Chapter 30
Toxicology

Learning Objectives

- Describe the extent of injury and death associated with toxicological emergencies
- Define poison, toxicology, and toxicological emergency
- Describe role of the poison control center in the treatment of toxicological emergencies

Learning Objectives (Cont'd)

- List four routes of entry of poisons into the body and how they affect the managed care of poisoned patient
- Understand the need for accurate scene size-up to ensure responder safety at toxicological emergencies

9/10/2012
Learning Objectives (Cont'd)

- List and use available reference materials for poisonings involving household and industrial chemicals
- Describe the general toxidromes used to classify and treat poisoned patients
- Understand the importance of decontaminating patients

Learning Objectives (Cont'd)

- Identify the difference between internal and external decontamination
- Describe appropriate uses of activated charcoal for internal decontamination
- Identify available antidotes to poisons and how they are used to treat patients

Learning Objectives (Cont'd)

- Identify medications commonly involved in toxicological emergencies
  - List common signs, symptoms, and treatment procedures that benefit patients
- Identify chemicals commonly involved in toxicological emergencies
  - List common signs, symptoms, and treatment procedures that benefit patients
Learning Objectives (Cont’d)

- Identify wildlife commonly involved in toxicological emergencies
  - List common signs, symptoms, and treatment procedures that benefit patients
- Identify plants and mushrooms commonly involved in toxicological emergencies
  - List common signs, symptoms, and treatment procedures that benefit patients
- Identify illegal drugs commonly involved in toxicological emergencies
  - List common signs, symptoms, and treatment procedures that benefit patients
- Understand the toxicological effects of alcohol and alcohol abuse and how to treat signs and symptoms of alcohol poisoning

Introduction

- Poisonings present many challenges
  - Scene safety
  - ABCs
  - Antidotes
- 93% of poisonings occur in the home
- 83% of poisonings are accidental
Toxicology

- Toxicology
  - Study of toxins or poisons
    - Properties of poisons
    - Effects of poisons on the body
      - Chemistry
      - Biochemistry
      - Epidemiology

Toxicology (Cont’d)

- Toxicology
  - Combining knowledge of chemistry, biochemistry, and epidemiology
    - Why poisoning occurs
    - How they affect the human body
    - How victims should be treated
    - How to prevent further injuries

Toxicology (Cont’d)

- Toxicology
  - Toxicology emergencies
    - Therapeutic errors
    - Idiosyncratic reactions
    - Environmental exposures
    - Neglect and abuse
    - Intentional drug and alcohol poisoning
    - Suicide
    - Assault
    - Homicide
    - Terrorism
Toxicology (Cont'd)

- Poison control center
  - Maintain national poison control system
    - Public education
    - Research
    - Data collection
    - Database

Toxicology (Cont'd)

- Routes of entry
  - Ingestion
    - Through eating/drinking
    - Most common for poisons
    - Effective, GI system breaks down and absorbs food
    - Equal opportunity absorber
    - Acids better absorbed in the stomach
    - Bases better absorbed in the small intestines
    - Poison must be in water to be absorbed

Toxicology (Cont'd)

- Routes of entry
  - Absorption
    - Through skin or eyes
    - Hydrocarbon solvents and fuels
Toxicology (Cont’d)

- Routes of entry
  - Injection
    - By penetration
    - Accidentally through puncture
    - Intentionally through needle or envenomation
    - Drug abuse most likely
    - In bloodstream

Toxicology (Cont’d)

- Routes of entry
  - Inhalation
    - Through breathing
    - Lungs cannot discriminate between life-giving O\textsubscript{2} and toxic gases
    - Rapidly enters the bloodstream at alveoli in lungs

Recognition and Identification of Poisoning Accidents

- Safety of self and patient dependent on how rapidly and accurately poison is identified
  - Toxin identified
  - Information relayed to hospital
  - Antidotes administered
  - Side effects can lead to violent behavior
Recognition and Identification of Poisoning Accidents (Cont’d)

- Scene size-up and responder safety
  - Dispatch information
    - Location
    - Primary complaint
    - Inconsistent with other dispatch information
    - Determine whether accidental or intentional
    - Call specialists early

- Crime scenes: suicidal patients and drug overdose
  - Law enforcement secures before entering
  - If potentially dangerous, leave, request backup

- Chemical release or spill
  - Practice hazardous materials awareness
  - RAIN

Reference materials

- NIOSH guide
  - Pocket guide
  - Chemical and physical properties of agents
  - Respiratory guidelines
  - Health effect
  - Immediate treatment regimens
  - Listed alphabetically
  - Look up by United Nations number or chemical abstracts services number
Recognition and Identification of Poisoning Accidents (Cont’d)

- Reference materials
  - WISER chemical database
    - Electronic database
    - Chemical and physical properties
    - Decontamination advice
    - Treatment guidelines
    - Search engine by signs/symptoms, chemical and physical properties
    - Can be downloaded to PDAs, laptops, tablets, online

Recognition and Identification of Poisoning Accidents (Cont’d)

- Reference materials
  - Agency for Toxic Substances and Disease Registry
    - EMS and hospital responses to hazardous materials poisonings

Recognition and Identification of Poisoning Accidents (Cont’d)

- Patient assessment and history
  - Initial assessment and patient history
    - Primary complaint
    - Substance to which patient is exposed
    - Entry route
    - Substance amount
    - Exposure onset
Recognition and Identification of Poisoning Accidents (Cont’d)

- Patient assessment and history
  - ABCs
  - Signs/symptoms
    - Altered mental status
    - Respiratory difficulty
    - Cardiac dysrhythmias
    - Emesis
  - Psychological illness
  - Unresponsive, ask bystanders
  - Emetics or activated charcoal given
  - Alert for containers, medications
  - If vomits, cautious of emesis

