Physiology and Pharmacology

Part II

ASA Physical Status Classification System

- The American Society of Anesthesiologists (ASA) Physical Status classification system
- The purpose of the grading system is to assess the degree of a patient's "sickness" or "physical state" prior to selecting the anesthetic or prior to performing surgery

ASA Classification	Medical description of patient
ASA I	No known systemic disease
ASA II	Mild or well controlled systemic disease
ASA III	Multiple or moderately controlled systemic disease(s)
ASA IV	Poorly controlled systemic disease(s
ASA V	Moribund patient
E	Emergency

Topical

- Unable to penetrate intact skin but do penetrate abraided (or sunburned) skin or any mucous membranes
- higher concentration used topically than that injected
- Higher concentrations facilitate diffusion through the mucous membrane **but** also increase the potential toxicity

Topical

- No vasoconstrictor
  - vasodilator properties take over, increasing absorption
- Injectable locals may be ineffective topically
  - the necessary concentrations for topical anesthesia would be associated with local tissue toxicity and systemic overdose

Topical

- Effective only on surface tissues (2 to 3 mm)
- Tissues deep to the area of application are poorly anesthetized

Topical benzocaine and lidocaine

- Insoluble in water, but soluble in alcohol, propylene glycol, polyethylene glycol, and other vehicles for surface application
- Slowly absorbed into the cardiovascular system → not likely to produce overdose reactions

EMLA

- Eutectic Mixture of Local Anesthetics
- Cream composed of lidocaine 2.5% and prilocaine 2.5%
- Emulsion in which the oil phase is a eutectic mixture in 1:1 ratio by weight
- Designed as a topical able to provide surface anesthesia of intact skin
- Applied 1 hour before procedure, maximum effect at 2-3 hours
- Lasts 1-2 hours after removal

Prevention of L.A. Overdose

- Primary Prevention
- Always aspirate
- Inject slowly
- Use vasoconstrictors if no contraindications

Distribution of Local Anesthetic

- Highly perfused organs such as the brain, head, liver, kidneys, lungs and spleen are more affected
- Blood level influenced by
  - Rate at which the drug is absorbed into the cardiovascular system
  - Rate of distribution of the drug from the vascular compartment to the tissue (cardiac function)
  - Elimination through metabolic and/or excretory pathways

Distribution of Local Anesthetic

- The rate at which a local anesthetic is removed from the blood is elimination half-life of the drug
  - One half-life= 50% reduction
  - Two half-lives=75% reduction
  - Three half-lives= 87.5% reduction
  - Four half-lives=94% reduction
  - Five half-live=97% reduction
  - Six half-lives=98.5% reduction

Distribution of Local Anesthetic

- Half-life of local anesthetics
  - Procaine 0.1*
  - Cocaine 0.7*
  - Lidocaine 1.6
  - Mepivicaine 1.9
  - Bupivicaine 3.5

*Esters: Hydrolyzed in the plasma by pseudocholinesterase.
Amides: Biotransformation by liver and excreted via kidneys

Pharmacology

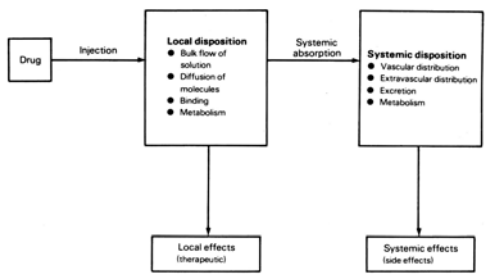

FIG. 3-9. Fate of local anesthetic agents. (Mather, L.E., and Cousins, M.J.: Local anaesthetics and their current clinical use. Drugs, *18*:185, 1979.)

Systemic Toxicity

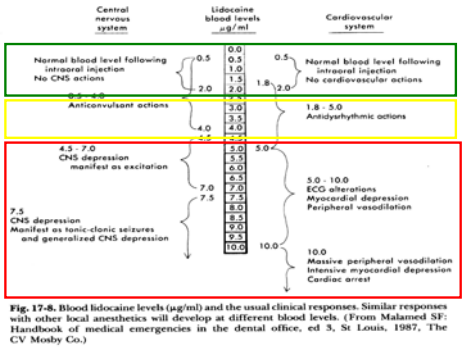

Fig. 17-8. Blood lidocaine levels (µg/ml) and the usual clinical responses. Similar responses with other local anesthetics will develop at different blood levels. (From Malamed SF: Handbook of medical emergencies in the dental office, ed 3, St Louis, 1987, The CV Mosby Co.)

CNS Toxicity at low to moderate overdose levels

- Signs
  - Slurred speech
  - Shivering
  - Muscular twitching
  - Tremors of face or distal extremities
- Symptoms
  - Numbness
  - Warm/flushed feeling of skin
  - Light-headedness
  - Dizziness
  - Visual disturbances (inability to focus)
  - Auditory disturbances (tinnitus)
  - Drowsiness
  - Disorientation

CNS Toxicity at moderate to high overdose levels

- Signs
  - Generalized tonic-clonic seizures
  - Generalized CNS depression
  - Depressed BP, heart rate and respiratory rate

Drug Interactions

- **Beta-blockers and cimetadine (Tagamet) – decreased liver metabolism of amide L.A.'s**
- **CNS and CVS depressants – possible additive or supra-additive effect**
- **Tricyclic antidepressants – enhanced effect of vasoconstrictor, dysrhythmias**
- **Digitalis glycosides – risk of cardiac dysrhythmias**
- **Cocaine – increased sympathomimetic response, cardiac dysrhythmias, cardiac arrest**

Contraindications for Local Anesthetics

Medical Problem	Drugs to avoid	Type of contraindication	Alternative drug
Local anesthetic allergy, documented	All LAs in same chemical class (e.g. esters)	Absolute	LAs in a different chemical class (e.g. amides)
Bisulfite allergy	Vasoconstrictor -containing local anesthetic	Absolute	Any local anesthetic without vasoconstrictor
Atypical plasma cholinesterase	Esters	Relative	Amides
Methemoglobinemia, idiopathic or congenital	Articaine, prilociane	Relative	Other amides or esters

Contraindications for Local Anesthetics

Medical Problem	Drugs to avoid	Type of contraindication	Alternative drug
Significant liver dysfunction (ASA III-IV)	Amides	Relative	Amides or esters, but judiciously
Significant renal dysfunction (ASA III-IV)	Amides or esters	Relative	Amides or esters, but judiciously
Significant cardiovascular dysfunction (ASA III-IV)	High concentrations of vasoconstrictors*	Relative	LAs with Epi 1:200,000 or 1:100,000 or mepivacaine 3% or prilocaine 4% (nerve block)
Clinical hyperthyroidism	High concentrations of vasoconstrictors*	Relative	LAs with Epi 1:200,000 or 1:100,000 or mepivacaine 3% or prilocaine 4% (nerve block)