

TOXICOLOGY - ANSWERS

SAQ 1

An 18 year old female is brought in by ambulance 45 minutes after ingestion of an unknown amount of diltiazem SR, atenolol tablets, and alcohol. She is drowsy but responsive, with BP 85/30, HR 55, RR 12, Sats 99% RA. She is triaged to a resuscitation area.

- a. List three clinical features of severe toxicity in this ingestion. (3 marks)

Severe hypotension

Severe bradycardia

Hyperglycaemia (CCBs)

Delirium/coma – BBs; mostly propranolol as this crosses the BBB

- b. State 5 specific treatments/antidotes you will administer with doses and endpoints where appropriate. (5 marks)

Calcium gluconate/chloride – 10ml of 10% repeated until serum calcium levels normal

Glucagon 1-5 mg IV – aim for improvement of BP/HR, but unlikely to work

Sodium bicarbonate 100mmol IV, repeat until improved BP/narrow QRS on ECG

HIET – 1 unit/kg of actrapid IV, then 50ml of 50% dextrose. Aim for improved BP.

Adrenaline infusion – 5 mcg/min titrated to MAP >65mmHg

- c. State four other management options you will initiate and justify each. (4 marks)

ITO/detain patient – serious overdose, suicidal intent presumed

Thiamine 300mg IV for alcohol

Charcoal NGT – sustained release preparation, may help reduce toxicity if under 3hrs of ingestion

IVT bolus 1000ml NS for hypotension

- d. List two consults you will request for this patient and justify each. (2 marks)

ICU – patient will need invasive monitoring for some time - high risk of CVS collapse

Psychiatry – will need psych assessment given high-lethality overdose

Toxicology – for further input regarding toxicity

SAQ 2

A 42 year old factory worker is brought in by ambulance after a petrochemical spill at his work. Hazchem has identified the substance as carbamate. The patient was doused with the substance after a container tipped over. He is complaining of feeling nauseous and lightheaded.

- a. State two management steps that must be undertaken immediately on patient arrival. (2 marks)

**Remove patient clothes outside department and shower patient to remove petrochemical*

Full PPE for all staff

- b. Briefly describe the toxic mechanism of action of carbamate and list five clinical symptoms that may result from exposure. (6 marks)

An organophosphate, so blocks the effect of AChE, leading to build-up of ACh at the neuromuscular junction. Overstimulation of nicotinic/muscarinic receptors results. Patients have SLUDGE – salivation, lacrimation, urination, diarrhoea, GI upset, emesis, miosis.

- c. What three specific treatment may be given to this patient? Include endpoints where appropriate. (3 marks)

Atropine 0.5-1mg IV every 3 mins until secretions dry
Pralidoxime 1-2g IV – knocks the toxin off the AChE
Benzodiazepines for seizures (diazepam 10mg IV)

- d. What is ageing and how does it affect organophosphate management? (2 marks)

Ageing refers to a change in the binding of the OP bound to the AChE, making it nearly impossible for reversal to be effective. Early treatment/reversal is therefore important. Interestingly, ageing is dependent on the type of OP involved, and carbamates don't tend to age.

SAQ 3

A 38 year old female presents after ingesting a large amount of Panadol. She took 20 x 500mg tablets the day before, and a further 20 x 500mg tablets 2 hours prior to presenting.

- a. List 5 factors you will include in your risk assessment of the patient. (5 marks)

**Weight of patient*
**Comorbidities – particularly liver disease*
Other co-ingestants
**Sustained release vs immediate release*
Suicidal intent
Vomiting after ingestion

- b. List six blood tests you will order and justify each. (6 marks)

**Panadol level – to direct therapy, as baseline*
**LFTs – AST/ALT levels indicative of hepatocellular damage*
VBG – acidosis with significant Panadol ingestion
BHCG/ETOH/Glucose/Salicylate level/INR/FBE/EUC

- c. When should a Panadol level be taken in this patient? Justify your answer. (2 marks)

Immediately. There is no indication for a four hour level in staggered overdoses like this. Calculation of toxic dose should be done and NAC started if indicated. Four hour levels are indicated in acute, non-staggered overdoses only.