Toxidromes

- Signs/symptoms that different toxic agents induce
- Classification
  - Associates symptoms with causative agent
  - Provide treatment regimen
  - Specific antidote, usually administered at hospital
Recognition and Identification of Poisoning Accidents (Cont’d)

- **Toxidromes**
  - Cholinergic syndrome
    - Signs/symptoms
      - SLUDGE
      - Diaphoresis and miosis
      - CNS depression
      - Confusion, weakness
      - Nausea, vomiting, cramps
      - Bronchoconstriction, wheezing
      - Cardiac dysrhythmias
      - Convulsions, seizures
      - Coma

- **Treatment**
  - ABCs
  - Activated charcoal
  - Atropine
  - Pralidoxime
  - Diazepam

Recognition and Identification of Poisoning Accidents (Cont’d)

- **Anticholinergic syndrome**
  - Signs/symptoms
    - Dry skin, flushed skin, thirst
    - Delirium, lethargy, dysphagia
    - Dilated pupils
    - Hyperthermia
    - Tachycardia
    - Cardiac dysrhythmias
    - Seizures
Recognition and Identification of Poisoning Accidents (Cont’d)

- Toxidromes
  - Anticholinergic syndrome
    - Treatment
      - ABCs
      - Activated charcoal
      - Diazepam

- Toxidromes
  - Hallucinogen syndrome
    - Signs/symptoms
      - Visual illusions
      - Strange behavior, delusions
      - Respiratory depression
      - CNS depression
    - Treatment
      - ABCs
      - Calming measures
      - Diazepam

- Toxidromes
  - Narcotic/opioid syndrome
    - Signs/symptoms
      - Euphoria, high
      - Pinpoint pupils
      - Nausea, vomiting
      - Hypotension
    - CNS depression
      - Respiratory depression
      - Seizures
      - Coma
Recognition and Identification of Poisoning Accidents (Cont’d)

- Toxidromes
  - Narcotic/opioid syndrome
    - Treatment
      - ABCs
      - Naloxone
  
Recognition and Identification of Poisoning Accidents (Cont’d)

- Toxidromes
  - Sympathomimetic syndrome
    - Signs/symptoms
      - Paranoia, delusions
      - Diaphoresis
      - Hypertension
      - CNS excitation, tachycardia
  
Recognition and Identification of Poisoning Accidents (Cont’d)

- Toxidromes
  - Sympathomimetic syndrome
    - Treatment
      - ABCs
      - Calming measures
      - Diazepam
General Treatment Principles

- Determine causative agent
- Be persistent during history
- Use family, friends, bystanders

General Treatment Principles (Cont’d)

- Immediate environmental clues
  - Open, partially empty containers
  - Medicine cabinet
  - Chemical residues
  - Drug paraphernalia

General Treatment Principles (Cont’d)

- ABCs and supportive care
  - Low-viscosity solvents prone to aspiration
  - IV access
General Treatment Principles (Cont’d)

- Decontamination
  - Contaminant removal from people/equipment
  - External decontamination
    - Before transport
    - Ingested volatile poisons never transported by air
    - Jurisdictional agencies can perform decontamination
    - Universal solution is soap and water

General Treatment Principles (Cont’d)

- Decontamination
  - GI (internal) decontamination
    - Within 1 hour of intake
    - Once reached the small intestine, ineffective
    - Syrup of ipecac
      - Universally discouraged
      - Only reduces absorption by 30%

General Treatment Principles (Cont’d)

- Decontamination
  - Activated charcoal
    - As effective as gastric lavage
    - Absorbs most chemicals
    - Administer within 1 hour of ingestion
    - Cathartics often added, increases elimination rate
General Treatment Principles (Cont'd)

- Decontamination
  - Gastric lavage
    - Pumping stomach
    - Effective if performed within 1 hour
    - Only decontaminates the stomach
    - Not effective once toxin reaches the small intestine
    - Excellent treatment for poisons that do not bind to activated charcoal and highly toxic agents without antidote

General Treatment Principles (Cont'd)

- Decontamination
  - Whole-bowel irrigation
    - Much more effective
    - Poisonings that form concretions
    - Substances not readily absorbed by activated charcoal
    - Continuously administers polyethylene glycol electrolyte into stomach with gastric tube
    - Contents of entire GI tract cleared
    - Drawback, lengthy time for fluid administration

General Treatment Principles (Cont'd)

- Antidote administration
  - Counteract effects of poison
  - Increase elimination rate
  - Reactivate enzymes damaged by poison
Poisonings

- Medications
  - Drug overdose
  - Sedatives
  - Hypnotics
  - Antipsychotics
  - Analgesics

Poisonings (Cont'd)

- Medications
  - Accidental overdose
    - Low therapeutic index
  - Family and patient education
    - Focus on prevention
    - Read instructions with medications
    - Storage in safe place
    - Consider using dosed and dated pillboxes

Poisonings (Cont'd)

- Medications
  - Treatment of poisonings
    - ABCs
    - Supportive care
    - Antidote varies
Poisonings (Cont'd)

- Medications
  - Pain relievers
    - Acetaminophen signs and symptoms
      - Stage 1: 0-24 hours
      - Stage 2: 24-48 hours
      - Stage 3: 72-96 hours
      - Stage 4: 4-14 days

- Medications
  - Pain relievers
    - Acetaminophen treatment
      - ABCs
        - Detailed patient history
        - Time of ingestion
        - Activated charcoal
        - Antidote: N-acetylcysteine

