Local Anesthetic Overview

Local anesthetics are a class of drug used to provide localized analgesia for minor procedures and epidurals. These drugs work by inhibiting intracellular Na⁺ influx by blocking Na⁺ channels. They are state dependant, as their neuronal blockade works best in rapidly firing neurons and they preferentially block activated sodium channels. Often, these drugs are combined with vasoconstricters when used for minor procedures, as vasoconstriction leads to increased concentration of the anesthetic agent used, and also decreased local bleeding. Infected tissues decrease the action of local anesthetics, and a larger amount is needed in an infected area to provide the same effects as in healthy tissue. These drugs can be broken into two groups, esters, which have one I in the name, and amides, which have two I's in their name. Depending on a patient's allergies and liver function, either an ester or amide is given to them. Local anesthetics are known to have the side effects of arrhythmia and cardiotoxicity.



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Indications

Minor Procedures
Miner Procedure
These drugs are often used for minor procedures, such as stitches and prior to placing lines, as they are local analgesics and decrease neuronal pain (and other sensory) transmission, effectively "numbing" tissue.

Epidurals
E-pick-drill
Another indication for local anesthetics are for epidurals and minor surgeries. In an epidural, large needle is placed in L2-3 and a catheter is fed to bathe the epidural space with local anesthetic. This serves to provide anesthesia to areas below this dermatome for analgesia during childbirth. Epidurals can also be used as an adjunct to general anesthesia in surgeries.

Mechanism of Action

Blocks Na+ Channels
Block-guy Blocking Salt-shaker Channel
Local anesthetics prevent sodium influx by blocking sodium channels in the neuronal membrane. This interruption of sodium passage prevents an action potential from arising, inhibiting signal conduction.

State Dependent
State Dependant mine
These drugs are state dependant, meaning they exhibit preferential binding to activated Na⁺channels and their neuronal blockade works best in rapidly firing neurons.

Combined with Vasoconstrictors
Used with Vessel-constrictor
When used for minor procedures, local anesthetics are often combined with vasoconstrictors, such as epinephrine. This vasoconstricion yields increased anesthetic action, as it is concentrated in the area, as well as decreased bleeding.

Infected Tissue Requires Higher Dose
Pathogen Injected with Large-needle Dose
Infected tissue, which is considered to be acidic, ionizes local anesthetics and decreases their ability to cross the cell-membrane and reach sodium channels, decreasing the drug's overall action. Thus, it takes a greater amount of local anesthetic to provide its effects.

Drugs

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Esters

Easter-bunny

Esters are a type of local anesthetic which are more prone to causing allergic reactions. They can be identified by having one "I" in their name: procaine, cocaine, tetracaine. Esters are hydrolized by pseudocholinesterases in the plasma.

Amides

King A-midas

Amides can be identified by having two I's in their name: lidocaine, mepivacaine, bupivacaine. Amide local anesthetics are metabolized in the liver and should not be used in patients with liver failure.

Side Effects

Arrhythmias

Broken Arrhythmia-drum

Cocaine causes coronary vasospasm and may give rise to arrhythmias, as well as levobupivacaine and ropivacaine.

Cardiotoxicity

Heart with Toxic-green-glow

Local anesthetics are sometimes administered intravenously in general surgery, and may lead to arrhythmias. Bupivacaine is considered to be cardiotoxic because it blocks cardiac Na⁺ channels and can lead to malignant arrhythmias.

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