



# Medical toxicology *for the Emergency Physician*

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# Poisoning & the ED

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- 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

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

= *Toxidromes*

= fingerprints of a group of products/poisons

# Recognition = "detective work"

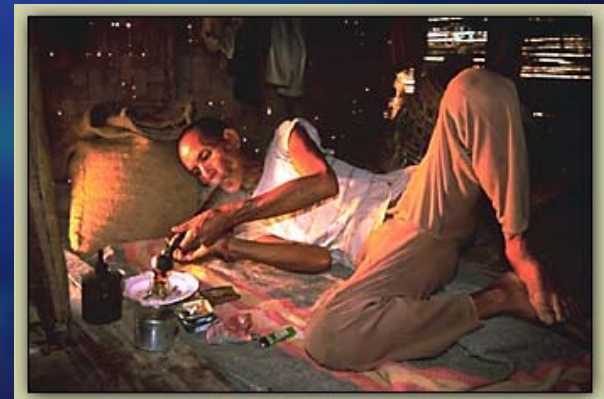
## ■ *History*

### ■ 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

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

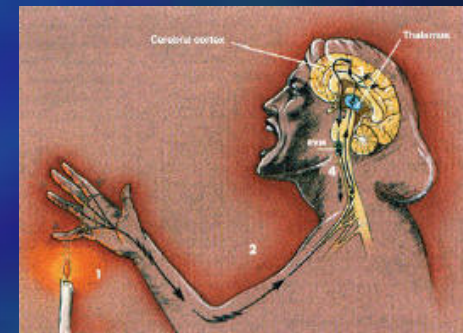
# Clinical assessment

## *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

# Clinical assessment

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## *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 ( $\beta$  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

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## *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

+

$\Sigma$  abnormalities in  
organ function

the key for toxidrome  
recognition

classifying the toxin

# Anticholinergic toxidrome

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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

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

f.i. organophosphate poisoning  
= bradycardia versus tachycardia

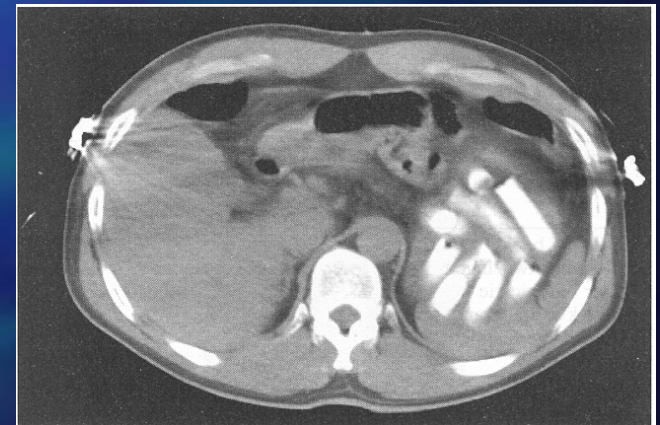
# Additive diagnostic protocol

- *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

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

# Therapeutic protocol

toxic agent



← reducing absorption

circulation



← inhibition of metabolism

chelator →  
immunother.

metabolism



← desintoxification

target organ



specific actions:

- receptor
- enzyme



Toxic symptoms

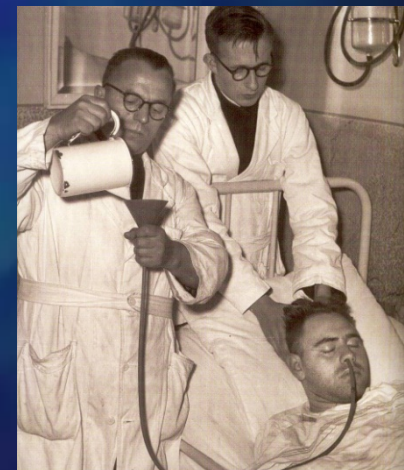


supportive therapy



# 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

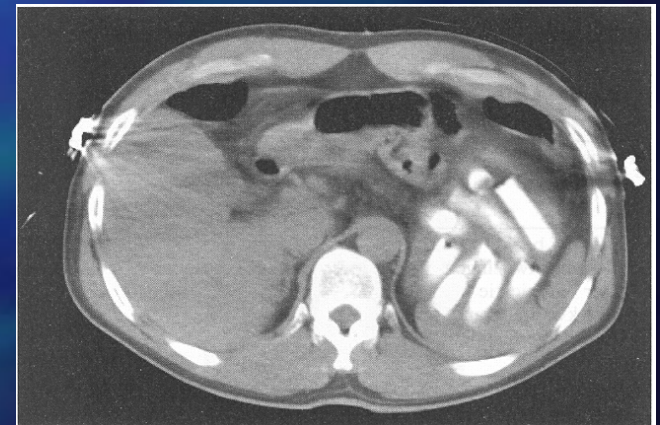
# Therapeutic protocol reducing absorption: whole bowel irrigation

## ■ 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

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### ■ 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