- Medications
  - Pain relievers
    - Salicylates signs/symptoms
      - Rapid respirations
      - Confusion and lethargy
      - Abdominal pain
      - Vomiting
      - Hypothermia
      - Dysrhythmias
      - Cardiac failure
      - Coma
Poisonings (Cont’d)

- **Medications**
  - Pain relievers
    - Salicylate treatment
    - ABCs
    - Detailed patient history, time of ingestion
    - Activated charcoal
    - IV fluids

Poisonings (Cont’d)

- **Medications**
  - Pain relievers
    - NSAIDs signs/symptoms
      - Headache
      - Tinnitus
      - Nausea, vomiting
      - Drowsiness
      - Edema in extremities
      - Rash, tinnitus
      - Dyspnea, wheezing
      - Pulmonary edema
      - Renal failure

Poisonings (Cont’d)

- **Medications**
  - Pain relievers
    - NSAIDs treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - Activated charcoal
      - Monitor for hypotension and dysrhythmias
Poisonings (Cont'd)

- Antidepressants
  - Tricyclic
    - Signs and symptoms
      - Early: anticholinergic signs
      - Late: confusion
      - Hallucinations
      - Respiratory depression
      - Cardiac dysrhythmias
      - Hypotension
      - Seizures
      - Death

- Antidepressants
  - Lithium
    - Signs/symptoms
      - Thirst, dry mouth
      - Nausea, vomiting, diarrhea
      - Blurred vision
      - Slurred speech
      - Confusion, stupor
      - Tremor, fasciculations
      - Dysrhythmias, bradycardia
      - Atria, seizure, coma
      - Renal failure

- Treatment
  - ABCs
  - Detailed patient history, time of ingestion
  - Activated charcoal
  - Cardiac monitoring
  - Alkalization with sodium bicarbonate
  - Do not use flumazenil because of seizure induction

- Signs/symptoms
  - Thirst, dry mouth
  - Nausea, vomiting, diarrhea
  - Blurred vision
  - Slurred speech
  - Confusion, stupor
  - Tremor, fasciculations
  - Dysrhythmias, bradycardia
  - Atria, seizure, coma
  - Renal failure
Poisonings (Cont'd)

- **Antidepressants**
  - **Lithium**
    - Treatment
      - ABCs
      - Detailed patient history
      - IV fluid replacement
      - Alkalization of urine with sodium bicarbonate
      - Activated charcoal ineffective, useful in coingestions

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Poisonings (Cont'd)

- **Antidepressants**
  - **Monoamine oxidase inhibitors**
    - Signs/symptoms
      - Headache
      - Agitation, restlessness
      - "Ping pong" gaze
      - Palpitations
      - Diaphoresis
      - Hypertension
      - Hyperthermia
      - Tachycardia
      - Severe: bradycardia, hypotension, coma, death

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Poisonings (Cont'd)

- **Antidepressants**
  - **Monoamine oxidase inhibitors**
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - Reverse hyperthermia
      - Cardiac monitoring
      - Activated charcoal
      - Seizures and hyperthermia: benzodiazepines
      - Hypotension: norepinephrine
      - Antagonist: cyproheptadine
Poisonings (Cont’d)

- **Antidepressants**
  - Selective serotonin reuptake inhibitors
    - Signs/symptoms
      - Serotonin syndrome:
        - Agitation, anxiety, confusion
        - Headache, drowsiness
        - Diaphoresis
        - Nausea, vomiting
        - Salivation, diarrhea
    - Flushed skin, cutaneous piloerection, shivering
    - Tremors, myoclonic jerks
    - Hyperthermia
    - Sinus tachycardia
    - R rigidity, lack of coordination
    - Hyperactive bowel sounds

Poisonings (Cont’d)

- **Antidepressants**
  - Selective serotonin reuptake inhibitors
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - Reverse hyperthermia
      - Activated charcoal
      - Cardiac monitoring
      - Antidote: serotonin receptor antagonists

Poisonings (Cont’d)

- **Sedatives, hypnotics, and antipsychotics**
  - Benzodiazepines
    - Signs/symptoms
      - Drowsiness, staggering gait, slurred speech
      - Respiratory depression
      - Hypotension
      - Hypothermia
      - Dysthyrias
      - Coma
Poisonings (Cont’d)

• Sedatives, hypnotics, and antipsychotics
  ➢ Benzodiazepines
    ➢ Treatment
      ➢ ABCs
      ➢ Respiratory support
      ➢ O₂
      ➢ IV fluids
      ➢ Detailed patient history, time of ingestion
      ➢ Activated charcoal
      ➢ Antidote: flumazenil

Poisonings (Cont’d)

• Sedatives, hypnotics, and antipsychotics
  ➢ Barbiturates
    ➢ Signs/symptoms
      ➢ Lethargy, drowsiness, staggering gait, slurred speech
      ➢ Emotional volatility
      ➢ Respiratory depression
      ➢ Fixed and dilated pupils
      ➢ Hypotension
      ➢ Fever
      ➢ Shock, coma

Poisonings (Cont’d)

• Sedatives, hypnotics, and antipsychotics
  ➢ Antipsychotics
    ➢ Signs/symptoms
      ➢ Sedation
      ➢ Miosis
      ➢ Dysrhythmias
      ➢ Hypotension
      ➢ Tachycardia
      ➢ Seizures
Poisonings (Cont’d)

- Sedatives, hypnotics, and antipsychotics
  - Antipsychotics
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - Activated charcoal

Poisonings (Cont’d)

