



Review Article

Anesthesia in Dermatological Practice: A short review

Balakumaran Chandrasekaran¹, Geo Celestin Danny¹ , Ashok Kumar¹, Sukanya Gurusamy¹, Sakthi Megalai^{1*}

¹Dept. of Dermatology, Venereology and Leprosy, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India

Abstract

Dermatologists are extensively using anesthetics to provide analgesia in dermatologic and laser procedures. The purpose of this review article is to provide some insight on the anesthesia and anaesthetic medications already in use in dermatological practice along with the newer modalities in anesthesia. Anesthetic side effects and regional anesthesia techniques are covered, as well as several regularly used nerve blocks. A thorough understanding of the pharmacology of anesthetics benefits the clinician's optimal therapeutic usage, as well as the avoidance, early diagnosis, and management of their toxicities.

Keywords: Dermatology, Cryoanesthesia, Local anesthesia, Topical anesthesia, Lignocaine

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1. Introduction

Anesthetics have been used to reduce pain during routine operations like punch and shave biopsies, electrosurgery and curettage. In recent history, the advent of aesthetic medicine and lasers has been a major promoter of out-patient dermatology operations. Laser-assisted hair removal is one of the most common procedures which requires topical anesthetics, especially in the upper lip and pubic regions. Local anesthesia is an important tool for day care procedures.

Broadly, anesthesia can be classified as-

1. Local Anesthesia
2. Regional Anesthesia
3. General Anesthesia

2. Materials and Methods

A thorough literature review was conducted to search for information about the various modalities of anesthesia being used in the practice of dermatology. The literature searches were done using PubMed and Google Scholar, using key phrases like "types of anesthesia," "classification of local anesthesia," "regional anesthesia," "adverse effects of

anesthesia," "tumescent anesthesia," "general anesthesia," and "cryoanesthesia." The study includes the articles that were extracted from the publications that were published in English between the years of 2012 and 2022. The findings of these studies were synthesized into a narrative review.

3. Discussion**3.1. Local anesthesia****3.1.1. History of local anesthetics**

Coca was the Incas' word for the substance obtained from the *Erythroxylum coca* plant. In 1860, Niemann discovered the active constituent, cocaine, and in 1884, German surgeon Karl Koller proved that ocular procedures could be performed without the use of general anesthesia by applying cocaine topically to the conjunctiva. Procaine and tetracaine, two more ester anesthetics, were developed later. Lofgren created lidocaine, the first amide anaesthetic, in 1943.¹

3.1.2. Mechanism of action

Local anesthetic agents inhibit action potentials by blocking voltage-gated Na⁺ channels. They inhibit action potentials in

*Corresponding author: Sakthi Megalai
Email: shakthisara19@gmail.com

nociceptive fibers, thereby blocking the transmission of pain impulses.

An amine group, an aromatic ring, and an intermediate chain are three components of local anesthetics. The lipophilic aromatic ring allows the anesthetic to permeate the nerve membrane which is quite lipophilic. More the lipophilicity, more is the potency of the anesthetic. Local anesthetics are categorized as amide or ester based on the intermediate chain that connects the aromatic and amine sections. (**Table 1**) Esters are metabolized by plasma cholinesterases, producing para-aminobenzoic acid (PABA), an allergen, whereas amides are less allergic and are hydrolyzed by microsomal enzymes in the liver.²

If sustained anesthesia is sought for dermatological operations, 1% lidocaine-epinephrine solution is a suitable local anesthetic. Epinephrine is frequently added to a local anesthetic solution, allowing the doctor to utilize a lesser dose of anesthesia while maintaining safety. Additionally, epinephrine acts as a vasoconstrictor, delaying the anesthetic's absorption into the peripheral arteriole and therefore lengthening the action duration. Inducing vasoconstriction in the surgical field with epinephrine can also help with hemostasis. The dose of epinephrine utilized, however, should not exceed 1 to 100,000 dilution. The drug can trigger arrhythmias in some patients, especially those who are receiving halothane. Since epinephrine can reduce flap viability, the operating doctor must consider this while deciding the dose, and whether it can be used in the first place. Finally, epinephrine should never be used on the ear, penis or nose, which have end arterial supply.³

