

FEx Net 2022 Collated SAQs:

Toxicology Answers

1. Carbamazepine
2. Citalopram
3. Digoxin
4. Diltiazem
5. Elderly
6. Eucalyptus Oil
7. GHB
8. Insulin
9. Iron
10. Iron
11. Iron
12. KCL
13. LAST
14. LAST Paeds
15. Lithium
16. Met Hb
17. Methamphetamine
18. Paracetamol
19. Paracetamol Liquid
20. Paracetamol SR
21. Polypharmacy
22. Polypharmacy
23. Polypharmacy
24. Polypharmacy
25. Polypharmacy
26. Quetiapine
27. Salicylate
28. Sodium nitrite
29. TCA
30. Toxidromes
31. Unknown
32. Unknown
33. VBG
34. VBG
35. Verapamil

Question 1 (17 marks)

A 30 year old 90kg lady presents to your emergency department having taken a poly-pharmacy overdose including panadeine forte, carbamazepine and temazepam. You are considering treating her with activated charcoal (AC).

i. List 4 general contraindications for this therapy (4 marks)

- Patient requiring active resuscitation
- OD > 1hr ago (controversial)
- OD of non binding agent – (Metals/Hydrocarbon/Alcohols/Acids/Alkalis)
- Aspiration risk - potential for seizures or decreasing LOC
- Benign agent
- Sub-toxic dose
- Corrosive agent

After a short period, she becomes drowsy, tachycardic (120 bpm) and hypotensive (85/43 mmHg). Further history reveals that she has taken up to 9g of carbamazepine.

ii. List 4 investigations that should be performed in this patient (4 marks)

- ECG
- BSL
- Paracetamol level
- HCG
- Carbamazepine level

iii. List 5 clinical features you would expect from a significant carbamazepine overdose (5 marks)

- CNS - decreased LOC/seizures/ataxia/nystagmus
- CVS - hypotension/tachy-or-brady-arrhythmias, prolonged PR/QRS/QT, pulmonary oedema
- Anti-cholinergic effects - retention/tachycardia/delirium etc

iv. During your management, the patient has a generalized tonic-clonic seizure. List 4 conditions that should be excluded (4 marks)

- Hypoglycaemia
- Hyponatraemia
- Intracranial pathology
- Pregnancy with eclampsia
- Co-ingestant
- Acute withdrawal

Question 2

1.

Sinus rhythm

75/min

Normal axis

2.

Long QT 500-520ms; K⁺ ch blockade

3.

Cardiac drugs	• Amiodarone • Sotalol • Disopyramide • Dofetilide • Procainamide • Quinidine
Antidepressants	• Selective serotonin re-uptake inhibitors: citalopram, escitalopram, fluoxetine • Moclobemide • Tricyclic antidepressants* • Lithium
Antipsychotics	• Amisulpride • Chlorpromazine • Haloperidol • Ziprasidone • Thioridazine
Antihistamines	• Loratadine • Astemizole • Diphenhydramine
Antimicrobials	• Ciprofloxacin, moxifloxacin, sparfloxacin • Clarithromycin, erythromycin • Fluconazole, voriconazole • Pentamidine
Other drugs	• Chloroquine • Cisapride • Dolesatron • Methadone • Arsenic

*The QT prolongation with tricyclic antidepressants is usually from QRS widening without actual lengthening of the JT interval (QT interval minus the QRS duration).

4.

Serotonin toxicity evidenced by:

hyperthermia, dilated pupils, tremor, hyperreflexia in lower limbs more than upper limbs, ocular clonus, ankle/finger clonus, tachycardia, seizures

Candidate number _____

Question 3 (13 marks)

An 18 year old female presents to ED after an ingestion of 200 x 62.5mcg digoxin tablets. She has no past medical history of note and weighs 65kg.

- i. What is the potential lethal dose of digoxin (1 mark)

- >10mg in adult or 4mg in child OR
- >10 times daily dose

- ii. List the clinical features of ACUTE digoxin toxicity (3 marks)

- GI – nausea, vomiting, abdo pain
- CVS – bradycardia including heart block, slow AF, dysrhythmias including ectopic, bigeminy, SVT, VT, hypotension
- CNS – lethargy, confusion, delirium

- iii. List 3 relevant investigations you would perform in this patient (3 marks)

- ECG
- UEC
- Digoxin level

iv. List the indications for the use of digoxin immune Fab (Digibind) (5 marks)

- Cardiac arrest
- Life threatening cardiac arrhythmias
- Ingestion of >10mg in an adult or >4mg in a child
- Serum digoxin level >15nmol/mL
- Serum K > 5mmol/L

v. What dose of digoxin immune Fab would be required for this patient (1 mark)

- Known dose – no. ampoules = ingested dose (mg) x 0.8 x 2 (based on one ampoule binding 0.5mg digoxin)
- OR 5 ampoules if HD stable, 10 if unstable
- Controversial with recent evidence suggesting minimal benefit

Question 4

Questions:

1- List 4 factors associated with significant toxicity following calcium channel blocker poisoning?

(4 Marks) 3/4

Answer:

Agent - diltiazem and verapamil associated with toxicity other CCBs do not cause significant toxicity

Dose - x2-3 therapeutic dose can cause toxicity with XR prep and >10x tablet ingestion likely to cause significant toxicity

Co-ingestion of other cardiotoxic medication increases likelihood of significant toxicity

Extremes of age - paediatric ingestion and elderly

Presence of significant co-morbidities

2- List 4 clinical features that may occur with significant calcium channel blocker toxicity.