- Cardiovascular drugs
  - Calcium channel blockers
    - Signs/symptoms
      » Confusion, slurred speech
      » Nausea, vomiting
      » Hypertension
      » Respiratory depression
      » Pulmonary edema
    - Treatment
      » ABCs
      » O2
      » Naloxone
      » Activated charcoal
      » IV fluids
      » Cardiac monitoring
      » Antiarrhythmias and vasopressors
      » Atropine; calcium chloride, calcium gluconate, atropine, pacing, glucagon, dopamine
      » Mild hyperglycemia, hypernatremia
      » Lactic acidosis
      » Cardiac dysrhythmias
      » Atrioventricular dissociation
      » Sinus arrest, bradycardia
      » Coma

Poisonings (Cont’d)

- Cardiovascular drugs
  - Calcium channel blockers
    - Treatment
      » ABCs
      » O2
      » Detailed patient history, time of ingestion
      » Activated charcoal
      » IV fluids
      » Cardiac monitoring
      » Antiarrhythmias and vasopressors
      » Atropine; calcium chloride, calcium gluconate, atropine, pacing, glucagon, dopamine

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Poisonings (Cont’d)

- Cardiovascular drugs
  - Beta-blockers
    - Signs/symptoms
      - Bradycardia
      - Hypotension
      - Respiratory depression
      - Seizures
      - Unconsciousness, coma

- Cardiovascular drugs
  - Beta-blockers
    - Treatment
      - ABCs
      - O₂
      - Detailed patient history, time of ingestion
      - Activated charcoal
      - IV access
      - Cardiac monitoring
      - Antidote: glucagon, calcium chloride, calcium gluconate, atropine, pacing, dopamine

- Cardiovascular drugs
  - Cardiac glycosides, digitalis, glycosides, digoxin, digitoxin
    - Signs/symptoms
      - Fatigue
      - Visual disturbance
      - Nausea, vomiting
      - GI disturbances, anorexia
      - Dysrhythmias
      - Hyperkalemia
Poisonings (Cont’d)

- Cardiovascular drugs
  - Cardiac glycosides, digitalis, glycosides, digoxin, digitoxin
    - Treatment
      - ABCs
      - O₂
      - Detailed patient history, time of ingestion
      - Activated charcoal
      - IV access
      - Cardiac monitoring
      - Antidote: digoxin-specific Fab

Poisonings (Cont’d)

- Anticonvulsants
  - Carbamazepine
    - Signs/symptoms
      - Anticholinergic effects
      - Movement disorders
      - Cardiac dysrhythmias
      - Respiratory depression
      - Hypotension
      - Coma

Poisonings (Cont’d)

- Anticonvulsants
  - Carbamazepine
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - Activated charcoal
      - Cardiac monitoring
Poisonings (Cont’d)

- Anticonvulsants
  - Phenytoin-hydantoin derivatives
    - Signs/symptoms
      - Nystagmus
      - Headache
      - Ataxia
      - CNS depression
      - Respiratory depression
      - Coma

Poisonings (Cont’d)

- Anticonvulsants
  - Phenytoin-hydantoin derivatives
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - IV access
      - Activated charcoal

Poisonings (Cont’d)

- Anticonvulsants
  - Valproic acid
    - Signs/symptoms
      - Drowsiness
      - CNS depression
      - Respiratory depression
      - Hypotension
      - Hypoglycemia
    - Hypocalcemia
    - Hypernatremia
    - Metabolic acidosis
    - Cerebral edema
    - Coma
Poisonings (Cont’d)

- Anticonvulsants
  - Valproic acid
    - Treatment
      - ABCs
      - Detailed patient history, time of ingestion
      - IV access
      - Activated charcoal

- Antihistamines and asthma medications
  - Diphenhydramine hydroxyzine
    - Signs/symptoms
      - Sedation
      - Respiratory depression
      - Anticholinergic effects
      - Nausea, vomiting
      - Dry patient
      - Dilated pupils
      - Hyperthermia
      - Hypertension
      - Cardiac dysrhythmias
      - Seizures

- Treatment
  - ABCs
  - Detailed patient history, time of ingestion
  - Reverse hyperthermia
  - IV fluids
  - Cardiac monitoring
  - Activated charcoal
Poisonings (Cont’d)

- Antihistamines and asthma medications
  - Theophylline
    - Signs/symptoms
      - Agitation, tremors
      - Nasal, vomiting, emesis
      - Diarrhea
      - Hypotension
      - Hypercalcemia
    - Hyperglycemia
    - Clonic posturing
    - Cardiac dysrhythmias
    - Intracranial hemorrhage
    - Seizures

- Treatment
  - ABCs
  - O2
  - Detailed patient history, time of ingestions
  - IV access
  - Cardiac monitoring
  - Activated charcoal
  - Seizure precautions
  - Antiemetics

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Corrode metal, destroy tissue on contact
  - Corrosivity measured by pH, 0-14 scale
    - Acid low <2
    - Base high >12.5
  - When acids and bases mix, toxicity
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Acids
    - Cleaning solutions, toilet bowl cleaners, drain openers, metal polishers
    - Foods
  - Soaps and water most effective decontaminate
  - Internal decontamination

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Acids
    - Eye decontamination immediate
      - Becomes necrotic, sore, eschar forms
      - Thin layer of cells on cornea destroyed
      - Denatures proteins in cornea
      - Visual impairment

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Acids
    - GI damage
      - Mouth, esophagus, and stomach burns
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Acids
    - Hydrofluoric acid
      - Acute and systemic toxicity
      - Penetrates deeper than most acids
      - Dermal burns show white/yellow-white underneath skin
      - Systemic hypocalcemia
      - Hypomagnesemia
      - Cardiac dysrhythmias from hypocalcemia in cardiac tissue
      - Antidote: topical calcium gluconate for skin burns

