Recommendations

Guidelines for administration of local anesthesia for dermatosurgery and cosmetic dermatology procedures

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ABSTRACT

Introduction, definition, rationale and scope: Dermatosurgery and Cosmetic dermatology procedures are being performed by increasing number of dermatologists. Most dermatosurgeries are performed in an outpatient setting and as day care surgeries, under local anesthesia. Hence, it is important to improve patient comfort during all procedures. These guidelines seek to lay down directives in the use of local anesthesia, outline the different local anesthetics, the mode of administration, complications arising out of such procedure and management of the same. **Facility for administration of local anesthesia:** Local anesthesia is usually administered in the dermatologist's procedure room. The room should be equipped to deal with any emergencies arising from administration of local anesthesia. **Qualifications of local anesthesia administrator:** Local anesthesia administrator is a person who applies or injects local anesthetic agent for causing analgesia. Procedures done under local anesthesia are classified as Level I office procedures and require the administrator to have completed a course in Basic Cardiac Life Support (BCLS). **Evaluation of patients for topical or infiltrative anesthesia:** Details of patient's past medical history and history of medications should be noted. Allergy to any medications should be specifically enquired and documented. Patients for tumescent anesthesia need additional precautions to be observed as described in these guidelines. **Methods of administration of local anesthesia:** Different methods include topical anesthesia, field block, ring block, local infiltration and nerve block. Also, it includes use of local anesthetics for anesthetizing oral and genital mucosa. Tumescent anesthesia is a special form of local anesthesia used in liposuction and certain selected procedures. **Local anesthetic agents:** Different local anesthetics are available such as lignocaine, prilocaine, bupivacaine. The dermatologist should be aware of the onset, duration of action, side effects and drug interactions of these agents. **Side effects of local anesthetics:** Various local and systemic side effects and complications arising from administration of local anesthetics have to be timely recognized and treated effectively. Skin testing prior to administration of local anesthetic is recommended.

Key words: Local anesthesia, Lignocaine, Adrenaline, Topical anesthesia, Digital block

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LEVEL OF EVIDENCE
Level A: Strong research-based evidence; multiple relevant, high-quality scientific studies with homogeneous results.
Level B: Moderate research-based evidence; at least one relevant, high-quality study or multiple adequate studies.
Level C: Limited research-based evidence; at least one adequate scientific study.
Level D: No research-based evidence; expert panel evaluation of other information.
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INTRODUCTION

Definition, rationale and scope

Most dermatological procedures are performed under local anesthesia as day care procedures. Hence, it is essential that the dermatologist be aware of the various local anesthetics, the mode of administration, complications arising out of such procedure and management of the same. These guidelines seek to establish minimum standards of care for the use of different anesthetics in dermatosurgical procedures including local anesthetics, topical anesthetics, and also different types of anesthesia such as infiltration, nerve blocks and tumescent anesthesia. Side effects, complications and precautions to be observed during anesthesia will be discussed.[1]

FACILITY FOR ADMINISTRATION OF LOCAL ANESTHESIA

Local anesthesia is usually administered in the dermatosurgery procedure room.

- Administration of local anesthetics should always be done in supine position in view of occurrence of syncope secondary to vasovagal attack. Hence, it is preferable to have a couch which can be manually or automatically changed to Trendelenburg position to manage any syncopal attack. Proper lighting is very essential to avoid blood vessel while injecting local anesthetic.
- The room should be equipped with essential instruments and medications to deal with any emergencies arising from administration of local anesthesia. An emergency trolley should be in place in the procedure room. These details may be found in the guidelines on dermatosurgery operation theatre, which are separately discussed.
- A stethoscope, blood pressure measuring apparatus, ambu bag, oxygen cylinder and endotracheal tube should be kept in an easily accessible area. Dermatologist and the assisting nurse should be knowledgeable about its location and use. It is recommended that pediatric size essential apparatuses are also available. A protocol should be in place to handle emergencies arising out of possible hypersensitivity reactions.
- A minimum of 5 vials/ ampoules of each of the emergency medications like hydrocortisone, pheniramine maleate, adrenaline and atropine should be kept along with the instruments. For details of such instruments please see the guidelines on operation theatre which are being published separately.

PHYSICIAN QUALIFICATIONS

Local anesthesia administrator (LAA) is a person who applies or injects local anesthetic agent for causing analgesia.

