

Anesthetics

Local and General

Read about the use of ketamine as an antidepressant

Research has been published showing that ketamine rapidly makes new CNS connections that abate the symptoms of MDD.^{1,2,3}

<http://journals.cambridge.org/action/displayAbstract;jsessionid=7AE C84E1DFDCEC349288CAF01A6A81FE.iournals?fromPage=online&aid>



Anesthesia versus Analgesia

In this section, we are going to discuss agents used to cause anesthesia, which is the loss of all sensation. Practically, there isn't one product that does everything. General anesthesia is carried out using combinations of drugs.

Local anesthetics are used to block pain sensation in the periphery, but they will impact ANY neuron ANYWHERE if allowed to come in contact with the nerve.

Generals are used to block nervous function in the CNS, and they aren't specific either.

Generals are rarely analgesic (whereas locals are).

1. A preliminary naturalistic study of low-dose ketamine for depression and suicide ideation in the emergency department. Larkin and Beautrais. *International J of Neuropsychopharmacology* 14(8) 2011:1127-1131.

2. Safety and Efficacy of Repeated-Dose IV Ketamine for treatment-Resistant Depression. Roth et.al. *Biological Psychiatry* 67(2) 2010:139-145

3. Replication of Ketamine's antidepressant efficacy in bipolar depression: a randomized controlled add-on trial. Zarate et.al. *Biological Psychiatry* 71(11) 2012:939-946

Goals of General Anesthesia

- Lose the ability to feel pain
- Lose the ability to move
- Forget everything that happened

Chloral hydrate

Chloral hydrate is a sedative, hypnotic used in kids and the elderly to help relieve anxiety and induce sleep prior to surgery. It is available as oral and rectal formulations.

The famous "Mickey Finn" is a drink laced with chloral hydrate in order to incapacitate the drinker. It can be traced back to a Chicago bartender of the same name who drugged and robbed his customers.



Local anesthetics

Local anesthetics fall into two groups: amides and esters. Esters were originally derived from cocaine. All the generic ester names have only one "i." This is important because esters are more likely to cause a PABA allergy. If the generic name contains two "i's" it is an amide.

Benzocaine is a very common ester OTC with lots of uses in many different products. One trade name is Anbesol.

Lidocaine (Xylocaine) is an amide indicated for:

- Ventricular arrhythmias,
- Itching, burning and pain related to skin inflammation
- Anesthesia for dental and minor surgery
- Tinnitus
- Numb the skin and reduce nematocyst firing in jellyfish stings.



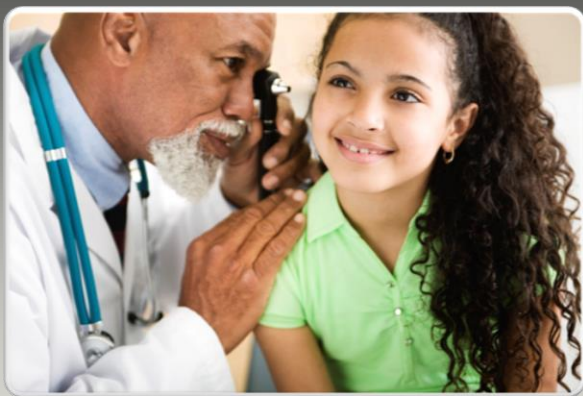
EMLA cream

EMLA stands for Eutectic Mixture of Local Anesthetics.

Eutectic means a combination of chemicals that exists as a solid at a lower temperature than any other combination of those chemicals

EMLA cream is a eutectic mixture of
2.5% Lidocaine
And
2.5% Prilocaine

Side effects of locals



- CNS effects
 - Headache, CNS depression, Coma
 - Seizures
- PNS effects
 - Flaccid paralysis
- Cardiovascular effects
 - Cardiac depression, hypotension
- Allergic reactions (to PABA)



Balanced Anesthesia

In order to achieve the collection of changes desired for surgical anesthesia, a number of drugs must be given. While this is called a cocktail, the drugs are typically administered in a sequence.

Pre-op medications

- To reduce GIT mobility and secretions; most also sedating
 - Anticholinergic antispasmodics
 - Hyoscyamine, dicyclomine, glycopyrrolate, propantheline, scopolamine, atropine
 - Antihistamines
 - Diphenhydramine, Hydroxyzine
- Sedative, hypnotic, anxiolytic, amnesia
 - Benzodiazepine
- To prevent unwanted skeletal muscle movements (paralytic agents)
 - Neuromuscular junction blockers
 - Pancuronium, Succinylcholine
- Antiemetics
 - Ondansetron, dexamethasone, metoclopramide, droperidol
- Opioid analgesic, sedative, hypnotic
 - Fentanyl, meperidine

Induction & Maintenance

- General anesthetic agent (IV &/or Inhalation)
- General anesthetic + opioid
- Local or regional anesthetic

Post-op medications

- Analgesics (opioid and/or NSAID or APAP)
- Antiemetic
- Antihistamine (anti-itch)
- Antacid
- Antibiotics
- Blood clot prophylaxis (aspirin)
- Stool softener or laxative

Drugs that should be discontinued prior to surgery – list varies by surgery, surgeon and anesthesiologist.