3.1.3. Lignocaine/Lidocaine

Even at high concentrations (as high as 88 percent), lignocaine does not irritate the tissues. It has three times the potency of procaine.⁴ (**Figure 1**) A 1 percent solution of lignocaine provides anesthesia for 45 minutes to 1 hour. Lignocaine has great penetrability for infiltration anesthesia. The maximum dose in adults without epinephrine is 4.5 mg/kg, with epinephrine it can go up to 7mg/kg. In children a maximum dose of 1.5 to 2 mg/kg is optimum without epinephrine and 3.0 to 4.5 mg/kg with epinephrine. Infiltration requires a concentration of 0.5 percent lignocaine, 1 percent to perform a minor nerve block, and 1.5-2 percent to perform a big nerve block. With topical lignocaine-containing anesthetics, pain attributed to laser therapy for pigmented (e.g., cafe-au-lait spot, lentigo) and vascular (e.g., hemangioma, telangiectasia, port-wine stain) lesions has been reduced. The use of topical anesthetics prior to chemical peeling lessens discomfort, while also keeping the peel's therapeutic efficacy at an optimum level. Topical lignocaine has also been shown to help with Q-switched laser tattoo removal by reducing the strong hot needle-like sensations.⁵

The local anesthetic most frequently used in Mohs micrographic surgery is lidocaine. Bupivacaine solution in strengths of 0.25 percent, 0.50 percent, and 1.0percent; 1 percent diphenhydramine, or bacteriostatic normal saline are utilized if the patient is allergic to lidocaine.⁶

3.1.4. Bupivacaine

Bupivacaine has a potency that is three to four times that of lignocaine or mepivacaine (**Figure 1**). It has a duration of analgesia of 120-240 minutes, which is 2-3 times that of lignocaine (**Figure 1**). Infiltration and nerve block anesthesia are both safe indications of bupivacaine. The total bupivacaine dose should be 175 mg without epinephrine and 225 mg with epinephrine.

3.1.5. EMLA or eutectic mixture of local anesthetics

A 1:1 ratio of 2.5 percent lignocaine and 2.5 percent prilocaine in an oil in water emulsion makes up EMLA cream. To produce analgesia, 1 hour of contact under occlusion is necessary, with a maximum depth of 5mm possible. It can be used for intralesional injection of a corticosteroid for alopecia areata, keloids, facial acne cysts, hypertrophic scars; curettage of molluscum contagiosum; debridement of ulcers; cryotherapy for verruca vulgaris, split skin graft harvesting, laser removal of port wine stains, and incision and drainage of abscesses. EMLA has reduced discomfort attributed to neodymium-doped yttrium aluminum garnet (YAG) laser hair removal. Because prilocaine (typically over 600 mg) is absorbed in the blood stream and converted to o-toluidine in the liver, causing methemoglobinemia, EMLA cream should not be used on broken skin or mucous membranes, or in newborns younger than the age of one month. If severe methemoglobinemia develops, it can be treated with methylene blue administered intravenously. EMLA belongs to category B, so it is to be given with caution to mothers who are breastfeeding.

3.1.6. Lidocaine/Tetracaine cream

One of the more recent alternatives, the lidocaine/tetracaine cream, provides efficient pain relief, has minimal side effects, and has a longer duration of action when compared to other topical local anesthetics.⁷ The lidocaine/tetracaine cream is made of an equal mixture of lidocaine and tetracaine (7% each). Adults experience undetectable tetracaine plasma levels (less than 0.9 ng/mL) and peak lidocaine concentrations of 220 ng/mL after applying 59 g of lidocaine/tetracaine cream over 400 cm square for up to 120 minutes. Lidocaine/tetracaine is FDA-approved for adults 18 years of age and older. Edema, temporary cutaneous erythema, and skin pigmentation are the commonly seen side effects.

Local anesthetics can be combined to create a faster onset (e.g. lignocaine and chlorprocaine) and a lengthier duration of action (e.g. 0.5 percent bupivacaine with 3 percent chlorprocaine).⁸

3.1.7. Adverse effects of local anesthetic medications

Local anesthetic formulations such as benzocaine, lignocaine, and tetracaine, when applied incorrectly, can result in serious consequences, including death. Long-term use, use of excessive doses, and application on broad surface areas all raise the risk of central nervous system damage and cardiotoxicity.

