

CHAPTER 11

General and Local Anesthetics

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Anesthetics

- Agents that depress the central nervous system (CNS)
 - Depression of consciousness
 - Loss of responsiveness to sensory stimulation (including pain)
 - Muscle relaxation
- Anesthesia: the state of depressed CNS activity

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Anesthesia

- A state of depressed CNS activity
- Two types
 - General anesthesia
 - Local anesthesia
- Balanced anesthesia

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General Anesthetics

- Agents that induce a state in which the CNS is altered to produce varying degrees of:
 - Pain relief
 - Depression of consciousness
 - Skeletal muscle relaxation
 - Reflex reduction

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General Anesthetics (cont'd)

- Inhaled anesthetics
 - Volatile liquids or gases that are vaporized in oxygen and inhaled
- Injectable anesthetics
 - Administered intravenously

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Inhaled Anesthetics

- Inhaled gas
 - Nitrous oxide (“laughing gas”)
- Inhaled volatile liquids
 - enflurane (Ethrane)
 - halothane (Fluothane)
 - isoflurane (Forane)
 - methoxyflurane (Penthrane)
 - sevoflurane (Ultane)

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Injectable Anesthetics

- Used:
 - To induce or maintain general anesthesia
 - To induce amnesia
 - As an adjunct to inhalation-type anesthetics

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Injectable Anesthetics (cont'd)

- etomidate (Amidate)
- ketamine (Ketalar)
- methohexital (Brevital)*
- propofol (Diprivan)*
- thiamylal (Surital)
- thiopental (Pentothal)*

* May also be used as adjunctive agents at lower dosages

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Adjunctive Agents

- Sedative-hypnotics
 - Barbiturates (secobarbital, thiopental)
 - Benzodiazepines (diazepam, midazolam)
- Opioids (narcotics)
 - morphine, fentanyl, sufentanil

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Adjunctive Agents (cont'd)

- Neuromuscular blocking agents (NMBAs)
 - Depolarizing agents (succinylcholine)
 - Nondepolarizing agents (pancuronium, d-Tubocurarine, vecuronium)
- Anticholinergics
 - atropine, glycopyrrolate, scopolamine

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Mechanism of Action

- Varies according to agent
- Overton-Meyer theory
- Overall effect
 - Orderly and systematic reduction of sensory and motor CNS functions
 - Progressive depression of cerebral and spinal cord functions

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Indications

- General anesthetics used during surgical procedures to produce:
 - Unconsciousness
 - Skeletal muscular relaxation
 - Visceral smooth muscle relaxation
- Rapid onset, quickly metabolized

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Side Effects

- Vary according to dosage and agent used
- Sites primarily affected
 - Heart, peripheral circulation, liver, kidneys, respiratory tract
- Myocardial depression is commonly seen

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Side Effects (cont'd)

- Malignant hyperthermia
 - Occurs during or after general anesthesia
 - Sudden elevation in body temperature (>104° F)
 - Life-threatening emergency

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Local Anesthetics

- Also called *regional anesthetics*
- Used to render a specific portion of the body insensitive to pain
- Interfere with nerve impulse transmission to specific areas of the body
- Do not cause loss of consciousness

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Local Anesthetics (cont'd)

- Topical
 - Applied directly to skin or mucous membranes
 - Creams, solutions, ointments, gels, ophthalmic drops, lozenges, suppositories
- Parenteral
 - Injected into the CNS by various spinal injection techniques

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Types of Local Anesthesia

- Epidural
- Infiltration
- Nerve block
- Spinal
- Topical

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Parenteral Anesthetic Agents

- lidocaine (Xylocaine)
- mepivacaine (Carbocaine)
- procaine (Novocain)
- tetracaine (Pontocaine)
- bupivacaine (Marcaine)
- ropivacaine (Naropin)

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Drug Effects

- First, autonomic activity is lost
- Then pain and other sensory functions are lost
- Motor activity is the last to be lost
- As local agents wear off, they do so in reverse order (motor, sensory, then autonomic activity are restored)

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Indications

- Local anesthetics are used for:
 - Surgical, dental, and diagnostic procedures
 - Treatment of certain types of pain
- Infiltration anesthesia
- Nerve block anesthesia

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Indications (cont'd)

- Infiltration anesthesia
 - Minor surgical and dental procedures
 - Injection of the anesthetic solution intradermally, subcutaneously, or submucosally across the path of nerves supplying the target area
 - May be given in a circular pattern around the operative area

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Indications (cont'd)

- Nerve block anesthesia
 - Used for surgical, dental, and diagnostic procedures
 - Also used for therapeutic management of pain
 - The anesthetic agent is injected directly into or around the nerve trunks or nerve ganglia that supply the area to be numbed