- d. State the level of Panadol ingestion (mg/kg) for each level of toxicity in supratherapeutic, staggered overdoses. (3 marks)

Non-toxic	<75mg/kg
Potentially toxic	75-150mg/kg
Toxic	>150mg/kg

- e. The patient returns an INR of 1.8 and an AST of 500. Briefly outline your NAC regime for this patient with two appropriate endpoints. (5 marks)

NAC: 150mg/kg over one hour, then 50mg/kg over 4 hours, then 100mg/kg over 16 hours.
Endpoints: AST <2 x normal levels, INR <1.3

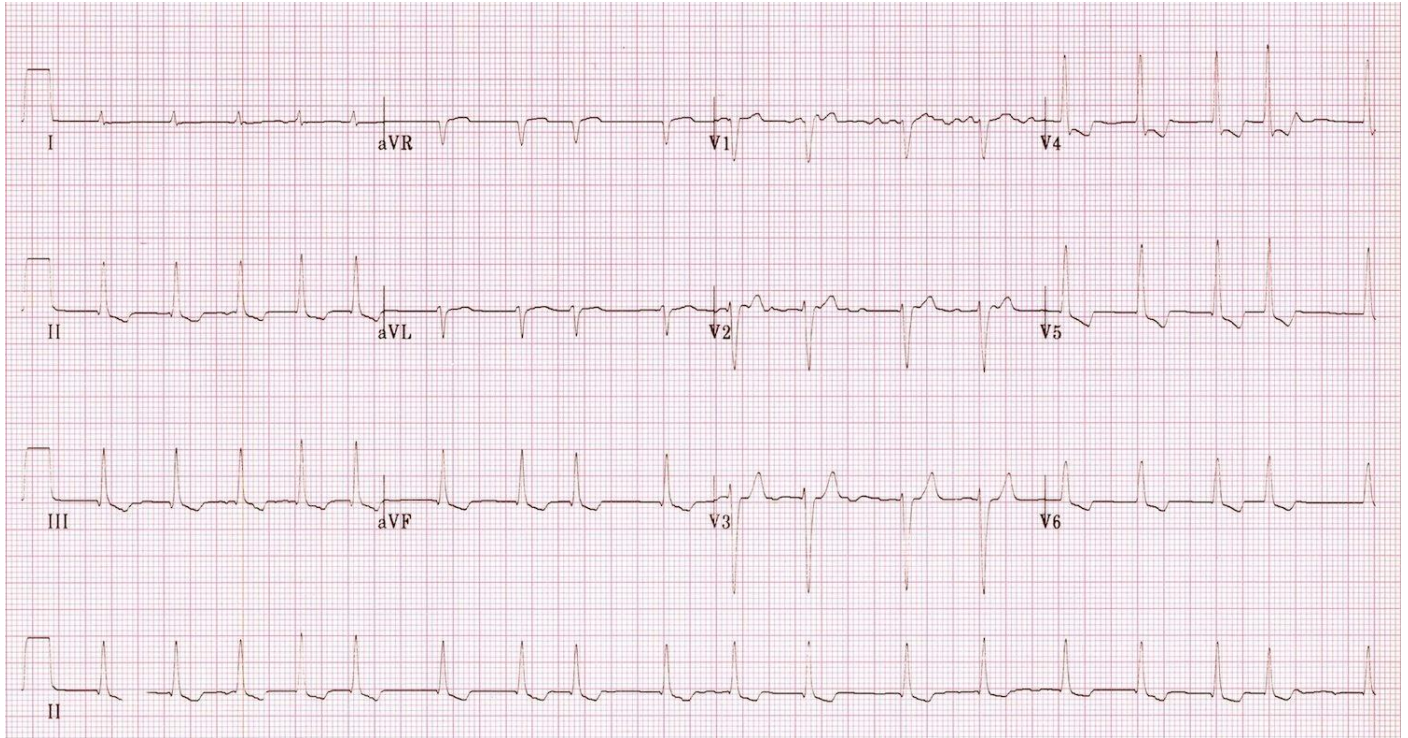
- f. State the most common side effect of NAC and the treatment required. (1 mark)

Anaphylactoid reaction – usually mild, only treatment indicated is antihistamine if mild reaction.

SAQ 4

A 52 year old male is brought in by ambulance after being found unconscious in his flat with a suicide note next to him. No evidence of trauma and no empty medication packets are found. He is intubated on scene. Naloxone was given en route with no effect.

On arrival, his obs are: HR 50, BP 110/70, RR 16, Sats 99% RA. His ECG is shown below, as is a venous gas.



Venous gas: Na 128 K 7.5 Cl 110 Urea 17 Creat 80 HCO₃ 24

- a. List 6 management steps for this patient, including doses where appropriate. (6 marks)

**Digibind 5-10 vials*

**Insulin/glucose for hyperkalaemia – aim K⁺ < 5*

NaHCO₃ 100mmol for acidosis/hyperkalaemia

Charcoal to reduce absorption (via NGT)

Atropine for bradycardia if needed – 0.5mg – 1mg

Transcutaneous/transvenous pacing

Dialysis if K⁺ treatment fails

Calcium controversial – texts usually say no, but no evidence for stone heart.