Bronchospasm, urticaria, and angioneurotic edema are all manifestations of an allergic reaction. Because amino-esters (such as cocaine, procaine, and chlorprocaine) are derivatives of para-aminobenzoic acid, which has allergic manifestations, they should be used with caution. The usage of amino-amides causes no cutaneous responses (like bupivacaine, prilocaine and lidocaine).

An intradermal injection test using 0.02 to 0.04 ml of the anaesthetic, and a response time of 15-20 minutes can be used to detect allergic responses. Wheal and erythema surrounding the injection site are symptoms of the reaction. Epinephrine and antihistamines such as diphenhydramine and aminophylline, as well as steroids, can be used to treat allergic responses.

Pain upon injection, regional nerve injury and infections are other side effects, along with ecchymoses and hematoma formation.^{9,10} Infection can be avoided by properly preparing the skin with iodine and alcohol. Improper technique leads to nerve injury. During peripheral nerve block, nerve laceration is a big possibility.¹¹

Dizziness, light-headedness, tinnitus and visual difficulties can be experienced. Shivering, muscular twitching, and tremors are typical excitatory indications of CNS poisoning, affecting the musculature of face and distal extremities at first. Seizures that are tonic-clonic in nature can develop into generalized tonic-clonic seizures. Respiratory depression and eventually respiratory arrest are possible outcomes. Local anesthetics generate an increase in the PR interval and QRS complex duration, which can cause sinus bradycardia and sinus arrest by depressing the sino-atrial (SA) node. They also reduce cardiac output and blood pressure. Bupivacaine causes CVS collapse via ventricular fibrillation.¹²

3.1.8. Management of toxicity

Because an increased PaO₂ raises the seizure threshold, 100% oxygen must be supplied. Endotracheal intubation-regulated breathing with 100 percent oxygen, and anticonvulsants such as thiopentone and diazepam are used to treat convulsions.

The topical anaesthetic must be rinsed off as soon as possible when the patient is suffering from any of the side effects. Vital signs should be evaluated while the patient is in a supine position. Maintaining ventilation and a viable airway are critical if the patient is seen to be losing consciousness. It

is advised that benzodiazepines be given. Serum lignocaine levels are to be examined. Anticonvulsants are given as a preventative measure or to treat post-anesthetic toxicity seizures.

3.1.9. Precautions

1. Administration of local anesthetics is done in supine position, preferably in Trendelenburg position, to avoid syncope secondary to vasovagal attack.
2. Emergency trolley is to be placed in the room where the dermatological operation is being carried out. Hydrocortisone, pheniramine maleate, adrenaline and atropine are all emergency drugs that should be placed along with the instruments.
3. History of allergy to any drugs or local anaesthetic to be duly noted.
4. Presence of systemic conditions like liver dysfunction and hypertension to be noted
5. Details regarding drugs the patient is taking, such as phenytoin, beta blockers should be noted.¹³
6. An intradermal test can be used to identify allergic responses by testing the substance using 0.02 to 0.04 ml and recording the response in 15 to 20 minutes. The response consists of wheal and erythema near the injection site.
7. If no safe local anaesthetic agent can be decided upon due to allergic response after test dose administration, 1 percent Diphenhydramine or normal saline are alternative anaesthetic options in selected instances. Topical capsaicin is a topical analgesic with a limited anaesthetic effect.

4. Regional Anesthesia

When surgery is performed on the skin surface, regional anesthesia can be used to prevent some of the risks associated with general anesthesia. In young children who are uncooperative or restless, in patients with psychiatric concerns, and in extended surgeries where the patient may grow agitated, uncomfortable, or restless, regional anesthetic is contraindicated. During the regional anesthetic procedure, it's desirable to have an I.V. cannula and fluid for infusion. In case the patient has a faint reaction or needs resuscitation, he or she is positioned in a head-low posture. It should be possible to get 100 percent oxygen by wearing a face mask. An Automated Artificial Manual Breathing Unit (AMBU) bag is a piece of resuscitation equipment that provides oxygen in an emergency.¹⁴

4.1. Regional anesthesia techniques

Topical regional anesthesia is the method of spraying, ointment spreading, or syringe instillation, to provide local anesthesia. Simple operations like superficial laser surgery, electrocauterization of epidermal growths and shave biopsies can be performed with lignocaine 2 percent jelly, EMLA cream, or lignocaine iontophoresis.¹⁵

4.2. Anesthesia by infiltration

It entails administering a local anaesthetic into the tissue to be sliced. The injection can be intradermal, which provides virtually instantaneous anesthesia, or subcutaneous, which provides delayed anesthesia with a lesser duration.

