactions includes epinephrine, antihistamines such as parenteral diphenhydramine, aminophylline and steroids.

2. **Side effects at the injection site**

Apart from pain during injection, LA drugs employed clinically rarely produce localized nerve damage. Other less common local reactions include infection and nerve damage. Proper skin preparation using iodine and alcohol prevents infection. Nerve damage is caused by improper technique. Laceration of the nerve is more likely to occur during peripheral nerve blocks.

3. **Central nervous system toxicity**

The initial symptoms are feelings of light-headedness
and dizziness, followed frequently by visual and auditory disturbances such as difficulty in focusing and tinnitus. Other subjective symptoms include disorientation and drowsiness. Objective signs of CNS toxicity are usually excitatory and include shivering, muscle twitching and tremors, initially involving the muscles of the face and distal parts of the extremities. Ultimately, generalized tonic-clonic seizures can occur. If a sufficiently large dose of LA agent is injected, a rapid increase in blood levels up to 6 $\mu$g/ml may occur and the initial signs of CNS excitation are rapidly followed by a state of generalized CNS depression. The seizures cease and respiratory depression and ultimately respiratory arrest may occur.

**Prophylaxis for CNS toxicity**

The least amount and lowest concentration of LA necessary should be administered. Epinephrine can be used to minimize the absorption and high blood levels can be avoided. The threshold of the CNS toxicity can be raised by pretreatment with barbiturates or benzodiazepines. Negative aspiration for blood into the syringe avoids intravascular injections and also a test dose can be injected to avoid intravascular injections. If the needle is placed intravascularly, after the test dose the patient complains of perioral numbness and slurred speech.

**Treatment of CNS toxicity**

Hundred percent oxygen has to be administered, as a raised PaO$_2$ raises the threshold for seizures. The ventilation has to be assisted to reduce the PaCO$_2$ below normal levels as respiratory or metabolic acidosis increases the risks of CNS toxicity from LAs.$^{[10]}$ Convulsions are treated with endotracheal intubation, controlled ventilation with 100% oxygen, and anticonvulsants such as diazepam or thiopentone.

**4. Cardiovascular system toxicity**

LAs prolong the conduction time through various parts of the heart, and hence can cause an increased PR interval, and QRS complex duration. High concentrations can depress the sino-atrial (SA) node, resulting in sinus bradycardia and sinus arrest. LAs exert a dose-dependent negative inotropic action on the heart, thereby reducing cardiac output and blood pressure.$^{[11]}$ Cardiac resuscitation is more difficult following bupivacaine-induced cardiovascular collapse. Fatal ventricular fibrillations are more common with a large dose of bupivacaine than with lidocaine. Acidosis and hypoxia markedly potentiate the cardiotoxicity of bupivacaine.

**REGIONAL ANESTHESIA**

Regional anesthesia refers to anesthesia of an anatomic part produced by the application of a LA for temporarily blocking conduction in the nerve tissue associated with the part. Regional anesthesia is preferred, as effects of local anesthesia tend to be limited to that part of the body to be operated upon. The various techniques of regional anesthesia include topical anesthesia, infiltration anesthesia, field blocks, peripheral nerve blocks and tumescent anesthesia.

The dermatologist should take careful history of previous exposure to local anesthesia and, more importantly, ‘faint reactions’. An examination of all the systems with a special emphasis on the cardiovascular and respiratory systems is to be undertaken, when the dermatologic procedure planned envisages the use of large quantities of local anesthetic solutions near the toxic doses i.e. 4 mg/kg body weight of lidocaine or up to 7 mg/kg of lidocaine with adrenaline or 2 mg/kg of bupivacaine at a time. Ideally, an informed consent for complications of LA is necessary before proceeding, especially for more than topical anesthesia or when the amount being injected exceeds 1 ml.

**PROS AND CONS FOR REGIONAL ANESTHESIA$^{[1]}$**

The regional anesthesia is indicated when one wants to avoid some of the dangers of general anesthesia and when the surgery is on the skin surface. The regional anesthesia is contraindicated in young children (age below 10 years), uncooperative or restless patients, psychiatric patients and in long operations when the patient may become uncomfortable and restless. It is preferable to have an indwelling intravenous cannula and fluid for infusion during the regional anesthesia technique. A tilting table or trolley with a manual release is helpful to place the patient in a head-low position in case he or she develops a faint reaction or for resuscitation. Facilities to provide 100% oxygen
through a face mask should be available. Resuscitation equipment in the form of an Ambu bag to provide oxygen in an emergent situation is required. Various syringes, needles should be available. Smaller syringes are easier to inject; 26- to 30-gauge needles are preferred.

**TECHNIQUES OF REGIONAL ANESTHESIA**

1. **Topical anesthesia**
   Topical anesthesia is the surface application of a LA to the skin or mucous membrane by means of a spray, spreading of an ointment, instillation with a syringe (as into the urethra) or placement of a saturated pledget of cotton. Lidocaine 2% jelly, EMLA cream, or iontophoresis of lidocaine can allow one to perform simple procedures such as shave biopsies, electrocauterization of epidermal growths or superficial laser surgery. Topical anesthetics can also provide surface anesthesia to permit painless insertion of a needle, especially in children, and on painful areas such as the nose, lips and genitalia.