Not salbutamol – heart is already tickled up, salb will make tachycardia/heart function worse

- b. For a patient with this specific overdose, state three indications for administration of the antidote. (3 marks)

Cardiac arrest

Life threatening dysrhythmia

K⁺ > 5

*Also: significant GI symptoms, co-existent renal failure, etc. *Controversial, no consensus on indications.*

- c. Two hours after giving the antidote, the laboratory calls to advise you that the level of the toxin remains elevated. Does this change your management? Explain. (2 marks)

No – the test measures the total level of digoxin in the serum, so will measure both free digoxin and digoxin bound to Digifab. It will therefore be elevated even if the patient is clinically improving.

**** bonus marks:** describe the mechanism causing hyperkalaemia in this toxidrome.

SAQ 5

A 30 year old female is BIBA after an overdose of Panadol, fluoxetine, phenylzine, and amitriptyline. Her BP is 90/60, HR 120, T 38.8, and she has muscle rigidity. Her level of consciousness is fluctuating.

- a. Briefly describe the difference between decontamination and elimination in acute poisoning, giving two examples of each method. (4 marks)

Decontamination – removal of substance before it is absorbed. EG removal of soiled clothing, gastric lavage, activated charcoal, WBI

Elimination – removal of substance after it has been absorbed. Aims to increase the rate of removal of agent from body. EG dialysis, urinary alkalinisation, MDAC, haemoperfusion.

- b. Regarding activated charcoal, list four toxins that may be adsorbed by charcoal, and four toxins/substance groups that charcoal is ineffective against. (4 marks)

Charcoal effective for: digoxin, theophylline, aspirin, phenytoin, quinine, SR/Enteric coated meds, carbamazepine

Charcoal ineffective for: strong acid/bases, metals, alcohols

- c. For each of the medications taken, state a treatment option or antidote. Doses are not required. (4 marks)

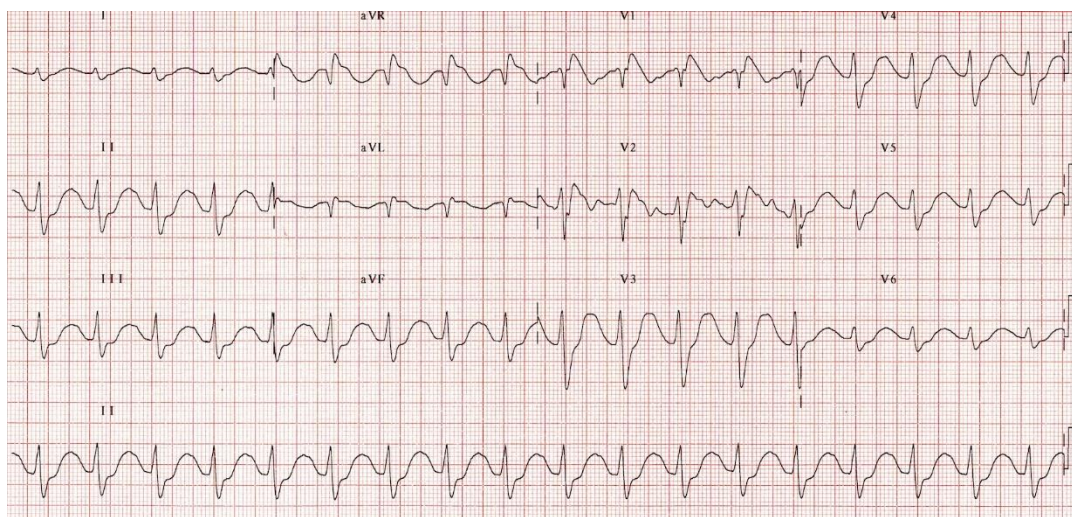
TCA – bicarbonate, hyperventilation

MAOI – IVT, supportive, cyproheptadine

Panadol – NAC

Fluoxetine – serotonin syndrome, supportive, cyproheptadine

- d. Soon after arrival, her blood pressure drops to 80/40. She is intubated and an ECG recorded (shown). State which medication is likely to be responsible for her deterioration, and list four management steps with doses and endpoints where appropriate. (5 marks)



TCA overdose (amitriptyline).

