Medical toxicology
for the Emergency Physician

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Poisoning & the ED

- Toxidrome recognition
- Assessment
- Management
Recognition = “detective work”

- Recognition of the risk = suspicion
  - History of suicide or psychiatric pathology
  - Coma e causa ignota
  - Cardiac arrhythmia in patients < 40 years
  - Metabolic acidosis
  - Victims of fire
  - Lethargy or coma in children
  - Heterogenic symptoms without a clear uniform clinical diagnosis
Recognition of poisoning

- Dissociation between typically paired changes
- Cluster of symptoms and signs

= Toxidromes

= fingerprints of a group of products/ poisons
Recognition = “detective work”

- **History**
  - Patient related factors
    - Access to products & medication
    - Gender, age, work or leisure conditions (epidemiology)
    - History of event - Medical history
  - Circumstance related factors
    - Containers, suicide notes, ...
    - Location
Clinical assessment

1. central nervous system
2. pupil diameter
3. respiration
4. heart and circulation
5. gastro-intestinal system
6. temperature
7. diuresis
8. general examination
Clinical assessment

1. Central nervous system
   - GCS
   - Fasciculations - myoclonus
   - excitation - convulsions
   - hyper / hyporeflexia

2. Pupil diameter
   - myosis
   - mydriasis
   - blurred vision
Clinical assessment: pupil size

- **Miosis (COPS)**
  - C cholinergics, clonidine, carbamates
  - O opiates, organophosphates
  - P phenothiazines, pilocarpine, pontine hemorrhage
  - S sedatives-hypnotics

- **Mydriasis (SAW)**
  - S sympathomimetics
  - A anticholinergics
  - W withdrawal
Clinical assessment

3. Respiration

- Breathing pattern
  - hyperpnoea = correction metabolic acidosis
  - superficial breathing (resp. freq.↑ and resp. vol.↓)
  - breathing depression (resp. freq.↓ and resp. vol.↓)

- Lung auscultation

- Breath odour
4. Heart and circulation

- ECG: arrhythmias / conduction abnormalities
- CVP (vasodilatation - intravascular volume deficit)
- blood pressure: hypotension - hypertension
Clinical assessment: brady-tachy

Bradycardia (PACED)
- P propranolol (β blockers), poppies (opiates), physostigmine
- A anticholinesterase drugs, antiarrhythmics
- C clonidine, calcium reentry blockers
- E ethanol
- D digitalis

Tachycardia (FAST)
- F free base (cocaine)
- A antichol, antihist, antipsych, amphetamine, alc withdrawal
- S sympathomimetics (cocaine, caffeine, ...), solvent, strychnine
- T theophylline, TCA, thyroid hormones
Clinical assessment: hypo-hypertension

- Hypotension (CRASH)
  - C clonidine, calcium reentry blockers
  - R rodenticides (arsenic, cyanide)
  - A antidepressants, aminophylline, antihypertensives
  - S sedatives-hypnotics
  - H heroin or other opiates

- Hypertension (CT SCAN)
  - C cocaine
  - T thyroid supplements
  - S sympathomimetics
  - C caffeine
  - A anticholinergics, amphetamine
  - N nicotine
Clinical assessment

5. Gastro-intestinal system

- Vomiting - diarrhoea
- hypo- / hyperperistalsis
Clinical assessment

6. Body temperature
   - hypothermia - hyperthermia

7. Diuresis
   - prerenal kidney insufficiency
   - acute tubular necros - rhabdomyolysis

8. General examination
   - injection points, petechia, bullae
   - icterus, methaemoglobinemia-cyanose
   - compartment syndrome
Clinical assessment

= the key for recognition

- dissociation between usually paired changes
- $\sum$ abnormalities in organ function

the key for tosidrome recognition

classifying the toxin
Anticholinergic toxidrome

- agitation, aggression, hallucinations, coma, hypertonia,
- hyperreflexion, myoclonus, strabismus, mydriasis, hyperpnea,
- tachycardia, QT-time prolongation (ECG), cardiac arrhythmia,
- hypoperistalsis, constipation, urine retention, hyperthermia, flush,
- dry skin & mucosa

Anticholinergics, antihistaminics, anti-Parkinson,
spasmolitics, antipsychotics, tricyclic antidepressants,
datura stramonium (Jimson weed)
Toxidromes pitfalls

No toxidrome = No poisoning? NO

No toxidrome “yet”

= delayed toxicity or delayed toxidrome
  → delayed onset of toxicity
  → delayed deterioration

mechanisms:
- delayed absorption-distribution
- metabolic factors
- cellular and organ capacity effects
Toxidromes pitfalls

No toxidrome “at all”

- very mild poisoning
- very serious poisoning + immediate fatal
- symptom free interval
  - Paracetamol, Paraquat, Hydrocarbons

Multiple compound ingestion
Toxidromes pitfalls

A toxidrome with a “missing” sign or an “non-expected” symptom

f.i. organophosphate poisoning
  = bradycardia versus tachycardia
Additive diagnostic protocol

- **Substance determination**
  - NO screening
  - Selective clinically driven

- **Biochemical evaluation**
  - Osmolality
  - Electrolytes - rabdomyolysis
  - Acid-base + anion gap
  - Baseline organ parameters
Additive diagnostic protocol: imaging

- **X-ray thorax**
  - Pneumonia?

