

# Pain Control in Dental Care

Tips on the safe and effective use of local anesthetics in dentistry.

Made possible through an educational grant from



## Anesthetic Duration Profile

The following local anesthetics have been approved for use in infiltration or nerve block injections by the U.S. Food and Drug Administration.

ADA Uniform color-coding system for local anesthetic cartridges	SHORT DURATION PLAIN		Maximum Suggested Dose, Expressed in Number of Cartridges									
	Brand Name	Manufacturer	Pulpal Infiltration	Pulpal Block	Dose Per Cartridge	Maximum Dose	Adult				Pediatric	
							≥ 70 kg (154+ lbs)	50 kg (110 lbs)	30 kg (66 lbs)	10 kg (22 lbs)		
	Lidocaine HCl Injection USP, Plain 2%	Xylocaine®	Dentsply	5 minutes	Not indicated	36 mg	300 mg 4.5 mg/kg 2.0 mg/lb	8	6	3½	1	
	Mepivacaine HCl Injection USP Plain 3%	Carbocaine® Isocaine® 3% Polocaine® Scandonest® 3% Plain Mepivacaine 3%	Cook-Waite Septodont Dentsply Septodont Hospira	20-30 minutes	34-45 minutes	54 mg	400 mg 6.6 mg/kg 3.0 mg/lb	7	6	3½	1	
	Prilocaine HCl Injection USP, Plain 4%	Citanest® Plain	Dentsply	10-15 minutes	45-65 minutes	72 mg	600 mg 8.0 mg/kg 3.6 mg/lb	8	5½	3	1	
INTERMEDIATE DURATION WITH VASOCONSTRICTOR		Brand Name	Manufacturer	Pulpal Infiltration	Pulpal Block	Dose Per Cartridge	Maximum Dose	Adult				Pediatric
								≥ 70 kg (154+ lbs)	50 kg (110 lbs)	30 kg (66 lbs)	10 kg (22 lbs)	
	Articaine HCl With Epinephrine USP, 4% 1:100,000	Septocaine® with epinephrine 1:100,000 Zorcaine®	Septodont Cook-Waite	60 minutes	Up to 120 minutes	68 mg	* 7.0 mg/kg 3.2 mg/lb	7*	5	3	1	
	Articaine HCl With Epinephrine USP, 4% 1:200,000 <sup>§</sup>	Septocaine® with epinephrine 1:200,000	Septodont	60 minutes	Up to 120 minutes	68 mg	* 7.0 mg/kg 3.2 mg/lb	7*	5	3	1	
	Lidocaine With Epinephrine Injection USP, 2% 1:100,000	Lidocaine HCl 2% with epinephrine 1:100,000 Lignospans® Standard Octocaine® 100 Xylocaine®	Multiple Septodont Septodont Dentsply	55-65 minutes	80-90 minutes	36 mg	500 mg 7.0 mg/kg 3.2 mg/lb	13½	9½	5½	1½	
	Lidocaine With Epinephrine Injection USP, 2% 1:50,000	Lidocaine Lignospans® Forte Octocaine® 50 Xylocaine®	Multiple Septodont Septodont Dentsply	55-65 minutes	80-90 minutes	36 mg	7 cartridges 0.1 cart/kg 0.045 cart/lb	7†	5*	3*	1*	
	Mepivacaine HCl With Levonordefrin Injection USP, 2% 1:200,000	Carbocaine® 2% with Neo-Cobefrin® 1:200,000 Isocaine® 2% Scandonest® 2% L	Cook-Waite Septodont Septodont	40-60 minutes	60-90 minutes	36 mg	400 mg 6.6 mg/kg 3.0 mg/lb	11	9	5½	1½	
	Prilocaine With Epinephrine Injection USP, 4% 1:200,000	Citanest® Forte	Dentsply	35-45 minutes	50-70 minutes	72 mg	600 mg 8.0 mg/kg 3.6 mg/lb	8	5½	3	1	
LONG DURATION		Brand Name	Manufacturer	Pulpal Infiltration	Pulpal Block	Dose Per Cartridge	Maximum Dose	Adult				Pediatric
								≥ 70 kg (154+ lbs)	50 kg (110 lbs)	30 kg (66 lbs)	10 kg (22 lbs)	
	Bupivacaine With Epinephrine Injection USP, 0.5% 1:200,000	Marcaine® Vivacaine® Bupivacaine HCl 0.05%	Cook-Waite Septodont Hospira	Up to 7 hours	Up to 7 hours	9 mg	90 mg†	10	7	Not recommended for use in children younger than 12 years		