- LAA should be a qualified doctor (Medical graduate or post graduate Master / Diploma degree) with sufficient training in administering local anesthesia. Such training and experience is generally gained during internship and postgraduation. However, specialized forms of anesthesia such as tumescent anesthesia and certain nerve blocks need additional specified training in dedicated workshops.
- LAA should be well versed with the anatomy of the region where the anesthesia is being administered; the course and surface anatomy of prominent blood vessels and the nerves that need to be anesthetized
- LAA should have the pharmacological knowledge of various local anesthetic agents and choose the most appropriate one among them for any particular patient
- He/ she should be able to recognize and manage any complication arising due to the local anesthetic agent viz., allergy or from the procedure of administration of local anesthesia
- Procedures done under local anesthesia are classified as Level I office surgery[2] and require the administrator to have completed a course in Basic Cardiac Life Support (BCLS). Level I office surgery has been defined as *"those minor procedures that are done under topical or local anesthesia without drug induced alteration of consciousness except for minimal preoperative anxiolytic medications."*

EVALUATION OF PATIENTS FOR TOPICAL OR INFILTRATIVE ANESTHESIA

- History of allergy to any of the local anesthetic or any other medication should be recorded
- History of presence of systemic illness like hypertension, liver dysfunction should be noted
- Information regarding all the medications patient is taking like beta blockers, phenytoin should be recorded
- Informed consent should include specific consent for intradermal test for infiltration local anesthesia
- Tumescent anesthesia may need additional historical information as mentioned below

METHOD OF ADMINISTRATION OF LOCAL ANESTHESIA

Local anesthesia can be topical anesthesia (skin and

mucosa), infiltration anesthesia, field block or ring block, peripheral nerve block and tumescent anesthesia.

- Topical anesthesia is application of local anesthetic agent on the skin or mucosa for causing analgesia. The delivery of the medication can be enhanced by occlusion, ionotophoresis[3] and also laser[4] (Evidence: Level C)
- Infiltration anesthesia involves injecting local anesthetic agent into the concerned area intradermally and/ or subcutaneously
- Field block or ring block is injecting local anesthetic agent circumferentially around the area of concern intradermally and /or subcutaneously when alteration of the skin/tissue in the concern area is not be altered
- Peripheral nerve block is injecting of local anesthetic agent in the vicinity of the peripheral nerve trunk so as to cause anesthesia in a circumscribed area supplied by that particular nerve trunk
- Tumescent anesthesia is administration of large quantities of very dilute local anesthetic (lignocaine) which is mixed with normal saline, sodium bicarbonate and adrenaline.

LOCAL ANESTHETIC AGENTS

Local anesthetics are classified broadly into 2 groups, amide group (lignocaine, prilocaine, bupivacaine, mepivacaine, ropivacaine) and ester group (benzocaine, tetracaine, procaine, cocaine).

- Esters but not amides are metabolized to *para*-amino benzoic acid (PABA) which has a high propensity for eliciting allergic reactions. Hence, amides are safer and preferred over esters.[5] (Evidence: Level C)
- Duration of action of local anesthetics is prolonged by addition of adrenaline (1:2,00,000 dilution) or low molecular weight dextran 40 (1:1 dilution) to the local anesthetic. Both the agents delay the clearance of the drug from the site of administration (former by causing vasoconstriction and latter by delaying its systemic absorption) and hence prolong its action.[6]
- Recent evidence suggests that lignocaine with adrenaline is safe for ears and tip of nose.[7,8] (Evidence: Level B)
- Lignocaine with adrenaline is contraindicated for penis
- Conventional teaching has held that lignocaine with adrenaline combination is unsafe for administration for digits and toes for fear of precipitating vascular insufficiency. However, several studies have demonstrated the safety of lignocaine with adrenaline combination for digits and toes in patients with normal circulatory status.[9-12] Hence, lignocaine with adrenaline may be used with caution, particularly in an otherwise healthy young patient and after proper examination of the vascular status, in injections to fingers and toes, if the treating physician feels that the use of such a combination is beneficial in the given circumstance. Each case needing such a combination has to be assessed individually by the treating physician. However in people with suspected vascular insufficiency, elderly patients, and in patients with unreliable history of previous disease states, such combinations are contraindicated because of the risk of precipitating vascular complications such as gangrene. In such individuals only plain lignocaine should be used. (Evidence: Level B)
- Lignocaine with adrenaline has to be cautiously used in cardiac patients and those on beta-blockers
- Pain of local anesthetic injections can be alleviated by the following measures:[13,14] (Evidence: Level B)
  - Combining local anesthetic with 8.4% sodium bicarbonate (10:1) to render the pH neutral. Solutions of local anesthetics are acidic (pH 5.0-7.0) and hence cause pain and stinging sensation on infiltration. Solutions of lignocaine with adrenaline is more painful than plain lignocaine as the former is more acidic (pH 3.3-5.5) than latter.[15,16] (Evidence: Level B) Reconstituted buffered lignocaine with or without adrenaline can be kept at room temperature for 1 week.[17,18] (Evidence: Level B)
  - Use of thin needles such as 26 or 30 gauge needle for infiltration of local anesthetic
  - Slow administration of only the required amount of the local anesthetic to prevent tissue distention, which may give rise to pain

