

boards fodder



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Local anesthesia

By Michael Visconti, DO; Zac Zheng, DO; and Kent J. Krach, MD, FAAD

	Generic name	Trade name	Anesthetic agent (plain or with epinephrine)	Maximum adult dose (mg/kg)	Maximum dose cumulative (mg for 70kg person)	Time to onset (min)	Maximum duration
Amides							
Amides <ul style="list-style-type: none"> Metabolism: CYP 3A4 (liver) Contraindicated in end-stage liver disease Rare allergic reactions to anesthetic agent Preservative (methylparaben) most common cause (can switch to preservative-free lidocaine) Two 'i's' = amides 	Lidocaine <ul style="list-style-type: none"> Anesthetic of choice in pregnancy (Category B) 	Xylocaine®	Plain	4.5-5	300	<1 *Fastest onset	30-120
			With epinephrine	7	490		60-400
	Articaine	Septocaine®	Plain	5.0	350	2-4	30-120
			With epinephrine	7.0	490		60-240
	Mepivacaine <ul style="list-style-type: none"> Risk of fetal bradycardia (Category C) 	Carbocaine®	Plain	6	400	3-20 *Slowest onset	30-120
			With epinephrine	7	550		60-400
	Prilocaine hydrochloride <ul style="list-style-type: none"> Risk of methemoglobinemia 	Citanest®	Plain	7	400	5-6	30-120
			With epinephrine	10	600		60-400
	Etidocaine	Duranest®	Plain	4.5	300	3-5	200
			With epinephrine	6.5	400		240-360
Bupivacaine hydrochloride <ul style="list-style-type: none"> Combined with lidocaine for extended dermatologic surgery cases Highest risk of cardiac toxicity Risk of fetal bradycardia (Category C) 	Marcaine®	Plain	2.5	175	2-10	120-240	
		With epinephrine	3	210		240-480 *Longest duration (with epinephrine)	
Levobupivacaine hydrochloride	Chirocaine®	Plain	2.1	147	2-10	120-240	
		n/a	n/a	n/a		n/a	
Ropivacaine	Naropin®	Plain	3	200	3-15	120-240 *longest duration (plain)	
		With epinephrine	4	225		180-480	
Esters							
Esters <ul style="list-style-type: none"> Metabolism: plasma (pseudocholinesterases), excreted renally Common allergic reactions to anesthetic agent (PABA) Cross-reacts with "PPPESTAA": - Paraphenylenediamine (PPD) - PABA - Para-aminosalicylic acid - Ethylenediamine - Sulfonamides - Thiazides - Anesthetics (esters) - Azo dyes 	Procaine	Novocaine®	Plain	10	500	5	15-30 *Shortest duration
			With epinephrine	14	600		30-90
	Chlorprocaine	Nesacaine®	Plain	11	770	5-6	30-60
			With epinephrine	14	980		n/a
	Tetracaine	Pontocaine®	Plain	2	100	7	120-240
			With epinephrine	2	N/a		240-480
	Cocaine	Generic only	Plain (vasoconstrictor)	3	200	1-5	30-60

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Topical anesthetics	Primary use
Benzocaine	Tympanic/mucous membrane
Cocaine	Nasal mucosa (vasoconstriction)
Eutectic Mixture of Local Anesthesia (EMLA) (2.5% lidocaine + 2.5% prilocaine)	Intact skin (requires occlusion, risk of ocular injury near eye & methemoglobinemia in infants)
Lidocaine 4%	Intact skin (no occlusion required)
Proparacaine	Conjunctiva
Tetracaine	Conjunctiva

Features of lidocaine overdose				
Serum blood level	Pulse rate	Blood pressure	Signs and symptoms	Management
1-6 mcg/ml (mild)	No change	No change	<ul style="list-style-type: none"> • Circumoral and digital paresthesia • Lightheadedness • Restlessness • Drowsiness • Euphoria • Talkativeness 	No intervention, observation only
6-9 mcg/ml (moderate)	No change	No change	<ul style="list-style-type: none"> • Nausea/vomiting • Muscle twitching • Tremors • Altered senses <ul style="list-style-type: none"> - Tinnitus - Dysgeusia - Blurred vision • Confusion • Excitement • Psychosis 	Diazepam Maintenance of airway
9-12 mcg/ml (severe)	Decreased	Decreased	<ul style="list-style-type: none"> • Seizures • Cardiopulmonary depression • Arrhythmia 	Respiratory support
>12 mcg/ml (life-threatening)			<ul style="list-style-type: none"> • Coma • Cardiopulmonary arrest 	Advanced cardiac life support and resuscitation

Additive	Mechanism	Purpose	Precautions
Epinephrine	Vasoconstriction, counteracting vasodilatory effects of most local anesthetics	Reduces bleeding Systemic absorption of anesthetics, preventing systemic toxicity Prolong duration of anesthesia	Reduces uterine blood flow in pregnancy Pheochromocytoma, uncontrolled hyperthyroidism
Hyaluronidase	Depolymerizes hyaluronic acid within intercellular ground substance Facilitates diffusion of anesthetic through tissue planes	Increases surface area of anesthesia Prevents tissue distortion	Reduced duration of anesthesia Potentially increased risk of anesthetic toxicity Cross-reactivity with bee/wasp venom (history of allergic reaction is relative contraindication)
Sodium bicarbonate (8.5%)	Correction of more acidic local pH level from acidic preservatives Elevation of local pH to near-physiologic levels	Reduction of anesthetic infiltrative pain More rapid onset of anesthetic action	Reduction of shelf-life of anesthetic

Note: Maximum doses may be less than calculated doses based on upper safety threshold recommendations.

Techniques for reducing injection site pain
Pretreatment with ice or topical anesthetic
Irritation of neighboring skin via pinching, rubbing (Gate theory of pain – reduces signal transmission through ascending nerve fibers)
Minimize needle gauge size (27g for general body, 30g for sensitive areas)
Addition of sodium bicarbonate 8.5% (see above)
Warm anesthetic to body temperature
Reduce speed of injection
Inject from deep to superficial, reintroducing needle and previously anesthetized areas
Mental distraction (conversation, music)

References:

1. Bologna J, Jorizzo J, Schaffer I. *Dermatology*. Philadelphia: Elsevier; 2017.
2. Alikhan A, Hocker TL. Review of Dermatology. Elsevier; 2017.
3. Kouba DJ, LoPiccolo MC, Alam M et al. Guidelines for the use of local anesthesia in office-based dermatologic surgery. *J Am Dermatol*. 2016; 74: 1201-1219.
4. Robinson JK, Hanke CW, Siegal DM, Fratila A. *Surgery of the Skin*. Philadelphia: Elsevier; 2015.
5. Maximum Recommended Doses and Duration of Local Anesthetics. 2019. Viewed 27 July 2021, <https://medicine.uiowa.edu/iowaprotocols/maximum-recommended-doses-and-duration-local-anesthetics>.
6. King M, Convery C, Davies E. This month's guideline: The Use of Hyaluronidase in Aesthetic Practice (v2.4). *J Clin Aesthet Dermatol*. 2018;11: E61-E68.