PATIENT CARE THEORY 2

UNIT 15, PART 1: Toxicology

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Learning Objectives

- Define: poison; drug abuse; physical dependence; psychological dependence; tolerance; addiction
- Identify four methods through which poisons can enter the body
- List common situations which may lead to accidental poisoning by ingestion
- Explain the purpose of toxidromes in understanding toxicological poisonings
- Describe the clinical manifestations and provide the rationale for their occurrence in various overdoses and poisonings

First Principles

- Toxicology
  - study of the nature, effects, and detection of poisons and the treatment of poisoning

First Principles

- Toxidrome
  - A collection of signs and symptoms that suggest a specific poisoning
  - "physiologic fingerprint"
    - Changes found in vital signs: skin, eyes, mucous membranes, and behaviours
  - *most* toxidromes represent agonists or antagonists effects on the autonomic nervous system

First Principles

- understanding the CNS & ANS is critical
- multi-drug overdoses are common
- Supportive care is life saving
- Paramedics should be familiar with all antidotes

First Principles

mortality = lethality
morbidity = damage (long term consequences

- Intervene early with supportive care
  - ABCDE
- Apply antidote therapy when appropriate
  - primary goal reduce mortality and early and late morbidity.
  - secondary goal reduce length of hospital stay and resources required
- both goals are highly dependant upon initial early management.

First Principles

- gather evidence
  - examples?
- always maintain a high index of suspicion
- err on the side of caution / over-triage
- **always** assess CBG in the face of an altered LOC
- Induction of vomiting is <u>not</u> recommended

can do damage on way up, can cause aspiration

Alcohol/Acidosis, Epilepsy/Endocrine/ Electrolytes, Infection, Overdose/Oxygen, Uremia, Trauma/Tumor/Temperature, Insulin, Psychiatric/Poisoning, and Stroke/Shock.

Recognition of Specific Toxidromes

Recognizing toxidromes requires:

- familiarity with basic pharmacology
- understanding the Autonomic Nervous System (parasympathetic vs. sympathetic)

Clinical Toxicology

Toddlers under 3 more likely to poison themselves, as older kids know not to consume bad shit

- most poisonings in children and the elderly occur accidentally and with remarkable frequency.
- most poisonings in adolescents and young adults occur
  - non-accidentally
  - through experimentation
  - risk taking behaviour
  - or suicidal “gestures” or intent.
- Adults aged 30-39 are the most likely to die from drug overdoses (Stats Canada)

more experience, can intentionally die easier.
More tolerance, will use higher odses
Use often, hurts body

Poisons most often associated with fatality

while opiods depress respiratory drive, stimulants cause cardiovascular issues to kill.

suboxone is a combination of naloxone and buprenorphine

- Analgesics (Opioids, Narcotics)
- Sedative/hypnotics
- Stimulants
- Cardiovascular drugs
- Alcohols/glycols
- Antidepressants – tricyclics

benzodazepines

1-800-268-9017

- Difficult to keep current on the variety of potential toxins
- PCC are an indispensable resource – do not hesitate to use
- Calling the PCC actually helps them collect data

http://www.ontariopoisoncentre.ca/get-help-now/get-help-now.aspx

Compendium of Pharmeceticals have pics of pills, so you can ID loose pills

Clinical Toxicology: Pediatrics

- Peak age: 10 months and ages 2-4 years
- assess for prior history of poisoning as this is common
- < 1 year: consider child abuse
- ≥ 5 years (normal intellect): overdose should be considered suspicious
- Pediatrics represent 4% of fatalities
- household products, gases/fumes/vapours, pharmaceuticals (analgesics, psychotropics, sedative-hypnotics
- **what family medications are in the home- have they been moved/depleted**

Autonomic Nervous System

Parasympathetic Nervous System

- Rest & Digest
- ↓ heart rate
- ↓ conduction velocity
- ↓ force of contraction
- mediated by the *vagus* nerve
- neurotransmitter: Acetylcholine