Few other practical tips for making the injections relatively painless are:

a) As soon as the needle is introduced into the skin, push some local anesthetic, wait for 1-2 mins so that the area is anesthetized and then introduce the needle further ahead
b) When lesion on the palmar or plantar area is to be anesthetized, if possible try to introduce the needle through the dorsal thin skin along with the above said technique for infiltration
c) Pre-cool the concerned area with ice pack

d) Apply topical anesthesia cream if deep infiltration is desired for about 30-60 mins under occlusion
e) Repetitive pinching of skin while injecting local anesthetic[19]

SPECIAL CONSIDERATIONS REGARDING ADMINISTRATION OF LOCAL ANESTHETIC BY VARIOUS TECHNIQUES

Topical anesthesia

- Topical anesthesia involves application of local anesthetic agents over skin or mucosa to cause anesthesia. Pharmacological preparations used are EMLA cream, benzocaine, lignocaine jelly. EMLA is eutectic mixture of 2.5% lignocaine and 2.5% prilocaine in oil in water emulsion with a melting point (17^{0}C) which is less than either of lignocaine (66-69^{0}C) or prilocaine (36-38^{0}C) and hence exist as liquid at body temperature enhancing its absorption.
- Prilocaine on systemic absorption is metabolized to *ortho*-toludine which can cause methemoglobinemia in predisposed individuals. Neonates less than 3 months have immature NADH reductase enzyme complex and hence, prilocaine has to be used cautiously in them (maximum dose 1 g for 1 hour application on intact skin).[20] (Evidence: Level B)
- Prilocaine should be cautiously used in individuals with deficiency of glucose-6-phosphate dehydrogenase enzyme deficiency, congenital or idiopathic methemoglobinemia and those on medications which can cause methemoglobinemia (viz., dapsone, chloroquine, sulfonamides).
- Depth of analgesia is dependent on the duration of application of EMLA. Maximum depth achieved is 5mm at the end of 2 hours of application.[21]
- EMLA has been used safely on mucosa[22-25] (Evidence: Level B)
- EMLA is better than benzocaine or plain lignocaine in producing analgesia on mucosa[26,27] (Evidence: Level B)
- Dosage of EMLA in adults is 2 g/10 sq.cm[28]
- Dosage of EMLA in pediatric patients given in Table 1.[29,30]

Table 1: Dosage of EMLA in pediatric patients[29,30]

Age and weight	Maximum total dose and time	Maximum application area (cm^2)
1-3 months or < 5 kg	1 g (1 hour)	10
4-12 months and > 5 kg	2 g	20
1-6 years and > 10 kg	10 g	100
7-12 years and > 20 kg	20 g	200

Infiltrative anesthesia (Field or ring block, infiltration anesthesia, peripheral nerve block and tumescent anesthesia)

Lignocaine with or without adrenaline is the most commonly used local anesthetic for this indication. Other commonly used agent is bupivacaine.

- In infiltrative anesthesia and field block, local anesthetics are injected intradermally. Onset and duration of action are delayed if injected into subcutaneous rather than into dermis.
- Bupivacaine acts for longer duration than lignocaine even in combination with adrenaline[31]
- Adding adrenaline decreases blood loss, reduces the toxicity and increases the duration of action of local anesthetic
- Peripheral nerve blocks are used for hands/foot, fingers/toes and face (branches of trigeminal nerve).
- Since lignocaine is metabolized by the liver, drugs that inhibit cytochrome P450 enzyme can increase plasma levels of lignocaine and cause toxicity. The physician must be aware of these drug interactions when planning anesthesia for the patient.
- Lidocaine and its metabolites are excreted through kidneys

The maximum dosage of lignocaine is generally thought to be about 6-7 mg/kg. However controlled data to support this dosage limit is lacking and higher doses have been administered safely, in surgeries such as hair transplantation and particularly by tumescent method, in liposuction. This topic is discussed in greater detail below.