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Side/Adverse Effects

- Usually limited
- Adverse effects result if:
 - Inadvertent intravascular injection occurs
 - Excessive dose or rate of injection is given
 - Slow metabolic breakdown
 - Injection into a highly vascular tissue

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Neuromuscular Blocking Agents

- Also known as NMBAs
- Prevent nerve transmission in certain muscles, resulting in paralysis of the muscle
- Used with anesthetics during surgery

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Neuromuscular Blocking Agents (cont'd)

- When used during surgery, artificial mechanical ventilation is required
 - These drugs paralyze respiratory and skeletal muscles
 - Patient cannot breathe on his/her own
 - Do not cause sedation or relief of pain
 - Patient may be paralyzed yet conscious

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Neuromuscular Blocking Agents (cont'd)

- Depolarizing agents
- Nondepolarizing agents
 - Short acting
 - Intermediate acting
 - Long acting

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NMBAs: Depolarizing Agent

- succinylcholine is the only one
- Works similarly to neurotransmitter acetylcholine (ACh), causing depolarization
- Metabolism is slower than ACh, so as long as succinylcholine is present, repolarization cannot occur
- Result: flaccid muscle paralysis

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NMBAs: Nondepolarizing Agents

- Short acting
 - mivacurium (Mivacron)
- Intermediate acting
 - atracurium (Tracrium)
 - rocuronium (Zemuron)
- Long acting
 - pancuronium (Pavulon)
 - d-Tubocurarine (dTC)

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Nondepolarizing NMBAs

- Prevent ACh from acting at the neuromuscular junctions
- Nerve cell membrane is not depolarized, muscle fibers are not stimulated
- Skeletal muscle contraction does not occur

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Neuromuscular Blocking Agents

- First sensation felt is weakness
- Followed by total flaccid paralysis
- Small, rapidly moving muscles are affected first (fingers, eyes), then limbs, neck, trunk
- Finally, intercostal muscles and the diaphragm are affected, resulting in cessation of respirations
- Recovery of muscles usually occurs in reverse order

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NMBAs: Indications

- Main use: maintaining controlled ventilation during surgical procedures
- Endotracheal intubation (short acting)
- To reduce muscle contraction in an area that needs surgery
- Diagnostic agents for myasthenia gravis
- Other uses

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NMBAs: Side/Adverse Effects

- Few when used appropriately
- May cause:
 - Hypotension (blockade of autonomic ganglia)
 - Tachycardia (blockade of muscarinic receptors)
 - Hypotension (release of histamine)
- Effects vary according to site

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NMBAs: Overdose

- Overdose causes prolonged paralysis requiring prolonged mechanical ventilation
- Cardiovascular collapse may occur
- Several conditions may increase the sensitivity of a patient to NMBAs

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Moderate Sedation

- Combination of an IV benzodiazepine and an opiate analgesic used
- Anxiety and sensitivity to pain are reduced, and patient cannot recall the procedure
- Preserves the patient's ability to maintain own airway and to respond to verbal commands

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Moderate Sedation (cont'd)

- Used for diagnostic procedures and minor surgical procedures that do not require deep anesthesia
- Topical anesthetic may be applied also
- Rapid recovery time and greater safety profile than general anesthesia

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Nursing Implications

- Always assess past history of surgeries and response to anesthesia
- Assess past history, allergies, medications
- Assess use of alcohol, illicit drugs, opioids

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Nursing Implications

- Assessment is vital during pre-, intra-, and postoperative phases
 - Vital signs
 - Baseline labwork, ECG
 - Pulse oximeter (PO₂)
 - ABCs (airway, breathing, circulation)
 - Monitor all body systems

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Nursing Implications

- Nursing considerations during the perioperative phase include the:
 - Preoperative phase
 - Intraoperative phase
 - Postoperative phase
- Each phase has its own complex and very specific nursing actions

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Nursing Implications

- Close and frequent observation of the patient and all body systems
- During a procedure, monitor vital signs, ABCs
- Watch for sudden elevations in body temperature, which may indicate malignant hyperthermia

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Nursing Implications

- During recovery, monitor for cardiovascular depression, respiratory depression, and complications of anesthesia
- Implement safety measures during recovery, especially if motor/sensory loss occurs due to local anesthesia

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Nursing Implications

- Reorient patient to his/her surroundings
- Provide preoperative teaching about the surgical procedure and anesthesia
- Teach the patient about postoperative turning, coughing, deep breathing

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Nursing Implications

If an NMBA is to be used for a procedure when the patient is to be awake, teach the patient that he/she may be paralyzed but still able to hear and feel

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