- **X-ray abdomen**
  - Visible
  - Body packers

- **CT abdomen**
  - Body packers
Additive diagnostic protocol: imaging

- Agents visible on abdominal X-ray (COINS)
  - C: chloral hydrate, cocaine packets, calcium
  - O: opium packets
  - I: iron & other heavy metals: lead, arsenic, mercury
  - N: neuroleptic agents
  - S: sustained-release or enteric-coated agents
Therapeutic protocol

- Supportive therapy
- Reducing absorption
- Increasing elimination
- Antidotes
- Psychosocial therapy
Therapeutic protocol

toxic agent

reducing absorption

circulation

inhibition of metabolism

chelator

immunotherapy

metabolism

-desintoxification

target organ

specific actions:
- receptor
- enzyme

Toxic symptoms

supportive therapy
Therapeutic protocol reducing absorption

- Vomiting (ipecac) - gastric emptying
- Gastric lavage - whole bowel irrigation
- Activated charcoal
Therapeutic protocol
reducing absorption: gastric lavage

- Evidence:
  - Lack of beneficial effects + serious risks: aspiration, fluid & electrolyte abnormalities, laryngospasm, ...

- Consideration
  - Early GI decontamination (< 1 h) / high amount ingested

- Contraindicated:
  - Loss of protective airway
  - Ingestion of acid or alkali - hydrocarbon
  - Risk of GI haemorrhage

*J Toxicol, Clin Toxicol 2004; 42(7): 933-943*
Therapeutic protocol
reducing absorption: whole bowel irrigation

- **Evidence:**
  - Decreased bio-availability in volunteer studies
  - No controlled trials on outcome of the poisoned patient

- **Consideration:**
  - Sustained-release & enteric-coated, potentially toxic
  - Iron ingestion
  - Ingested packets of illicit drugs
Therapeutic protocol
reducing absorption: whole bowel irrigation

- **Contraindicated:**
  - Bowel obstruction, perforation, ileus
  - GI haemorrhage
  - Haemodynamic unstable
  - Unprotected airway, intractable vomiting

- **Caution:**
  - Specific medical conditions
  - Concurrent administration of activated charcoal

*J Toxicol, Clin Toxicol 2004; 42(6): 843-854*
Therapeutic protocol

reducing absorption: single dose activated charcoal

- **Evidence:**
  - Effectiveness decreases with time
  - No benefit on outcome

- **Consideration:**
  - Ingestion of a potentially toxin up to 1 h or longer
  - Known to adsorb to charcoal

- **Caution:**
  - Intact or protected airway

*J Toxicol, Clin Toxicol 2005; 43(2): 61-87*
Therapeutic protocol

Increasing elimination: Multiple-dose AC

- **Theoretical rationales: pro ‘s**
  - Sustained-release products
  - Enterohepatic circulation
  - Actively secreted in GI tract
  - “GI dialysis”

- **Theoretical rationales: con ‘s**
  - Given within one hour following ingestion
  - Side effects (aspiration, constipation,…)
  - No evidence of improvement in outcome
Therapeutic protocol
Increasing elimination

- Extracorporeal drug removal techniques
  - Haemodialysis - haemoperfusion
  - Molecular Adsorbent recycling system (MARS)
- Limited indications - severe cases
- Poor tolerance in haemodynamically compromised patient
Therapeutic protocol

antidotes

- Binding to non-toxic complex (chelator)
- Inhibition on metabolism
- Competitive receptor binding
- Physiological antidote (atropine vs. overdose acetylcholine)
Therapeutic protocol
antidotes

- Side effects of antidote may be threatening
- Poison - antidote: own pharmacokinetic & dynamic properties
- Limited evidence & experience
  - USA: 43,278 specific antidote administration on 2.4 million cases
Therapeutic protocol

- Psychosocial support
  - Task of each ED collaborator
  - Task social worker
  - Task Emergency psychiatry
Conclusions

- Recognition = cornerstone
- Therapy = combination of
- Be careful with antidotes
- “Primum non nocere”
Conclusions

- Teach me, I will forget
- Show me, I will probably remember
- Involve me, I will understand
- Amphetamines
- Cocaine
- Cafeine
- Nicotine
- LSD
- Psilocybin
- Opium
- Benzodiazepines
- Alcohol
- Solvents
- PCP
- Cannabis
- XTC & co
- LSD
- Psilocybin
- Hallucination
- Inhibition
- Excitation