Sympathetic Nervous System

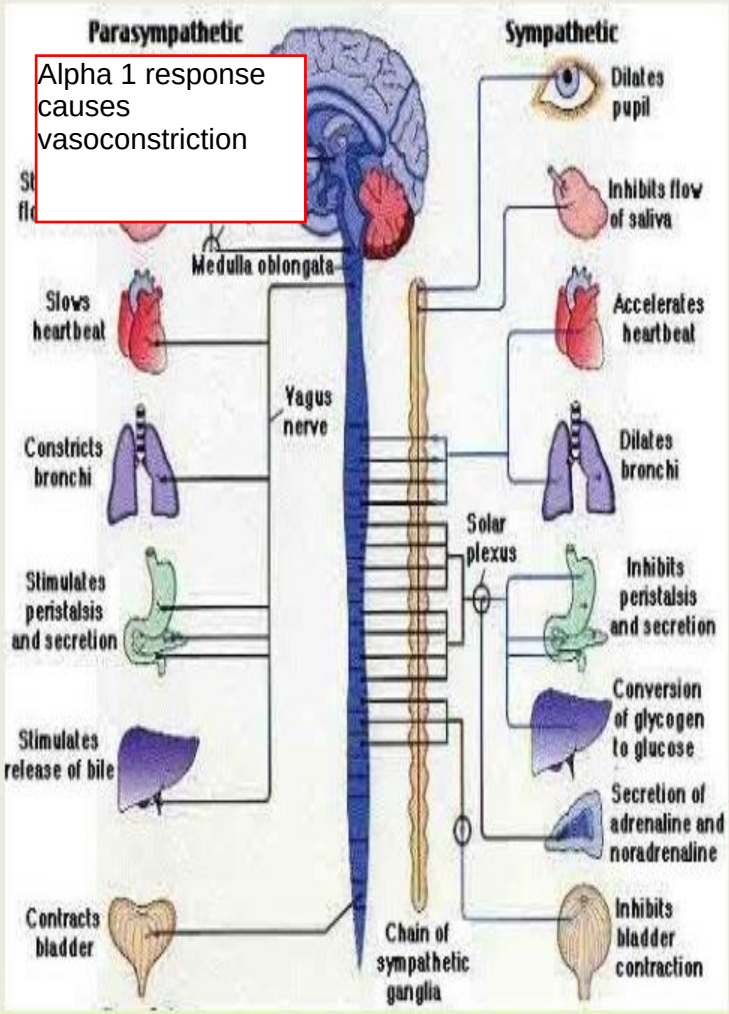
- Fight or Flight
- ↑ heart rate
- ↑ conduction velocity
- ↑ force of contraction
- mediated by sympathetic nerves
- neurotransmitter: Epinephrine & norepinephrine

PARASYMPATHETIC

SYMPATHETIC

Drugs Acting on Autonomic Nervous System

- Cholinergic Drugs
- Anticholinergic Drugs
- Drugs Acting Autonomic Ganglia
- Adrenergic Drugs
- α-Adrenergic Blocking Agents
- β-Adrenergic Blocking Agents
- Drugs Used for Glaucoma



Routes of Absorption

- ***Dermal***
  - Effects take longer to appear
  - Can be very serious
    - Opiates (Duragesic)
    - Organophosphates (pesticides)
  - Scene safety is important
  - Decontamination may be required

Routes of Absorption

- ***Ingestion***
  - Rate of effects
    - Can be immediate or delayed (for several hours)
    - Caustic substance (acid or alkali) may be immediate
    - Some may absorb into bloodstream before producing effect
  - What was ingested and why?
  - Assessment clues
  - Time frame for treatment
    - Oral ingestion usually provides a little more time for treatment than other routes

Routes of Absorption

- ***Inhalation***
  - Present in the surrounding atmosphere
    - Patient must be moved from the environment to avoid continuous exposure (risky for rescuer)
  - Accidental or intentional
    - Combination of cleaning agents, CO
  - Inhalation provides almost immediate access to the bloodstream (via alveoli)
  - Look for clues as to what the toxin could be
    - CO, Glue, paint thinner, furniture stripper (methylene chloride)

Routes of Absorption

- Injection
  - Stings or bites
    - Hymenoptera are the most common cause of anaphylactic reactions (bees, wasps, hornets, fire ants)
  - IV drug use
- Result in immediate effects
  - Local, allergic, systemic

Substance Abuse

- Self-administration of licit or illicit substances for purposes other than approved medical use or accepted social situations
- Cultural factors
- Terms associated with Substance Abuse
  - Drug abuse
  - Habituation
  - Drug addiction
  - Physical dependence/ psychological dependence
  - Tolerance
  - Withdrawal Syndrome

HISTORY AND PHYSICAL EXAMINATION

History

- **What** drug(s) /poison(s) was taken? --Try to locate the container(s)
- **How/Why** did this occur: Intentional? Accidental?
- **How** much? if possible, do a pill count based on the prescription date? Or estimate the quantity/volume missing.
- **When** was it ingested/injected/dermally absorbed/inhaled?
- **Co-ingestions?** Was the drug/poison taken with alcohol or any other drugs or chemicals? Interactions?
- **Co-morbidities?** Does the patient have any underlying medical conditions that puts him/her at greater risk?
- Symptoms: Conscious? Airway patent? Breathing adequately? Hemodynamic/ECG status? Vomiting or aspiration?

