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

Anesthesia

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

Inhaled Anesthetics

- Inhaled gas
  - Nitrous oxide ("laughing gas")
- Inhaled volatile liquids
  - enfurane (Ethrane)
  - halothane (Fluothane)
  - isoflurane (Forane)
  - methoxyflurane (Penthane)
  - sevoflurane (Ultane)
Injectable Anesthetics

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

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

Adjunctive Agents

- Sedative-hypnotics
  - Barbiturates (secobarbital, thiopental)
  - Benzodiazepines (diazepam, midazolam)
- Opioids (narcotics)
  - morphine, fentanyl, sufentanil
Adjunctive Agents (cont'd)

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

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

Indications

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

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

Side Effects (cont’d)

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

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
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

Types of Local Anesthesia

- Epidural
- Infiltration
- Nerve block
- Spinal
- Topical

Parenteral Anesthetic Agents

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

Indications

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

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
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

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

Neuromuscular Blocking Agents

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

Neuromuscular Blocking Agents (cont'd)

• Depolarizing agents
• Nondepolarizing agents
  – Short acting
  – Intermediate acting
  – Long acting

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
NMBAs: Nondepolarizing Agents

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

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

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
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

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

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
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

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

Nursing Implications

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

• Assessment is vital during pre-, intra-, and postoperative phases
  – Vital signs
  – Baseline labwork, ECG
  – Pulse oximeter (PO$_2$)
  – ABCs (airway, breathing, circulation)
  – Monitor all body systems

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

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
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

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

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