The maximum number of cartridges has been truncated to the nearest one-half cartridge. A cartridge volume of 1.8 mL was used to calculate the number of cartridges for lidocaine, mepivacaine and prilocaine; a volume of 1.7 mL was used for articaine. Reduced doses should be used whenever possible, especially for children and medically compromised patients.  
 \* Maximum single dose not determined by manufacturer.  
 † Lower doses are recommended for small adults as well as adults in poor health.  
 ‡ Doses lower than those approved by manufacturers are recommended on the basis of the high epinephrine content.  
 § New color will be added to the ADA Uniform Color-Coding System.

### Local Anesthetics: Adverse Effects, Precautions and Contraindications

Body system	Adverse effects	Precautions/contraindications
<b>General</b>	Allergic reactions, including contact dermatitis, skin rash, urticaria, erythema, itching, swelling of injection site, lips, tongue, eyelids and throat; may be accompanied by nausea with or without vomiting; much more likely to occur with esters than with amides  Serious anaphylactoid reactions, including shock (rare)  Numbness and tingling possible in area affected by injection; long-lasting or permanent paresthesia (rare)	<i>Inflammation or infection in the region of injection or in the area to be anesthetized may decrease or eliminate anesthetic effect</i>  <i>Contraindicated in patients who have history of drug sensitivity to the anesthetic being considered for use, to any preservative or other component of the anesthetic solution and to chemically related agents; it is not known whether a small test dose can predict the risk of allergic reaction</i>
<b>Blood</b>	Methemoglobinemia, common with prilocaine overdose but rarely observed with other local anesthetics; cyanosis, symptomless with mild reactions, possibly accompanied by respiratory distress, tachycardia, headache, fatigue, dizziness and cardiopulmonary collapse	<i>Methemoglobinemia, congenital or acquired, contraindicates the use of prilocaine</i>
<b>CV</b>	Cardiovascular depression may be caused by excessive doses of local anesthetics, especially bupivacaine, but usually is secondary to respiratory depression; if not treated promptly, may cause or worsen hypoxia and acidosis and may lead to heart block and cardiac arrest	<i>Cardiovascular disease or impairment, especially serious forms of heart block and hypotension, may increase responsiveness to the cardiovascular depressant effects of local anesthetics</i>
<b>CNS</b>	Stimulation, including anxiety, minor twitching and tonic-clonic convulsions (especially in children), may be transient after intravascular injection or administration of large toxic doses  Depression, including drowsiness, unconsciousness and respiratory depression, may follow initial stimulant phase or occur by itself (especially in children and with lidocaine)	None of significance to dentistry
<b>GI</b>	Nausea, vomiting	None of significance to dentistry
<b>GU</b>	None of significance to dentistry	Local anesthetic metabolites may accumulate in patients with renal disease
<b>Liver</b>	None of significance to dentistry	Any condition that involves decreased hepatic blood flow or function (heart failure, cirrhosis, other hepatic disorders) may impair amide metabolism in the liver  Decreased synthesis of plasma cholinesterase may reduce ester metabolism
<b>Oral</b>	Trismus after nerve block injection (inferior alveolar, posterior superior alveolar nerves)	None of significance to dentistry

*Italics indicate information of major clinical significance.*

Source: Yagiela JA. Injectable and topical local anesthetics. In: Ciancio S, ed. ADA Guide to Dental Therapeutics. 3rd ed. Chicago: American Dental Association; 2003:1-16.