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Bases
    - Alkaline materials
    - Caustics
    - Toilet bowl cleaners, drain openers, household bleach
    - Burns produce tissue liquefaction necrosis
    - Burns penetrate deeper

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Bases
    - Rapid external decontamination
    - Burns to stomach more severe, dissolves protective mucus layer that lines the stomach
    - Ulceration
    - Perforation
    - Ammonia
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Hydrocarbons
    - Combustible, flammable liquids
    - Not water soluble, float on water
    - Gasoline, mineral spirits, paints
    - Affect CNS
    - Absorbed through the skin
    - Hydrocarbons
    - Protoxins

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Hydrocarbons
    - Volatility measured by vapor pressure, indicates risk to respiratory system
    - Viscosity affects aspiration risk
    - Huffing

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Hydrocarbons
    - Recognition of inhalant abuse
      - Solvent stains on skin and clothing
      - Irritation or sores around the mouth
      - Solvent odor on breath
      - Altered level of consciousness
      - Red eyes
      - Runny nose
      - Difficulty sleeping or memory loss
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Hydrocarbons
  - Gastric lavage
  - Camphor
  - Halogenated hydrocarbons
  - Aromatic hydrocarbons
  - Heavy metals with hydrocarbons
  - Pesticides containing hydrocarbons
  - Avoid epinephrine with hydrocarbon intoxication

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Pesticides and nerve agents
    - Organophosphates
    - Carbamates
    - Insect sprays
    - Ingestion, absorption, inhalation
    - More toxic by ingestion/contact

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Pesticides and nerve agents
    - Nerve signal travels along the neuron through an electrochemical mechanism
    - Stops at synapses
    - At the synapse, a chemical neurotransmitter is released from the neuron, travels across the junction
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Pesticides and nerve agents
    - Acetylcholine binds to cholinergic receptor and electrochemical pulse continues in the next neuron or contraction starts in the muscle
    - Once signal transmitter, neurotransmitters removed
    - Inhibit enzyme acetylcholinesterase

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Pesticides and nerve agents
    - Signs/symptoms
      - Wet patient presenting with SLUDGEM symptoms
      - Sweating and muscle fasciculations
      - Respiratory arrest
      - Airway management is the priority

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Carbon monoxide
    - In home, heating/cooking appliances
    - Symptoms
      - Flulike early
      - Hypoesthesia
      - Red, flushed skin
    - Treatment in field
      - High-flow O₂
      - Supportive care
      - Rapid transport
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Methemoglobinemia
    - Nitrites and nitrates oxidize iron in hemoglobin
    - Medication overuse
    - Rural areas, biological processes/fermentation creates nitrites after silos filled with grain
    - Peak toxicity occurs 1 week after being filled
    - “Blue baby” syndrome

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Methemoglobinemia
    - Effects of poisoning
      - Hypotension
      - Dizziness
      - Headache
      - Nausea, vomiting
      - Confusion
      - Cerebral ischemia
      - Cyanosis
      - Cardiovascular collapse
      - Asphyxiation

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Methemoglobinemia
    - Symptoms
      - Slate-gray cyanosis
      - Respiratory distress
      - Altered level of consciousness
      - Anxiety, confusion, stupor
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Methemoglobinemia
    - Antidote
      - Methylene blue

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Cyanides
    - Silver polish
    - Fruit seeds
    - Rodenticides
    - Electroplating
    - Plastics manufacturing
    - Solids, liquids, gases

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Cyanides
    - Combustion gases from residential fires contain cyanide gas
    - Smoke inhalation victims
    - Long-term nitroprusside therapy
    - Suicide
    - Inhalation
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Cyanides
    - Systemic chemical asphyxiating
    - Affects all tissues in body
    - Oxidative phosphorylation
  - Antidotes
    - Amyl nitrite and sodium nitrite first part
    - Sodium thiosulfate

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Sulfides
    - Hydrogen sulfides
      - Improper confined space, industrial accidents
      - Two chemicals mixed
      - Scene size-up
      - Do not retrieve patient without chemical protective clothing, respiratory protection
      - Rotten egg odor
      - Olfactory fatigue

Poisonings (Cont’d)

- Household products and industrial chemicals
  - Sulfides
    - Signs/symptoms
      - Dizziness
      - LOC
      - Nausea, vomiting
      - Respiratory tract irritation
      - Pulmonary edema
      - CNS depression
      - Respiratory distress
      - Seizures
      - Anaerobic metabolism leads to metabolic acidosis
Poisonings (Cont’d)

- Household products and industrial chemicals
  - Sulfides
    - Treatment
      - Supportive
      - High-flow O₂
    - Antidote
      - Amyl and/or sodium nitrite
      - Many times, administration is too late

Poisonings (Cont’d)

- Alcohols
  - Protoxins
    - Processed by body to form toxins
    - Ethylene glycol
    - Methanol

Poisonings (Cont’d)

- Alcohols
  - Ethanol
    - Signs/symptoms of toxicity
      - Euphoria
      - Irritability
      - Confusion
      - Lethargy
      - CNS depression
      - Ataxia
      - Death
    - Slumber
    - Respiratory depression
    - Hypothermia
    - Hypotension
    - Coma
    - Cardiovascular collapse
Poisonings (Cont’d)

- Alcohols
  - Ethanol
    - Treatment
      - Supportive
      - ABCs
      - IV access

Poisonings (Cont’d)