A ring or field block is quite similar to infiltration. The agent is applied to the operation site and anesthetizes the nerve fibers that exit the area. When needle penetration into a lesion like a cyst, isn't ideal, a ring block can be used. In both the deep and superficial planes, the anesthetic must be injected. The amount of anesthetic required to anesthetize the location is also reduced using ring block. This is very useful when a vast area needs to be anesthetized.

4.3. Peripheral nerve block

The anesthetic is placed along a nerve trunk to generate a conduction block, which results in anesthesia in the distribution area of the nerve (**Figure 2**).

Most widely used nerve blocks in dermatological surgery are for the central face and digits. With efficient blockage of the head and neck nerves, several plastic surgery operations and laser resurfacing surgeries of the face are performed.

4.3.1. Digital block

Two ventral and two dorsal nerves placed near bone supply each digit. In the web space, the digital nerves are blocked; the needle is inserted at a superior angle into the web space, and about 1 ml of anesthetic is injected in the areas surrounding the base of the finger.¹⁶

4.3.2. Anesthesia of hand

This constitutes administering infiltrative, peripheral nerve blocks to target the sensory supply of medial, ulnar or radial nerve, which are the major nerves over the forearms and hands.¹⁷ (**Figure 2**)

4.3.3. Jaipur block

The Jaipur block, which comprises of a local S.C. infiltration of 2 percent lignocaine, 4 mg/ml dexamethasone, and 0.5 percent bupivacaine solution, can be used to treat post-herpetic neuralgia.

4.3.4. Tumescence anesthesia

Tumescent Anesthesia involves injecting vast amounts of dilute anesthetic under the skin, along with epinephrine and other medications. Hair transplant, liposuction, rhinophyma correction, skin grafting and dermabrasion are all performed following tumescent anesthesia, with 1% lignocaine (50 ml), 12.5 mL sodium bicarbonate (1 mEq/L), 1 mL 1:1000 adrenaline, and 1000 mL normal saline. Lignocaine total dosages range from 35 to 55 mg/kg, with plasma concentrations peaking 8 to 12 hours after infusion.

Table 1: Classification of LA agents on the basis of chemical structure

Esters	Amides
Benzocaine	Articaine
Chloroprocaine	Bupivacaine
Cocaine	Dibucaine
Procaine	Etidocaine
Proparacaine	Lidocaine
Tetracaine	Levobupivacaine
	Mepivacaine
	Prilocaine
	Ropivacaine

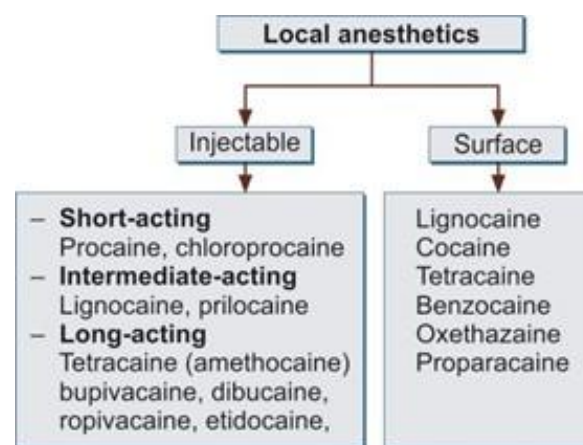
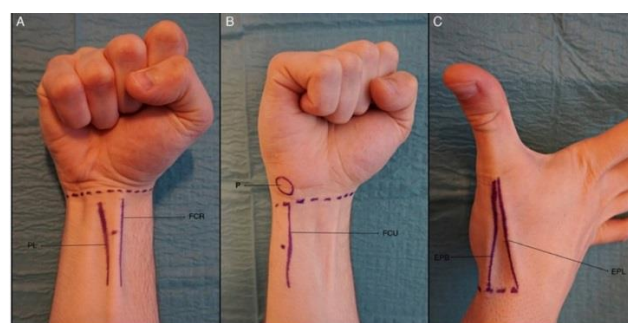


Figure 1: Classification of local anesthetics



Peripheral nerve blocks at the wrist. A, Median nerve block. B, Ulnar nerve block. C, Radial nerve block.