**Statement of Warning:** A major cause of adverse reactions involving this group of local anesthetics is related to excessive plasma levels, which may be due to overdosage, inadvertent intravascular injection or slow metabolic degradation. All of these anesthetics are contraindicated for use in patients who have a known hypersensitivity to amide-type drugs. Local anesthetics should be used only by clinicians who are well-versed in the diagnosis and management of dose-related toxicity and other acute emergencies that might arise from their use. Resuscitative equipment and oxygen and other resuscitative drugs should be made available for immediate use. Local anesthetics that contain an antioxidant, such as sodium metabisulfite, may cause allergic-type reactions, including anaphylactic symptoms and life-threatening or less severe asthmatic episodes in certain susceptible people. Local anesthetics are known to produce a rare blood condition known as methemoglobinemia. The clinical signs of methemoglobinemia are cyanosis of the nail beds and lips, fatigue and weakness. If methemoglobinemia does not respond to administration of oxygen, administration of methylene blue intravenously 1-2 mg/kg body weight over a 5-minute period is recommended.

### Vasoconstrictors: Possible Interactions With Other Drugs

Drug taken by patient	Interaction with vasoconstrictors	Dentist's action
α-adrenergic blockers (phenoxybenzamine, prazosin), antipsychotic drugs (haloperidol, thioridazine)	Blockade of α-adrenergic receptors may lead to hypotensive responses to large doses of epinephrine	Use vasoconstrictors cautiously—as low a dose as feasible for the procedure
Catechol-O-methyltransferase inhibitors (tolcapone, entacapone)	Blockade of catecholamine metabolism may enhance systemic effects of vasoconstrictors	Use vasoconstrictors cautiously—as low a dose as feasible for the procedure
CNS stimulants (amphetamine, methylphenidate), ergot derivatives (dihydroergotamine, methysergide)	Increased effects of stimulants or vasoconstrictors may occur	Use vasoconstrictors cautiously—as low a dose as feasible for the procedure
Cocaine	Increases effects of vasoconstrictor; can result in cardiac arrest	Avoid using vasoconstrictors in patient under the influence of cocaine
Digitalis glycosides (digoxin, digitoxin)	Increase risk of cardiac dysrhythmias	Use in consultation with physician
Hydrocarbon inhalation anesthetics (halothane, enflurane)	Sensitization of the heart may lead to cardiac dysrhythmias	Inform anesthesiologist of intended use of vasoconstrictors
Levodopa, thyroid hormones (levothyroxine, liothyronine)	Large doses of levodopa or thyroid hormone (beyond replacement amounts) may increase risk of cardiac toxicity	Use vasoconstrictors cautiously—as low a dose as feasible for the procedure
Maprotiline, tricyclic antidepressants (amitriptyline, doxepin, imipramine)	May enhance the systemic effects of vasoconstrictor	Avoid the use of levonordefrin or norepinephrine; use epinephrine cautiously—as low a dose as feasible for the procedure
Methylodopa, adrenergic neuronal blocking drugs (guanadrel, guanethidine, reserpine)	May enhance systemic responses to the vasoconstrictor	Use vasoconstrictors cautiously—as low a dose as feasible for the procedure
Nonselective β-adrenergic blockers (propranolol, nadolol)	Blockade of β-adrenergic receptors in skeletal muscle may lead to hypertensive responses to the vasoconstrictor, especially epinephrine	Monitor blood pressure after initial local anesthetic injection

*Italics indicate information of major clinical significance.*

Source: Yagiela JA. Injectable and topical local anesthetics. In: Ciancio S, ed. ADA Guide to Dental Therapeutics. 3rd ed. Chicago: American Dental Association; 2003:1-16.