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

# Conclusions

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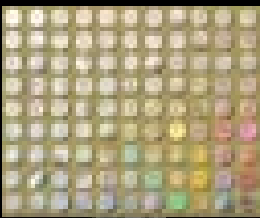
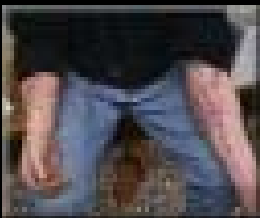
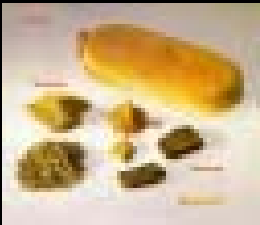
- Recognition = cornerstone
- Therapy = combination of
- Be careful with antidotes
  
- "Primum non nocere"

# Conclusions

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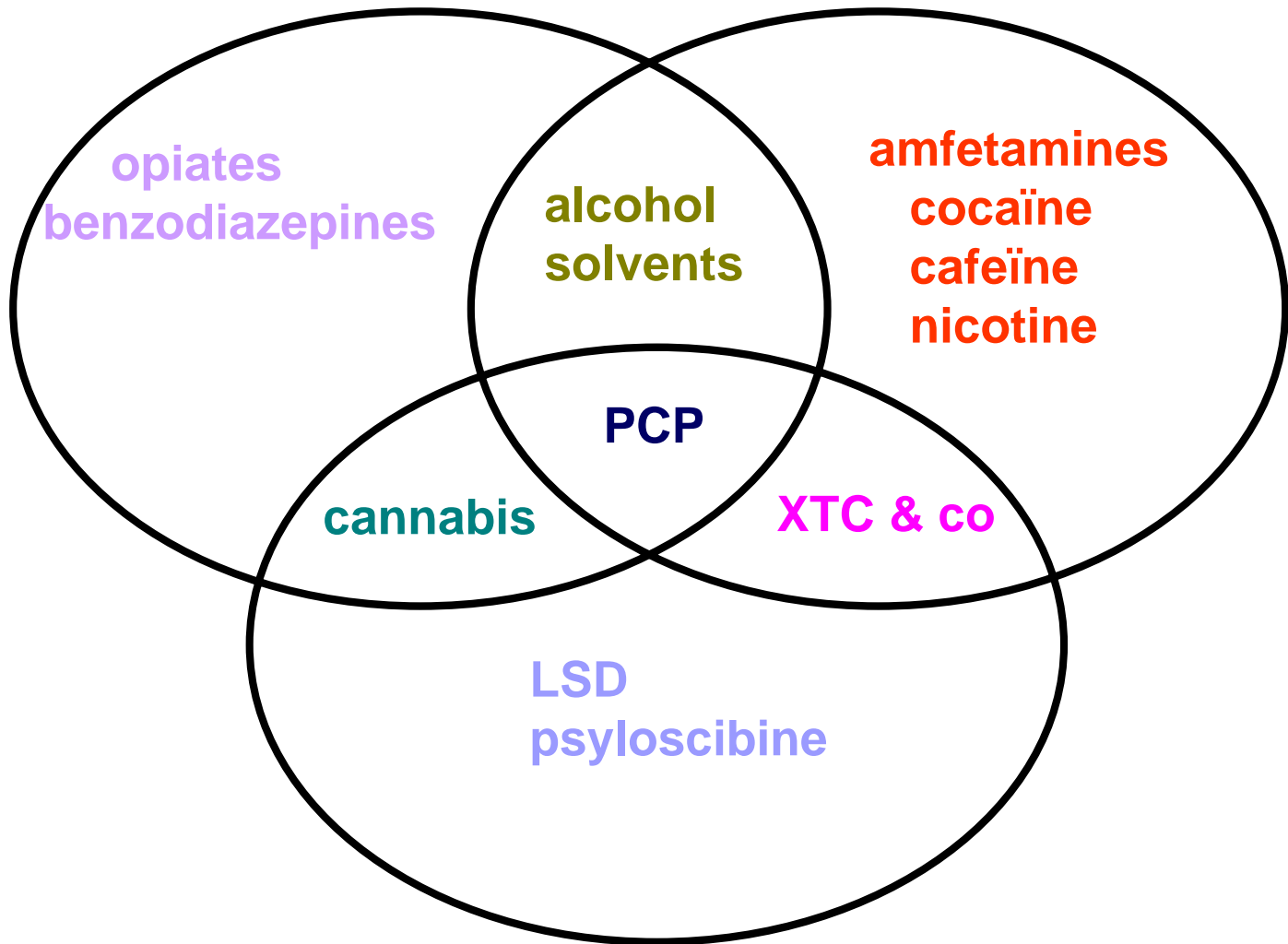
- Teach me, I will forget
- Show me, I will probably remember
- Involve me, I will understand





**inhibition**

**excitation**



opiates  
benzodiazepines

alcohol  
solvents

amfetamines  
cocaine  
cafeine  
nicotine

PCP

cannabis

XTC & co

LSD  
psyloscibine

**hallucination**