2. **Infiltration anesthesia**
   This is the most commonly used method of anesthetizing the skin. It consists of injecting the anesthetic agent into the tissue to be cut. The injection may be intradermal, when the anesthesia is almost immediate, or into the subcutaneous tissue, when the anesthesia is usually delayed and has a shorter duration. However, an intradermal injection is more painful. The pain of a LA injection into the skin can be reduced by adding freshly prepared sodium bicarbonate (8.4%) solution to the LA solution in a 1:10 dilution. Local pain can also be reduced by injecting the drug slowly, while pinching the neighboring skin to distract the patient. The infiltration may distort the operative site; this can be minimized by gentle massage after the injection.

3. **Field blocks [Figure 1]**
   A field or ring block is a variation of infiltration anesthesia. The LA agent is placed around the operative site, anesthetizing the nerve fibers leaving from the area. A ring block is useful when direct needle entry into a lesion such as a cyst is not desirable. The LA has to be placed in both superficial and deep planes. This also limits the amount of LA needed to anesthetize the operative site. This is a particular advantage when a large area has to be anesthetized.

4. **Peripheral nerve blocks**
   A peripheral nerve block places the LA along a nerve trunk to produce a conduction block that produces anesthesia in the distribution of the nerve. In dermatological surgery, the commonly employed nerve blocks are for the digits and for the central face, because both areas are painful to anesthetize using local infiltration. Peripheral nerve blocks are difficult to perform and complications include laceration of the nerve, intravascular injection of LA and hematoma formation.

**BLOCKS FOR HEAD AND NECK SURGERY**

Regional anesthesia for head and neck surgery declined rapidly after general anesthesia and tracheal intubation became available and accepted. Still, in no other area of the body can such small doses of a LA cause such an effective regional block. However, such small doses in this location can also produce systemic toxicity very easily. The head and neck blockade is useful to diagnose and treat pain syndromes. Many plastic surgical procedures and laser resurfacing of the face can be performed easily with effective blockade of the nerves of the head and neck.

Maxillary and mandibular blocks: Sensory innervation of the face is from the trigeminal nerve, through its
three branches: ophthalmic, maxillary and mandibular [Figure 2]. Maxillary nerve blockade can be used to perform surgical procedures in its cutaneous distribution (V₂ in Figure 2). Three to five ml of LA will produce anesthesia to the upper jaw, skin on the lower eyelid, cheek and upper eyelid. Maxillary nerve block can cause hematoma formation. The spread of LA to the optic nerve can cause temporary blindness. Three to five ml of LA will produce anesthesia of the skin of the lower jaw and the skin anterior and superior to the ear (V₃ in Figure 2). If the needle is advanced more than the recommended 0.5 cm past the pterygoid plate, the pharynx may be entered. Rarely, the subarachnoid spread of LA results in brain stem anestheisa.

Apart from these two major branches of the trigeminal nerve, large areas of the face can be anesthetized by blocking different smaller branches of the trigeminal nerve.

**Forehead:** The supraorbital nerve is blocked by injecting 1-2 ml of lidocaine toward (but not in) the supraorbital notch, which lies along the supraorbital ridge in the mid-pupillary line. The supratrochlear nerve lies at the junction of the nasal root and the upper orbital rim. These two nerves when blocked anesthetize the medial forehead from the eyebrow to the scalp.

**Cheek, Eyelid and Nose:** The infraorbital nerve that supplies the lower eyelid, medial cheek, sidewall of the nose and upper lip exits the infraorbital foramen 1 cm below the infraorbital ridge in the mid-pupillary line. Two ml of 2% lidocaine is placed around the foramen, which can be palpated without difficulty.

**Chin:** The mental nerve block can anesthetize the chin and the lower lip. The mental nerve exits the mental foramen approximately 2.5 cm from the midline in the mid-pupillary line.

**ANESTHESIA FOR THE HAND**

The radial, median and ulnar nerves have to be blocked at the wrist to achieve anesthesia over the hand. Each nerve can be blocked singly to achieve analgesia over the skin supplied by the respective nerve.

**Radial nerve:** At the level of the ulnar styloid, sensory branches to the radial side of the thumb lie between the radial artery and the flexor carpi radialis tendon. One to two ml of LA deposited in this interval, deep to the tendon, will block this sensation. The dorsal branches can be blocked with a linear field block at the level of the ulnar styloid from the volar lateral edge of the radius to the mid-forearm and this anesthetizes the dorsal aspect of the lateral 3½ fingers [Figure 3].

**Median nerve:** The patient is asked to flex the wrist against resistance, to identify the palmaris longus tendon. It is marked at the proximal flexion crease. A 22-25 gauge needle is inserted medial and deep to the palmaris longus, and 3-5 ml of anesthetic is injected.
Ulnar nerve: A 22-gauge needle is directed just medial to the ulnar artery pulse or immediately lateral to the flexor carpi ulnaris if the pulse is not palpable. Three to five ml of LA will suffice [Figure 4].