**Sodium bicarbonate 100mmol IV until QRS <100ms OR improvement in haemodynamics*

**Hyperventilate to pH 7.5 – 7.55*

IV bolus 1000ml NS

Adrenaline infusion to maintain MAP >65 if needed

BZD (diazepam 10mg) for seizures

NB: risk of seizure if QRS>100ms, risk of ventricular dysrhythmias if QRS >160ms.

SAQ 6

A 24 year old metalworker presents with confusion and two seizures after dermal exposure to a chemical at his work. He has no past history of note and does not use illicit drugs. His workmates state he was found collapsed; they removed his outer clothing and applied copious amounts of water to his skin. You notice his pupils are dilated. His blood gas is shown below.

VBG: pH 6.98
CO₂ 30
O₂ 75
HCO₃ 7
Lactate 12
Na 138
K 5
Cl 99

- a. Describe the four abnormalities on the blood gas and give a likely diagnosis. (5 marks)

Severe life-threatening acidosis

High anion gap metabolic acidosis

Normal Oxygen levels despite venous gas – ddx accidental arterial gas or cyanide toxicity

Elevated lactate +++

Inadequate respiratory compensation

Diagnosis: likely cyanide toxicity (HAGMA, metal worker, miosis, seizures/confusion, high oxygen)

- b. What is the mechanism of toxicity in this agent? (1 mark)

Cyanide inhibits cell metabolism/respiration by uncoupling oxidative phosphorylation, leading to severe anaerobic metabolic state, often with lactate levels >10.

- c. List three antidotes that may be given for this toxin. Doses are desirable but not essential. (3 marks)

Hydroxycobolamin (Vit B12) 5g IV – ideal antidote, binds CN and is excreted in urine

Thiosulfate 50ml of 25% IV. Few adverse effects, mostly N/V. Don't use if suspect COHb poisoning, as it will cause increased hypoxia.

Dicobalt EDTA 300mg IV – binds CN. Toxic salt, so only use if severe CN toxicity.

SAQ 7

Complete the following table regarding toxins that have been the focus of questions in past exam papers. (10 marks)

Toxin	Toxic effect	Treatment option(s)
Quinine	<i>Na channel blockage</i>	<i>Charcoal, dialysis, TCA-type treatment</i>
Gliclazide/sulfonyurea	<i>Hyperinsulinemia</i>	<i>Glucose, OCTREOTIDE</i>
Lithium	<i>CNS, CVS, direct irritant GI</i>	<i>Dialysis, IVT</i>
Iron	<i>Direct GI toxicity</i>	<i>Desferrioxamine, supportive</i>
Local anaesthetic	<i>Na channel blockade</i>	<i>ILE 20% 1ml/kg, NaHCO₃</i>
Hydrocarbons	<i>Pulm/CNS effects</i>	<i>NaHCO₃</i>
Eucalyptus oil	<i>CNS, CVS depression</i>	<i>Supportive</i>
Oil of wintergreen*	<i>Tinnitus, GI effects</i>	<i>Urinary alkalinisation, dialysis, etc</i>
Chlorine gas	<i>Forms HCl – acid effect</i>	<i>Supportive</i>
Hydrofluoric acid	<i>Chelates Ca/Mg</i>	<i>Calcium, Mg in a variety of ways</i>

* also known as salicylic acid, if that helps!

SAQ 8

- a. List 6 medications which, if ingested, may be fatal in children (i.e. one pill can kill). (8 marks)

Beta blockers
CCBs
Opioids
Amphetamines
Antidepressants
Sulfonylureas
Clonidine

- b. What is the significance of vin de rose urine in the treatment of iron toxicity? (2 marks)

Indicates the treatment is working- the desferrioxamine is binding the iron, and being excreted through the urine, giving it a rose colour.

APPROACH TO ALTERED MENTAL STATUS

- Toxic ingestion
- Hypoglycaemia
- Opioid/sedative – hypothermia, CNS/resp depression
- Sympathomimetic – fever, HTN, tachycardia, seizures
- Cholinergic toxidrome – SLUDGE, diaphoresis, seizures
- Anticholinergic toxidrome – mad as a hatter etc, hyperpnoea
- AMI
- Hypoxia

Steps:

1. Check Sats/ABG for O₂
2. Check BGL
3. Check ECG – AMI, toxins
4. Then follow list:
 - a. CNS – stroke etc
 - b. Toxins – alcohol etc
 - c. Metabolic – glu, Ca, Na, Urea
 - d. Infections – meningitis, UTI

- e. CVS – MI
- f. Pulmonary – APO, pneumonia
- g. Shock – hypovolaemia, cardiogenic, septic