- Alcohols
  - Ethylene glycol
    - Antifreeze
    - Sweet taste, ingested by children and pets
    - Ingestion
    - Hypocalcemia, cardiac dysrhythmias
    - Severe joint pains
    - Liver and kidney damage

Poisonings (Cont’d)

- Alcohols
  - Ethylene glycol
    - Signs/symptoms
      - Intoxication
      - Headache
      - CNS depression
      - Respiratory difficulty
      - Metabolic acidosis
      - Cardiovascular collapse
      - Renal failure
      - Seizures
      - Coma
Poisonings (Cont'd)

- **Alcohols**
  - Ethylene glycol
    - Treatment
      - Maintain ABCs
    - Antidote
      - Ethanol or formepizole
      - Cofactor therapy with pyridoxine and thiamine

Poisonings (Cont'd)

- **Alcohols**
  - Methanol
    - Windshield wiper solvent
    - Gasoline treatment
    - Paints
    - Sterno

Poisonings (Cont'd)

- **Alcohols**
  - Methanol
    - Absorbed through skin
    - Inhalation
    - Ingestion
    - Metabolizes through formaldehyde, converts into formic acid
Poisonings (Cont’d)

- Alcohols
  - Methanol
    - Signs, symptoms
      - Sedation
      - Ataxia
      - Headache
      - Vertigo
      - Nausea, vomiting
    - Abdominal pain
    - Respiratory difficulty
    - Blurred vision
    - Seizures
    - Coma

Poisonings (Cont’d)

- Alcohols
  - Methanol
    - Treatment
      - Maintain ABCs
      - Antidote
        - Ethanol or formepipazine
        - Coenzyme therapy with tetrahydrofolate

Poisonings (Cont’d)

- Alcohols
  - Isopropanol
    - Rubbing alcohol
    - Metabolizes into acetone
    - Causes acetonemia, ketonuria
Poisonings (Cont’d)

- Alcohols
  - Isopropanol
    - Signs/symptoms
      - Confusion
      - Lethargy
      - CNS depression
      - Respiratory depression
      - Ketoxemia
      - Mild hypothermia
      - Hypokalemia
      - Coma
      - Fruity breath odor

Poisonings (Cont’d)

- Alcohols
  - Isopropanol
    - Treatment
      - Supportive
      - Maintain ABCs
      - IV access
      - Possible hemodialysis in hospital

Poisonings (Cont’d)

- Metals and heavy metals
  - Iron
    - Supplements and vitamin formulations
    - Children <6 years most common
    - >20 mg/kg, must determine amount of overdose
    - Toxic to stomach lining
    - Form concretions/bezoars in GI tract
    - Significant ingestion, cardiovascular collapse and death within 12-48 hours
Poisonings (Cont’d)

- Metals and heavy metals
  - Lead and mercury
    - Older buildings, lead paint
    - Mercury found in fluorescent bulbs, mercury thermometers, thermostats, electronics, cars
    - Long-term exposure symptoms
  - Treatment
    - Supportive
    - Chelating agents

- Arsenic
  - Three oxidation states, leads to toxicological effects
  - Naturally found in ground water
  - Treated lumber decks, CCA-treated wood
  - Semiconductor agent
  - Inhalation hazard
Poisonings (Cont'd)

● Metals and heavy metals
  ➢ Arsenic
    ▶ Signs/symptoms
    ▶ Acute GI illness
    ▶ Nausea, vomiting
    ▶ Diarrhea
    ▶ Lethargy

    ▶ Weakness
    ▶ Dehydration
    ▶ Severe anemia
    ▶ Renal failure

Poisonings (Cont'd)

● Metals and heavy metals
  ➢ Arsenic
    ▶ Treatment
      ▶ Supportive
      ▶ ABCs
      ▶ Chelating agents, definitive

Poisonings (Cont'd)

● Wildlife
  ➢ Insects
    ▶ Honeybees signs/symptoms
      ▶ Local pain, itching
      ▶ Swelling, edema
      ▶ Anaphylactic shock
      ▶ Headache, weakness
      ▶ Nausea, vomiting
      ▶ Respiratory distress
      ▶ Respiratory failure
      ▶ Renal failure
Poisonings (Cont’d)

• Wildlife
  ➢ Insects
    ➢ Honeybees treatment
    ➢ ABCs
    ➢ Rapid removal of stinger
    ➢ Ice pack to bite site
    ➢ Detailed patient history, including allergies
    ➢ Analgesics
    ➢ Anaphylactic shock, IV access
    ➢ Epinephrine
    ➢ Rapid transport

Poisonings (Cont’d)

• Wildlife
  ➢ Wasps, yellow jackets, fire ants
    ➢ Signs/symptoms
      ➢ Local pain, itching
      ➢ Swelling, edema
      ➢ Anaphylactic shock
      ➢ Headache, weakness
      ➢ Nausea, vomiting
      ➢ Respiratory distress
      ➢ Respiratory failure
      ➢ Renal failure

Poisonings (Cont’d)

• Wildlife
  ➢ Wasps, yellow jackets, fire ants
    ➢ Treatment
      ➢ ABCs
      ➢ Ice pack to bite site
      ➢ Detailed patient history, including allergies
      ➢ Analgesics
Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - **Black widow spider signs/symptoms**
      - Severe pain at bite site
      - Swelling at bite site
      - Piloerection
      - Diaphoresis
      - Tachycardia
    - **Hyperkalemia**
    - Fever, hyperthermia
    - Muscle spasms
    - Abdominal pain

Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - **Brown recluse spider signs/symptoms**
      - Local: itchiness at site bite
      - Erythema, edema
      - Papule formation
      - Necrotic lesion
      - Bulbous rash
      - Systemic: fever, chills
      - Malaise, weakness
    - Nausea, vomiting
    - Rash
    - Seizures
    - Hypertension
    - Disseminated intravascular coagulation

Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - **Black widow spider treatment**
      - ABCs
        - Detailed patient history, including ID
        - Ice pack to bite site
        - Cardiac monitoring
Poisonings (Cont’d)

• Wildlife
  ➢ Spiders, scorpions, ticks (arachnida)
    • Brown recluse spider treatment
      ➢ ABCs
      ➢ Detailed patient history, including ID
      ➢ IV fluids

Poisonings (Cont’d)

• Wildlife
  ➢ Spiders, scorpions, ticks (arachnida)
    • Brown recluse spider bite

Poisonings (Cont’d)

• Wildlife
  ➢ Scorpions
    ➢ > 600 species in the US
    ➢ Only Bark scorpion is dangerous to human beings
Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - Bark (sculptured) scorpion signs/symptoms
      - Mild: local pain
      - Severe: pulmonary edema
      - Neuromotor hyperactivity
      - Respiratory distress

Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - Bark (sculptured) scorpion treatment
      - ABCs
      - O₂
      - Ice pack to bite site
      - Detailed patient history, including ID
      - IV access
      - Rapid transport

Poisonings (Cont’d)

- **Wildlife**
  - Spiders, scorpions, ticks (arachnida)
    - Ticks
      - Disseminates diseases
      - Ticks paralysis
      - Treatment
      - Possibly fatal
Poisonings (Cont'd)

• Wildlife
  ➢ Pit vipers, copperhead
    ➢ Signs/symptoms
      ➢ Fang marks
      ➢ Localized swelling, pain
      ➢ Weakness
      ➢ Diaphoresis
    ➢ Nausea, vomiting
    ➢ Paraesthesia
    ➢ Edema
    ➢ Ecchymosis
    ➢ Shock

• Treatment
  ➢ Scene safety
  ➢ ABCs
  ➢ Detailed patient history, including ID
  ➢ Cardiac monitoring
  ➢ Clean wound
  ➢ Immobilize extremity
  ➢ Rapid transport
Poisonings (Cont'd)

Wildlife

Coral snakes
- Signs/symptoms
  - Slurred speech
  - Dilated pupils
  - Dysphagia
  - Flaccid paralysis
  - Respiratory failure

Poisonings (Cont'd)

Wildlife

Coral snakes
- Treatment
  - Scene safety
  - ABCs
  - Detailed patient history, including ID
  - Cardiac monitoring
  - Clean wound
  - Immobilize extremity
  - Rapid transport

Poisonings (Cont'd)

Wildlife

Marine creatures
- Jellyfish
- Portuguese man-of-war
- Stingrays
- Lionfish
- Sea urchins
- Sea anemones
- Fire coral
- Coral snails
- Blue-ringed octopus
- Nematocysts
Poisonings (Cont'd)

- Wildlife
  - Marine creatures
    - Signs/symptoms
      - Intense local pain
      - Redness, swelling
      - Lacerations
      - Nausea, vomiting
      - Weakness
      - Dyspnea
      - Tachycardia
      - Hypotension

Poisonings (Cont'd)

- Wildlife
  - Marine creatures
    - Treatment
      - ABCs
      - Detailed patient history, including ID
      - Remove stinging cells or spines
      - Apply 110°F-113°F heat to site
      - Cardiac monitoring
Poisonings (Cont’d)

Foods, plants, and mushrooms

- Food poisoning
  - Salmonella sp.
  - Botulinum
    - Contaminates improperly preserved/canned foods
    - Spores resistant to heat
    - Biological weapon

Poisonings (Cont’d)

- Botulinum signs/symptoms
  - Severe CNS effects
  - Head-to-toe paralysis
  - Respiratory arrest
  - Quadriplegia
Poisonings (Cont’d)

- Foods, plants, and mushrooms
  - Food poisoning
    - Botulinum treatment
    - Supportive
    - Artificial respirations

Poisonings (Cont’d)

- Foods, plants, and mushrooms
  - Plants and mushrooms
    - GI irritants
    - Dermatitis inducers
    - Oxalate-containing substances
    - Cyanogenic glycosides
    - Cardiac glycosides
    - Solanine
    - Amanita and Galerina genera mushrooms

Poisonings (Cont’d)

- Foods, plants, and mushrooms
  - Plants and mushrooms
    - Signs/symptoms vary
      - Redness, irritation at contact site
      - Examine oropharynx for redness, irritation, swelling, blistering
      - Excessive salivation, lacrimation
      - Diarrhea
      - Nausea, vomiting, cramps, diarrhea
      - Reduced consciousness, coma
Poisonings (Cont’d)

- Foods, plants, and mushrooms
  - Plants and mushrooms
    - Treatment
      - Supportive
      - Patient history
      - Ingested material sample for ID

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Alcohol abuse
    - Alcohol dependence
      - Ethanol is potent CNS depressant
      - Coma, death
    - Alcoholism

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Alcohol abuse
    - Alcohol dependence signs
      - Drinking every day
      - Alcohol odor
      - Flushed appearance
      - Binge drinking
      - Memory loss, blackouts
      - Bruises, lacerations, falls
      - GI problems
      - Liver disease
Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Withdrawal syndrome
    - Potentially lethal
    - Seizures
    - Delirium tremens
    - Respiratory arrest
    - Ataxia

- Signs/symptoms
  - Anxiety
  - Irritability
  - Tremors
  - Nausea, vomiting
  - Weakness
  - Diaphoresis
  - Hallucinations
  - Tachycardia
  - Hypertension with possible orthostatic hypotension
  - Poor sleep