- Anticoagulants
 - NSAIDs, especially aspirin
 - Warfarin (Coumadin)
 - Clopidogrel (Plavix)
 - Herbs*, vitamins, supplements
- Diabetic medications
 - All oral antihyperglycemics
 - Insulin (clear with doctor)
- Diuretics
- Psychotropics
 - Lithium
 - SSRIs & TCAs (clear with doctor)
 - MAOI
- Decongestants & allergy meds
- Other cardiac meds
 - Digoxin

* Herbs that may present problems during surgery: Echinacea, Ephedra, Feverfew, Fish Oil, Flaxseed, Garlic, Ginger, Ginko biloba, Ginseng, Kava-Kava, Licorice, Omega 3 supplements, Vitamin E & K supplements.

General Anesthetics

Thiopental (Pentothal) is a C-III barbiturate that may be used as a hypnotic for very short procedures. It is not analgesic. It has a very rapid onset in less than a minute following injection.

Etomidate (Amidate) is a non-barbiturate, but like thiopental, has a very rapid onset, short duration and is only hypnotic, not analgesic. Etomidate can cause a lot of transient muscle movement and injections are painful.

Thiopental or Etomidate are effective induction agents.

Ketamine (Ketaset, Ketalar) is a C-III non-barbiturate general anesthetic. It is an excellent analgesic and produces a true dissociative anesthesia. This is the anesthetic of choice for asthmatics. However, in adults, a large number experience an unpleasant, and potentially dangerous, emergence reaction.

Propofol (Diprivan) is the top selling general anesthetic agent in the world. It is a non-barbiturate and does not provide analgesia. It is however, very well tolerated, rapid on/off and popular in many surgical and emergency medicine applications including the induction of coma. Due to its thick milky white consistency, propofol is casually known as "Milk of Amnesia."

Fentanyl (Sublimaze) is a potent, C-II, opioid analgesic used for pre-medication, induction and maintenance of anesthesia. It may continue to cause apnea long after the analgesic effects have faded.



Monitored Anesthesia Care

Called MAC Sedation, this is a level of sedation that allows the patient to interact with the surgeon. It allows a procedure to be carried out on an out-patient basis that previously required hospital admission and stay.

It usually involves intravenous sedation using a product such as propofol combined with analgesia from local anesthetic infiltration or nerve blocks.

Another combination is propofol with ketamine.

Typically, the patient is not intubated and mechanically ventilated. Which means the anesthetics must be carefully titrated to maintain spontaneous respiration.

The patient typically recovers faster and experiences less PONV following MAC sedation.

Don't confuse MAC sedation with MAC (Minimal Alveolar Concentration).

Adjuvants

Midazolam (Versed) is a C-IV benzodiazepine with a rapid onset and very short duration. It is used as a pre-medication for its sedative, hypnotic, anxiolytic and amnesiac properties. It is not analgesic. It is a powerful amnesiac, though, and patients may experience memory problems for up to a week after midazolam use. It also may cause transient muscle movement and is renowned for causing potentially fatal respiratory depression. Midazolam, and other BZD, may be reversed with [Flumazenil](#) (Romazicon).

Other opioids used as adjuvants may include, meperidine (Demerol), Sufentanil, Alfentanil or Remifentanil. The last three are very potent opioids.

Selective alpha 2 agonists such as dexmedetomidine may be used for the short-term sedation of critically ill patients. Clonidine (Catapres) may be used in combination with an opioid to synergize the opioid analgesic action.

Inhaled Anesthetics

Volatile Liquids

Isoflurane (Forane) and **Sevoflurane (Ultane, Sojourn)** are two volatile liquid anesthetics administered using a mask and a vaporizing machine specific for the agent. Isoflurane has a potent odor and triggers coughing, laryngospasm and breath holding. Thiopental given 7-10 minutes prior to induction can help eliminate this reflex. Sevoflurane is degraded in contact with soda lime (used to scrub carbon dioxide) to produce chemicals toxic to the kidneys and liver. Its use requires continuous fresh gas flow.

The volatile liquid anesthetics are associated with:

- Sensitizing the myocardium to catecholamines & hyperkalemia leading to arrhythmias
- Increased intracranial pressure
- Apnea
- Curare-like effects
- Malignant hyperthermia
- Electroencephalogram activity consistent with seizures
- Decreases in intellect and changes in mood for 2-6 days
- Shivering
- PONV!!!

Inorganic Gas

Nitrous oxide (N₂O) is the only inorganic gas used as an anesthetic. It must be administered hyperbarically, typically with 100% oxygen to prevent asphyxiation.

Nitrous oxide is frequently given with the volatile liquid anesthetics (or other parenteral anesthetics) because synergy between the products allows less of each to be used resulting in cost savings as well as increased safety.

MAC = Minimal Alveolar Concentration

MAC is the amount (concentration) of drug needed to stop ½ of patients from responding to surgical stimuli.

It is significant because Nitrous Oxide can be used as an adjuvant to increase the potency of other anesthetics. The results of using less anesthetic:

1. Cost savings
2. Patient safety



Homework and Exercises

1. Read the "START HERE" announcement in Lulima for updates and instructions.
2. Read about Anesthetics in Chapter 30, **Anesthetics and Anesthetic Adjuvants**. Adams & Urban, PHARMACOLOGY Connections to Nursing Practice.
3. Review the Powerpoints and listen to the audio from the face-to-face lecture. You may opt to watch the appropriate videos for this lecture. Review any handouts available for this lecture in the Course Index.
4. Complete the SLO practice set for Anesthetics in Tasks, Tests and Surveys.
5. Use "Chat," "Discussions and Private Messages" or the lecture "Forum" to ask questions and find answers or to seek assistance.
6. Complete the online quiz in Lulima, Tasks, Tests and Surveys.

If you have any questions, email me at abeale@hawaii.edu