

RESIDENT ROUNDS: PART II

Anesthetics Review

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Local Anesthetics

Structure	Aromatic end - hydrophobic and lipophilic (allows diffusion through nerve cell membranes) Amine end - hydrophilic (water solubility); binds sodium channel Intermediate chain - determines ester or amide class					
General properties	Ionized form - water-soluble (diffuse through extracellular space and intracellular cytoplasm); ionized cation is responsible for blocking nerve conduction Non-ionized form - lipid-soluble (diffuse into the nerve cell membrane) pKa (dissociation constant) - determines proportion of anesthetic base and its cation at a given pH Low pKa → more in non-ionized form → faster onset of action of anesthetic High pH → more in non-ionized form → faster onset of action of anesthetic Lipid solubility - greater lipid solubility associated with higher anesthetic potency Duration of action - determined by anesthetic binding to sodium channel pore					
Anesthetic	Trade Name	Duration w/o epi (hour)	Onset of action (min)	Max dose plain (mg/kg) for adults	Max dose w/ epi (mg/kg) for adults	Comments
Amides	Metabolized by hepatic cytochrome P450 enzyme system (caution in patients with liver disease) Metabolites excreted by kidneys					
Lidocaine	Xylocaine	0.5-2	< 1	5 (1.5-2 in children)	7 (3-4.5 in children)	Anesthetic of choice in pregnancy (pregnancy class B) Max dose for tumescent anesthesia: 55mg/kg Symptoms of overdose: 1-6 mcg/ml: tongue and circumoral paresthesias, euphoria, lightheadedness, metallic taste, restlessness 6-9 mcg/ml: nausea, vomiting, blurred vision, tinnitus, muscle fasciculations, tremors, confusion, psychosis 9-12 mcg/ml: seizures, cardiopulmonary depression > 12 mcg/ml : coma, respiratory and cardiac arrest
Mepivacaine	Carbocaine	0.5-2	3-20	6	8	Pregnancy class C, fetal bradycardia
Prilocaine	Citanest	0.5-2	5-6	7	10	Pregnancy class B Risk of methemoglobinemia esp. infants and G6PD deficiency
Articaine	Septocaine	0.5-2	2-4	5	7	Pregnancy class C, can penetrate bone
Bupivacaine	Marcaine	2-4	5-8	2.5	3	Pregnancy class C, fetal bradycardia, cardiotoxicity
Levobupivacaine	Chirocaine	2-4	2-10	2.1	not determined	Pregnancy class B
Etidocaine	Duranest	3-5	3-5	4.5	6.5	Pregnancy class B
Ropivacaine	Naropin	2-6	1-15	3.5	not determined	Pregnancy class B
Esters	Hydrolyzed by plasma pseudocholinesterases Metabolites excreted by kidneys (metabolite para-aminobenzoic acid causes allergic reactions with ester anesthetics)					
Chloroprocaine	Nesacaine	0.5-2	5-6	10	14	Pregnancy class C
Procaine	Novocaine	1-1.5	5	10	14	Pregnancy class C
Tetracaine	Pontocaine	2-3	7	2	2	Pregnancy class C
Other local anesthetics						
Diphenhydramine 1% solution						Epinephrine can be added to counteract vasodilation of diphenhydramine
Other antihistamines i.e. promethazine						
Normal saline with benzoyl alcohol preservative						Works through pressure effects on cutaneous nerve endings and anesthetic properties of benzoyl alcohol

Additives to local anesthetics		
Additive	Dosage	Comments
Epinephrine	≤ 1:100,000	<p>Strong beta and alpha agonist</p> <p>Vasoconstriction decreases bleeding and prolongs anesthesia, reduces anesthetic toxicity (reduced absorption rate)</p> <p>Absolute contraindications: hyperthyroidism, pheochromocytoma, digital anesthesia in patients with PVD</p> <p>Caution in patients taking beta blockers, monoamine oxidase inhibitors, tricyclic antidepressants, phenothiazines</p> <p>Avoid large amounts in patients with severe hypertension or several cardiovascular disease</p> <p>Low doses of epinephrine (diluted 1:300,000) can be used during pregnancy (high doses can induce labor)</p> <p>Pregnancy class C</p> <p>Avoid - periorbital area in patients with narrow angle glaucoma; ring blocks of the digit</p> <p>Side effects:</p> <p>Self limited - palpitations, anxiety, fear, diaphoresis, headache, tremor, weakness, tachycardia, elevated BP</p> <p>Serious (if large amounts used) - arrhythmias, ventricular tachycardia, ventricular fibrillation, cardiac arrest, cerebral hemorrhage</p>
Hyaluronidase	150 units added to 30 ml of anesthetic	<p>Derived from bovine testicular hyaluronidase</p> <p>Facilitates drug diffusion by breaking up ground substance; less tissue distortion with infiltration</p> <p>Facilitates undermining in subcutaneous plane by hydrodissection of fatty tissue</p> <p>Decreases duration of anesthesia and increases risk of anesthetic toxicity due to increased absorption</p> <p>Side effects:</p> <p>Allergic reactions (rare); intradermal skin test prior to use</p> <p>Thimerosal preservative can cause contact dermatitis</p>
Sodium bicarbonate (8.5%)	1 ml (1 mEq/ml) for every 10 ml of 1% lidocaine with epi	<p>Alkalinizes anesthetic solution → more of the anesthetic in non-ionized form → speeds onset of action</p> <p>Decreases pain with infiltration of acidic solution</p> <p>Decreases activity of epinephrine overtime (epinephrine only stable in acidic pH)</p>

DISCLOSURES

The author has no relevant conflicts of interest to disclose.

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