- Treatment
  - Supportive
  - ABC
  - Patient history, other drugs
  - Diazepam for seizures
  - IV access
  - Secure scene with law enforcement
  - Transport
Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Amphetamines
    - Signs/symptoms
      - Exhilaration, hyperactivity
      - Dilated pupils
      - Hypertension
      - Psychosis
      - Tremors, seizures

- Treatment
  - ABCs
  - O2
  - Cardiac monitor
  - IV fluids
  - Cardiac treatment as necessary
  - Seizure treatment as necessary
  - Rapid transport

Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Amphetamines
    - Treatment
      - ABCs
      - O2
      - Cardiac monitor
      - IV fluids
      - Cardiac treatment as necessary
      - Seizure treatment as necessary
      - Rapid transport

Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Amphetamines
    - High doses
      - Seizures
      - Hallucinations
      - Paranoia
      - Psychoses
Poisonings (Cont’d)

• Alcohol abuse and illegal drugs
  ➢ Amphetamines
    ➢ Withdrawal symptoms
    ➢ Lethargy
    ➢ Depression
    ➢ Suicidal tendencies
    ➢ Coma

Poisonings (Cont’d)

• Alcohol abuse and illegal drugs
  ➢ Cocaine
    ➢ Stimulates CNS system
    ➢ Lethal dose 1200 mg
    ➢ Powder form
    ➢ Freebase form, more potent

Poisonings (Cont’d)

• Alcohol abuse and illegal drugs
  ➢ Cocaine
    ➢ Signs/symptoms
      ➢ Euphoria
      ➢ Hyperactivity
      ➢ Dilated pupils
      ➢ Psychosis
      ➢ Anxiety, twitching
    ➢ Hypertension
    ➢ Hyperthermia
    ➢ Dysrhythmia, tachycardia
    ➢ Chest pain, heart attack
    ➢ Seizures
Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Cocaine
    - Treatment
      - ABCs
      - Respiratory support
      - O₂
      - Cardiac monitor
      - IV fluids
      - Cardiac treatment as necessary
      - Seizure treatment as necessary
      - Rapid transport

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Opioids: heroin
    - CNS depressants
    - Respiratory failure
    - Orally, intranasally, intradermally
    - Smoked
    - Speedballs

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Opioids: heroin
    - Signs/symptoms
      - Eurphoria
      - CNS depression
      - Respiratory depression
      - Miosis
      - Hypotension
      - Bradycardia
      - Pulmonary edema
      - Coma
Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Opioids: heroin
    - Withdrawal symptoms
      - Irritability
      - Diaphoresis
      - Abdominal cramps
      - Nausea, vomiting
      - Hypothermia
      - Tremors
      - Tachycardia

Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Methamphetamines
    - Clandestine laboratories
    - Lethal risk to paramedics
    - Potent CNS stimulant

Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Methamphetamines
    - Tweaker
      - Not slept in 3-10 days
      - Irritable, unpredictable
      - Dangerous for EMS
      - Scene security
      - Euphoria, sleeplessness
      - Invincibility
      - Keen senses, intelligence
Poisonings

- Alcohol abuse and illegal drugs
  - Methamphetamine
    - Tweaker signs/symptoms
      - Euphoria
      - Muscle tremors
      - Insomnia
      - Depression
      - Hypertension
      - Chest pain
      - Stroke
      - Hallucinations
      - Psychosis
      - Anxiety
      - Anorexia

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Methamphetamine
    - Tweaker treatment
      - Scene safety
      - ABCs
      - O2
      - Cardiac monitor
      - IV fluids
      - Cardiac treatment as necessary
      - Seizure treatment as necessary
      - Rapid transport

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Drugs used in sexual abuse crimes
    - MDMA/ecstasy signs/symptoms
      - Euphoria
      - Confusion
      - Agitation, tremor
      - Hyperthermia
      - Diarrhea
Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Drugs used in sexual abuse crimes
    - MDMA/ecstasy treatment
    - ABCs
    - Respiratory support
    - O2
    - Cardiac monitor
    - IV fluids
    - Cardiac treatment as necessary
    - Rapid transport

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Drugs used in sexual abuse crimes
    - Rohypnol
      - Date rape drug
      - Treat consequences of sexual abuse
      - Law enforcement involvement

Poisonings (Cont’d)

- Alcohol abuse and illegal drugs
  - Hallucinogens: phencyclidine
    - Signs/symptoms
      - Euphoria
      - Disorientation, confusion
      - Sudden mood shifts
      - Flushing
      - Diaphoresis
      - Hypersalivation
      - Vomiting
      - Pupils reactive
      - Facial grimacing
      - Nystagmus
      - Involuntary eye movement
Poisonings (Cont'd)

- Alcohol abuse and illegal drugs
  - Hallucinogens: phencyclidine
    - High doses signs/symptoms
    - CNS depression
    - Coma
    - Respiratory depression
    - Hypertension
    - Tachycardia
    - Encephalopathy
    - Intracerebral hemorrhage
    - Seizures

Chapter Summary

- Toxicological emergencies can cover a wide range of signs and symptoms depending on the toxin
- Toxins can affect any organ system in the body
- In unknown medical emergency, quickly assess signs and symptoms and determine nature of the emergency

Chapter Summary (Cont'd)

- If underlying medical condition seems implausible, a good patient history and examination of the area may reveal the source of the illness as poisoning
- Poisons found almost anywhere—in the home, workplace, nature
- Poisonings may be accidental or intentional
Chapter Summary (Cont’d)

- Must always be cautious when responding to a toxicological emergency

Questions?