### Local Anesthetics: Potential Cross-Sensitivity With Other Drugs

A person with a sensitivity to	May also have a sensitivity to
Para-aminobenzoic acid (PABA) or paraben preservative	Procaine, chlorprocaine, benzocaine, butamben, tetracaine, other local anesthetic solutions containing paraben preservatives (as in multidose vials)
Any ester local anesthetic	Other ester local anesthetics
Any amide local anesthetic	Other amide local anesthetics (rarely)
Sulfites	Any local anesthetic with an adrenergic vasoconstrictor (sulfites are included with vasoconstrictors as antioxidants)

Source: Yagiela JA. Injectable and topical local anesthetics. In: Ciancio S, ed. ADA Guide to Dental Therapeutics. 3rd ed. Chicago: American Dental Association; 2003:1-16.

### Systemic Complications of Local Anesthetic Administration

The two systemic complications associated with local anesthetic administration are (a) allergy and (b) overdose (toxic reaction).

- Allergy:** True, documented and reproducible allergy to local anesthetics (LA) used today in dentistry is so rare as to be essentially nonexistent. Allergy to epinephrine is nonexistent. Upon examination, most reported instances of alleged allergy are determined to have been either psychogenic reactions (fainting, tachycardia) or side effects associated with the drug.
- Overdose:** Also known as toxic reaction, overdose occurs when the blood level of the local anesthetic is overly high. The most common causes of LA overdose are (1) administration of too much LA and (2) rapid intravascular injection. Overadministration of LA most often occurs in a younger, lighter-weight patient (a child, for example) who is undergoing multiple quadrants of dental care in one visit. Overdose resulting from intravascular injection may be prevented by aspirating prior to administering the LA, while the severity of the reaction can be minimized by injecting the LA slowly. The recommended rate of LA administration for a full 1.8-milliliter cartridge is one minute. Clinically, LA overdose presents as either seizures (convulsions) or unconsciousness, both of which may be managed by the trained dentist. LA-induced seizures commonly last for approximately 15 to 30 seconds.

Adapted with permission of Mosby from Malamed SF. Handbook of Local Anesthesia. 5th ed. St. Louis: Mosby; 2004.

### Localized Complications of Local Anesthetic Administration

Localized complications associated with the intraoral administration of local anesthetics include the following:

- Trismus** is a spasm of the muscles of mastication, which is commonly seen following the administration of multiple inferior alveolar nerve blocks (NB) on one side. The following day, the patient complains of soreness and limited ability to open the mouth. Treatment includes use of chewing gum to exercise the muscles. Trismus usually resolves within a few days.
- Hematoma** is a bruise or discoloration occurring after LA administration. It is most often seen extraorally following posterior superior alveolar (PSA) NB. Treatment is to allow the body to heal itself. Hematoma requires about 14 days to resolve fully.
- Soft-tissue injury** occurs most frequently in younger children following inferior alveolar NB. The lip and tongue remain anesthetized for many hours after dental treatment. Prevention involves informing the patient of this possibility. In the case of a child, prevention involves informing the patient's parent or guardian of this possibility and advising careful observation of the child until any residual anesthesia is gone.
- Paresthesia** represents a prolonged anesthesia, usually more than 24 hours after injection of the LA. More than 95 percent of reported paresthesias occur in the mandible, with more than 70 percent involving the lingual nerve. There is no known treatment for paresthesia beyond "tincture of time." Most paresthesias resolve within approximately 8 weeks without treatment.

Adapted with permission of Mosby from Malamed SF. Handbook of Local Anesthesia. 5th ed. St. Louis: Mosby; 2004.

This chart represents a compilation of manufacturers' and authors' data. It is offered as a guideline for the safe use of dental anesthetics by dental professionals. Additional information is available in the manufacturer's package insert accompanying each specific dental anesthetic product. Registered trademarks of drugs listed above are owned by the respective manufacturers of those drugs.