Signs & Symptoms

- Always start with a General Impression
- Airway patent?
- SOB? Tachypnea? Bradypnea?
- Altered level of conscious?
- Pain?
- Hemodynamics
  - Dysrhythmias?
- Physical signs?
  - Track marks?
  - Poor hygiene?
  - Rotting teeth?
- Other?

R/O other causes of altered LOA

- focal vs global neurological deficits
  - focal deficits *generally* suggests a structural cause
  - global deficits *generally* suggests metabolic/poison causes
- assess CBG – treat according to protocol

Principles of Management

- supportive care - *treat the ABCDs*
- rule out other causes of altered LOA
  - Differentiate structural from metabolic causes
- decrease absorption (decontamination)
- enhance elimination
- ***provide antidote(s)***
- adjunctive therapies

Principles of Management

- Be prepared for potential problems
  - Cardiac arrest
  - Airway obstruction/Emesis
  - Respiratory distress/ arrest
  - Altered/changing level of consciousness
  - Sudden changes in behaviour
  - Hyperthermia
  - Seizures

Supportive Treatment

- BLS care aimed at preserving function of vital systems - respiratory, cardiovascular and CNS.
  - OPA or NPA
  - +/ - ventilation,
  - intubation prn,
  - treatment of co-existing conditions (e.g. hypoglycemia)
  - etc...

DECONTAMINATION

Decontamination

- Generally not a prehospital treatment
  - Emesis induction
  - gastric lavage,
  - activated charcoal,
  - more invasive (hospital) procedures; i.e .whole bowel irrigation
- effectiveness may be limited because of time since ingestion / exposure to substance.

Emesis

- Emesis can be good
  - But we don't induce it
- We don't discourage it pharmacologically
  - i.e. don't give gravol to an OD who is nauseated

Induction method is the issue, not actual emesis

Gastric Lavage

- via gastric lavage tube or large NG tube, the intent is to “pump the stomach” and limit absorption.
- Needs to done within 1-2 hours of ingestion
- Used for dangerous intoxicants with limited antidotes

Gastric Lavage (Cont'd...)

- Advantages
  - direct access to stomach
  - potential for immediate recovery of all gastric contents if performed within one hour
- procedure should be repeated until the return of fluid is clear.
- not recommended in patients with altered LOC or if a ↓ in LOC is anticipated (gag reflex should be present)

ENHANCING ELIMINATION

Enhancing Elimination

- activated charcoal
- forced diuresis
- Alkalinization *ACP*
- hemodialysis
- many of these interventions are hospital based

Activated Charcoal

- most drugs are carbon based, and as such, will adhere to carbon based compounds
- efficacy can be greater than emesis or gastric lavage

Repeating Charcoal

- intended to increase clearance of drugs by interrupting enterohepatic circulation
- proven successful with eliminating a substantial number of drugs, including multi-drug overdoses.

Forced Diuresis

Fluid Boluses (patch to BHP)

- theory: give fluids in large volumes = increased urine output = more rapid clearance of poison
- evidence inconclusive for some poisons (e.g. ethenol clearance)

$NaHCO_3$ & Alkalinization

Administration of $NaHCO_3$ 1-2 mEq/kg or to a pH of 7.50 to 7.55

- alkalinisation of the urine,
  - ↓ concentration of free hydrogen ions, promotes drug binding to blood proteins → increase of urinary excretion/elimination of toxins.
- Contraindicated in patients with pulmonary edema or renal failure.
- $NAHCO_3$ can be used for its high sodium content
  - e.g. TCAs, cocaine

Adjunctive Therapies

- Hemodialysis
  - Reserved for extreme acute cases and persistent chronic cases or cases where other decontamination therapies are having limited success

IV Lipid Emulsion Therapy

- ILE or intravenous fat emulsion (IFE)
- may be beneficial in treating life-threatening cardiotoxicity induced by highly lipophilic drugs
  - Bupropion; lamotrigine; verapamil; atenolol; sertraline (quetiapine)
  - TCAs
  - calcium blockers and beta blockers

QUESTIONS?