Figure 2: Peripheral nerve blocks at the wrist¹⁷

5. General Anesthesia

Patients having surgical operations that require deep relaxation for longer durations are best meant for general Anesthesia. General Anesthesia maybe used for surgeries where the patient cannot be effectively sedated with local or regional anesthetic, or in instances where severe blood loss or a compromise in breathing is anticipated. It may be useful for uncompliant patients, like those in the pediatric age group. Other procedures like surgical excision of epidermal cysts, and laser treatment of vascular lesions might be rarer indications.¹⁸

6. Cryoanesthesia

The use of cold to relieve pain has been around for a long time. Topical analgesia for superficial operations such as shave biopsy is an intriguing application of light nitrogen. The procedure's simplicity, speed, and lack of the need for penetrating local anesthetic make it an excellent choice for shave biopsy.¹⁹

Cryoanesthesia is an efficient technique of anesthesia in administration of injections containing botulinum toxin for hyperhidrosis of the palms. Ice can be placed directly to the skin and then withdrawn to allow for a relatively painless injection. Similarly, it can be used to reduce pain in intralesional steroid application. This can be accomplished with circumferential cryoanesthesia. The use of a glove filled with water which is then allowed to freeze, has been described as a method for circumferential cryoanesthesia.²⁰

The use of platelet-rich plasma (PRP) as a hair loss treatment is on the rise all over the world. It results in pain and discomfort, and most patients need some kind of anesthetic to lessen the discomfort. Scalp cooling reduces alopecia brought on by chemotherapy and can be utilized as a non-invasive pain management technique. For 30 minutes before to the operation, the patient is required to keep a frozen hypothermic scalp cap (Elasto-gel) that is kept at or below 10°C.²¹

7. Other Modalities of Anesthesia

0.9 percent Sodium Chloride can be used as an intradermal, short acting anesthetic, and can be used in cases where patient is allergic to conventional anesthetics. Administration of this modality is less painful as compared to other anesthetics.²²

Diphenhydramine can be used intradermally. It has a longer duration of action but is a more painful modality. It is known to cause rebound hyperesthesia.²²

Benzyl alcohol is an ester-based anesthetic (unrelated to PABA), it is less allergic. It is short acting (two-three minutes), and less painful on administration.²²

Vibration competitively inhibits C fibers and A-delta fibres, which work on pain transduction. It is being used in cosmetic procedures like Botulinum toxin injections. It might cause tingling teeth sensations, headache and bruising as side effects.²²

Ethyl chloride and dichlorotetrafluoroethane sprays are being used for analgesia, for preparation for digital ring blocks. These short-acting substances (four to six seconds) may be used in conjunction with injectable anesthetics.²²

8. Conclusion

Dermatological procedures and lasers have been major promoters of out-patient dermatology operations. Local anesthesia is an important tool for day care procedures. The

traditional methods of anesthesia are still the most popular, these being lidocaine-epinephrine topical and injectables, Eutectic Mixture of Local Anesthetics (EMLA), and injectable preparations of bupivacaine for infiltrative anesthesia and nerve blocks. It is important to administer test dose, pick up symptoms and signs of possible allergic reactions, and manage the toxicity associated with anesthetic agents. Amongst the newer methods in anesthesia in dermatology, the authors feel that cryoanesthesia is the most practical and efficient mode of Anesthesia in both regular and sophisticated dermatology procedures. Ring block, digital block, peripheral nerve blocks, tumescent anesthesia and Jaipur block are other facets of anesthesia. This review has given a concise viewpoint of the different modes of anesthesia in dermatological practice and has highlighted the importance of newer modalities of anesthesia in procedural dermatology.

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10. Conflicts of Interest

None.

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