Digital block [Figure 5]
Each digit is supplied by two dorsal and two ventral nerves located close to the bone. The digital nerves are blocked in the web space; the needle enters the web space at a superior angle and about 1 ml of LA is injected around the base of the digit. LA agents containing epinephrine should not be used.

Intercostal Nerve Block
Intercostal blocks can be used for a wide variety of intraoperative and postoperative applications. Repeated blocks or application of LA through an intrapleural catheter provide excellent pain relief for rib fractures and herpes zoster.

Complications
The major complication is pneumothorax. There is a risk of LA toxicity with multiple intercostal blocks because of the large volumes and rapid absorption of the solutions. Patients with severe pulmonary disease who rely on their intercostal muscles may develop respiratory decompensation after bilateral intercostal blockade.

Technique [Figures 6 and 7]
The intercostal nerve can be blocked at the angle of the rib just lateral to the sacrospinalis muscle group. The patient is placed prone with a pillow under the abdomen to reduce the lumbar curve. A line is drawn along the posterior vertebral spines. Nearly parallel lines are drawn along the posterior angles of the ribs, which can be palpated 6-8 cm from the midline. The inferior edge of each rib is palpated and marked on the line intersecting the posterior angle of the rib. A 22-gauge 4-cm needle is inserted at the point marked until it rests on the rib. Then the needle is ‘walked’ 3-5 mm off the lower rib edge, and 3-5 ml of LA is injected.
This procedure is repeated at each rib. Alternatively, intercostal block can be performed in the supine patient in the mid-axillary line.

JAIPUR BLOCK

Postherpetic neuralgia can be treated with the Jaipur block, which consists of local subcutaneous infiltration of 2% lidocaine, 0.5% bupivacaine and 4 mg/ml dexamethasone solution. Not many patients require a third injection. Non-responders either are old or have pain for a period longer than 2 years.¹²

5. Tumescent anesthesia: This is a technique of local anesthesia which involves the subcutaneous injection of large volumes of dilute LA in combination with epinephrine and other agents. It is used for dermabrasion, skin grafting, rhinophyma correction, liposuction and hair transplant procedures. The injection consists of 1000 ml of normal saline, 50 ml of 1% lidocaine, 1 ml of 1:1000 adrenaline and 12.5 ml of sodium bicarbonate (1 mEq/l). Total doses of lidocaine range between 35-55 mg/kg, and the plasma concentrations may peak more than 8-12 hours after infusion.¹³ Clinicians are advised to exercise great caution in administering additional local anesthesia by infiltration or other routes for at least 12-18 hours following the use of this technique.

Supplementation with sedation

Dangers of intravenous sedation in regional blockade include undetected, sometimes fatal respiratory insufficiency. It should be used only in selected cases with minimal doses, extreme care and full monitoring. This situation is an example of the differences between the ideal world (no sedation needed) and the real world (some patients are terrified and the procedure cannot be done without it!).¹⁴

Purposes

1. To allay anxiety and control restlessness, opioids such as fentanyl or remifentanil boluses or continuous infusion, and benzodiazepines (e.g. midazolam 1-2 mg IV) or propofol infusion (target level 1 µg/ml).

Midazolam provides more rapid onset of action and a shorter recovery time, compared to diazepam. It is twice as potent as diazepam, is better absorbed after an intramuscular injection. The IM dose is 0.07-0.08 mg/kg. Sedation occurs in 15 minutes and peaks in 30-60 min. Anterograde amnesia that occurs in all the patients is an added benefit. Intravenous midazolam causes no phlebitis. Sedation occurs in 3-5 min and lasts for 30 min. It is safe to use in pediatric age group. Midazolam is only a sedative and not an analgesic like opiates.

2. To provide extra analgesia for less than perfect blocks, e.g. NSAIDs, short-acting opioids or nitrous oxide or low-dose ketamine intravenously.

3. To prevent vasovagal (faint) reactions during procedure.

Children may require more sedation, even light anesthesia. Reassuring conversation or relaxing music through headphones also serve the same purpose.

Some practical tips for successful infiltration anesthesia in dermatology:

1. Use a 26-gauge to 30-gauge needle.
2. Inject slowly. This hurts less and the toxicity is less.
3. Deeper injections into the subcutaneous area hurt less than intradermal injections.
4. Repetitive pinching of the skin during lidocaine...
infiltration reduces the level of pain and patient discomfort.[15]

5. If possible, insert the needle tip through a dilated pore. This minimizes pain associated with needle stick.
6. Use the smallest amount of anesthetic.
7. Pain on injection of LA can be reduced by buffering the drug using 8.4% sodium bicarbonate and also by slowing the rate of injection.[16]
8. Smaller syringes make slower injections easier to perform.
9. Minimize the number of needle punctures by moving the needle in a fan shape. When reinserting a needle, try to do so into an area that has already been numbed.
10. Check for aspiration of blood to prevent inadvertent intravascular placement of needle.
11. For longer procedures, use bupivacaine.
12. Keep talking to the patient to allay anxiety and for early detection of toxicity.

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REFERENCES