Tumescent anesthesia[32-36] (Evidence: Level B)

Recently a new form of local anesthesia is being used for several dermatosurgical procedures, particularly liposuction. The procedure consists of using a local anesthetic-saline mixture, over a wide area to provide anesthesia and analgesia, using sufficient quantity of lignocaine far in excess of the conventional dosage. The details of the procedure of tumescent anesthesia can be found in the IADVL guidelines on liposuction.[37] The basic principle is described here.

The underlying principle of tumescent anesthesia is that contrary to conventional thinking, larger doses of lignocaine, even up to 45-55 mg /kg weight can be administered safely, if it is administered in this technique called tumescent technique. Conventional teaching has widely regarded, without adequate pharmacological proof, that the safe upper limit for

lignocaine administration is 6 mg/kg body weight. In a radical departure from this hitherto accepted fact, Klein showed that, in tumescent anaesthesia, much higher doses can safely be administered, because, in tumescent anaesthesia, rate of absorption of lignocaine is slow, leading to smaller peak values and hence lesser toxicity. The reasons for the slow absorption of lignocaine are:

- Subcutaneous fat has a low volume of blood flow
- Lignocaine is lipophilic and is easily sequestered in fat
- Diluted epinephrine in saline solution ensures vasoconstriction, thus minimizing systemic absorption and bleeding
- The large volume of tumescent solution itself compresses blood vessels by hydrostatic pressure
- The very low dilution of lignocaine in Klein's solution does not achieve the gradient required for systemic absorption
- Most of the solution is removed during aspiration, minimizing the quantity and duration available for absorption
- The usual tumescent solution concentration used by dermatologic surgeons is 0.05% to 0.1% lignocaine. The concentration of adrenaline or epinephrine is at 1:1,000,000 to 1.5:1,000,000. About 10 mEq of sodium bicarbonate is added to one litre of tumescent solution to raise pH and to prevent stinging (due to acidic pH of lignocaine). The required lignocaine dosages are dependent on appropriate epinephrine concentration in the tumescent solution. The recommended maximum dose of lignocaine is 55 mg/kg for most patients. The recommended concentration of epinephrine in tumescent solutions is 0.25 to 1.5 mg/L. The total dosage of epinephrine should be minimized, within these limits, and usually should not exceed 50 μg/kg [Table 2].

COMPLICATIONS DURING LOCAL ANESTHESIA

i. Syncope secondary to vasovagal attack (presence of pallor, hyperhidrosis, hyperventilation and hypotension) is common, particularly in anxious patients, and those with unstable autonomic nervous system. It is always advisable to ask about previous syncopal attacks before administration of anesthesia. Vasovagal syncopal attack can be treated by raising the foot end of the bed. For this reason, all procedures needing local anesthesia should be done in supine position. Injection atropine may be helpful in cases who develop bradycardia.

ii. Hypersensitivity reactions: Hypersensitivity reactions are potentially serious and hence should always be recognized and treated early. However, it must be recognized that true allergic reactions to local anesthetics are rare.[38-40] Vasovagal syncopal attacks are often mistakenly considered as hypersensitivity reactions. Careful evaluation and skin testing is needed for proper diagnosis.[41-43] Sensitivity to local anesthetics may be either due to the anesthetic itself or to the preservatives.
   - Sensitivity to local anesthetics can be either of type I reaction (anaphylaxis) or type IV (delayed hypersensitivity). Anaphylaxis, though very rare, may be potentially fatal. Ester group anesthetics are more prone to cause anaphylaxis than the amide group anesthetics.[44] Type IV reaction can be either due to amides or ester based local anesthetics. Amides and ester groups of local anesthetics do not cross react. However, within the group, there may be cross-reaction to other agents.[45] Rarely, hypersensitivity can exist in a patient, to both amide and ester group of local anesthetics.[46]
   - Hypersensitivity may also be caused by reactions to preservatives (methylparaben) and antioxidants (metabisulphite).[40,42,47] (Evidence: Level C)
   - **Skin testing**: Skin testing is an important means of determining possible hypersensitivity. However, both false positives and false negatives may occur.
   - A) Skin testing for topical cream anesthesia: Contact hypersensitivity to topically applied anesthetics is infrequent (Evidence: Level

Table 2: Characteristics of local anesthetics[14,29]

	Lidocaine		Bupivacaine		Ropivacaine
	Without adrenaline	With adrenaline	Without adrenaline	With adrenaline	
Dosage	3 mg/kg, maximum 200 mg	6 mg/kg, maximum 500 mg	3.5 mg/kg, maximum 175 mg	4.5 mg/kg	Maximum 200 mg
Onset	1-2 mins	5 mins	2-10 mins	-	1-15 mins
Duration of action	60-90 mins	2-6 hrs	3-10 hrs	-	2-6 hours

B).[40-42] Topical allergic reaction is usually mild, limited to development of dermatitis or contact urticaria. Hence a patch test is not recommended as a routine in all cases. However, where there is a suspicion of hypersensitivity, a patch testing may be performed. Apply about 1-2 mm thick layer of anesthetic preparation over about 1cm^2 area for 30 mins and check for history of itching or any erythema or maculopapular rash.

- B) Intradermal testing: All anesthetic injections may be associated with systemic hypersensitivity which may be potentially fatal. Hence intradermal test is mandatory in all such cases. This is performed by injection of lignocaine or bupivacaine with 0.1ml on flexural forearm about 1-2 inches below the antecubital fossa. If the patient complains of any itching, with the development of urticarial rash in the form of erythema, edema and induration at the site of intradermal test, it indicates a positive test, indicating that the patient is hypersensitive to it. In such a situation, it is not safe and ethical to administer/ use the same local anesthetic.
- Alternatives for anesthesia in patients with lignocaine hypersensitivity: (Evidence: Level C) In cases of hypersensitivity to lignocaine, anesthesia can be achieved by using an anesthetic from the ester group. If there is any allergy to the preservative, then preservative free lignocaine may be used, if such a preparation is available. If there is hypersensitivity to both amide and ester groups, then the alternative would include:
- Ethyl chloride sprays, applying ice cubes or using cryospray (care should be taken not to cause frosting). Ethyl chloride has to be sprayed from a distance of 3-9 inches taking care so that, there is whitening and not frosting of skin (spray duration 3-7 sec).[20]
- Diphenhydramine and chlorpheniramine are alternatives though they provided milder anesthesia.[48-50]
- Benzyl alcohol can also be used for anesthesia.[51]
- Intravenous sedation/general anesthesia can be used in a hypersensitive patient, if the circumstances of the case demand.

iii. Ethyl chloride is more inflammable than alcohol; eventhough it vapourizes rapidly, it is safe to avoid it when electrocautery is planned.

iv. When injecting lignocaine or bupivacaine (especially latter) ensure that the needle is not within a vessel as it can precipitate arrhythmias

v. Avoid using lignocaine with adrenaline, in patients with hypertension, history of Raynauds's phenomenon, peripheral vascular disease, vasopasm, history of thromboembolism, history of thromboangiitis obliterans

vi. On anesthetizing oral mucosa, ingestion of food has to be avoided for 1 hour as swallowing is impaired and hence can lead to aspiration. Also, there is risk of tongue bite.

vii. Other side effects include:

- Bruising is common in elderly persons due thin dermis. Localize the bruise by immediate application of pressure or ice cubes at the site.
- Intravascular injection or use of excess amount of local anesthetic, when low causes excitation of central nervous system; higher concentration in blood causes depression of central nervous system and cardiac complications like hypotension and arrhythmia.[29,52]
- In case of mild ischemia due to lignocaine with adrenaline, apply topical nitroglycerine; for severe cases, start phentolamine 2.5-5.0 mg which is diluted in 4.5-9.0 ml of normal saline.[11]
- At low dose, adrenaline can cause tachycardia; tremors, palpitations, arrhythmias and chest pain are caused at higher concentration.
- Laceration of nerve fibres during peripheral nerve block

CONCLUSION

Local anesthesia is an invaluable tool in dermatosurgery and aesthetic procedures. When used appropriately, it greatly enhances patient comfort. However, proper use of technique and awareness of possible side effects is very important.

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