(4 Marks) 3/4

Answers:

Bradycardia (must have)

Hypotension (must have)

(Any of the following for 1 mark)

AV block - 1st degree AV block

Myocardia ischaemia

Hyperglycaemia

Pulmonary oedema

Lactic acidosis

Seizures

3- Several hours later the patient becomes agitated and clammy. He is being managed in a Resus area with non-invasive monitoring.

His vital signs now are:

BP 87/40
HR 40
Sat 93% on RA
GCS 15/15

List in a step-wise approach your management of this patient. (8 Marks) 6/8

Answer:

Fluid bolus 10-20 ml/kg

Calcium - 60mls Calcium gluconate 10% or 20mls Calcium chloride 10% - rpt bolus up to three times

Atropine 600mcg iv, repeat if response

Invasive monitoring with art line & CVL

Catecholamine infusion - adrenaline or dopamine or noradrenaline

High Dose Insulin Infusion

Sodium bicarbonate - if metabolic acidosis

Cardiac pacing

ECMO / By-pass / IABP

Passmark = 12/16 (adjust to /10) (7.5/10)

Question 5 (13 marks)

An 83 year old man presents with a 2 week history of lethargy, anorexia and dehydration. He has a past history of atrial fibrillation.

An ECG is obtained at triage.

- i. Describe the key features of the ECG (3 marks)

AN ECG IS SHOWN IN THE PROPS BOOKLET, PAGE 4

- Underlying atrial activity likely fibrillation (seen best in inferior leads)
 - Regular ventricular response at 65/min
 - Regular QRS in context of AF suggests complete block of A-V conduction
 - Wide QRS complexes consistent with ventricular escape (or “accelerated idioventricular”)
 - Rightward axis, tall left “rabbit ear” in V1
- ii. List 3 possible causes of these ECG abnormalities (3 marks)
- Digoxin toxicity
 - Hyperkalaemia
 - Acute ischaemia
 - TCA toxicity
 - Beta blocker toxicity
 - Calcium channel blocker toxicity

His blood results show

K 6.4 mmol/L

Urea 20 mmol/L

Cr 200 umol/L

Digoxin 3.0 nmol/L

His HR has dropped to 30 with a SBP 100.

iii. List 5 treatment steps (5 marks)

- Bicarbonate 100 mEq
- Insulin 10 units with 50% Glucose 50 mL
- Atropine
- Digoxin Fab 2 ampoules empirically
- External pacing (rarely effective)
- Adrenaline (rarely effective without dig Fab)

iv. Briefly explain the controversy surrounding the use of intravenous calcium in this setting (2 marks)

- In theory (and in limited case reports) calcium can exacerbate digoxin toxicity ("stone heart") and it is widely said to be contra-indicated
- However frequently these patients will be hyperkalaemic and if delay to getting digoxin level, empiric Tx with calcium probably acceptable

Question 6

(i) 3 marks - ***Sequelae of poisoning***

1. Coma, reduced LOC
2. Seizures
3. Vomiting
4. Aspiration

(ii) 4 marks - ***Management Priorities***

- · **Ensure airway is protected and ventilation is maintained, if not, intervene with intubation and mechanical ventilation**
- **Check blood glucose level**

Contact Toxicologist or Poisons Centre

Observe in ED for > 4 hours (or overnight)

- Apply monitoring – ECG, pulse oximetry
- Examine child, particularly:
 - o Neuro exam
 - o Airway and chest auscultation
- Prevent vomiting with anti-emetics (e.g. ondansetron 0.2 mg/kg)
- Check for aspiration – CXR
- Treat seizures with benzodiazepines (e.g. midazolam 0.15 mg/kg IV)
- If no evidence of aspiration, keep NBM for minimum 2 hours; trial of oral fluids after 2h, if alert and no further vomiting
- Does not need other pathology testing unless intubated or aspirated
- Confirm history – if non-accidental, refer to child protection services

(iii) 5 marks

- | | |
|-------------------------------|--|
| ● Agent(s) | ● Clinical features and progress |
| ● Dose(s) | ● Patient factors (weight and co-morbidities) |
| ● Time since ingestion | |

Question 7

1. List 4 important complications of a GHB overdose. (3 marks)

- coma/sedation
- agitation/confusion/behavioural disturbance/fluctuating conscious state
- respiratory depression/hypoxia/respiratory failure
- loss airway reflexes/airway obstruction
- vomiting/aspiration
- hypotension
- secondary injury/trauma/sexual assault
- Didn't give marks for
- bradycardia – unless specified hypotensive – rarely needs treatment, not “important”
- seizures – GHB causes myoclonus, but not seizures
- Show consultant level thinking by prioritizing your answers
- Not a random list of symptoms

2. List 4 indications for intubation of this patient. (4 marks)

- Inability to maintain own airway/stridor
- Hypoxia
- Resp failure
- Aspiration
- Severe agitation/behavioural disturbance
- Concern for head injury/requiring CT brain
- Did not give marks for:
- Coma/sedation – not an indication by itself without impaired oxygenation/ventilation, expect short recovery time
- Co-ingestants – read the question(!)
- Transfer – unlikely, assumed to be in an ED with FACEM

3. Ten hours later the patient is GCS 14 (E4 V4 M6) and states he wants to leave. He moves towards the ED exit. List 3 interventions in sequence to manage this scenario. (3 marks)

- Call security/Code Grey
- Talk to patient/verbal de-escalation
- Enlist help of friends/family
- Physical restraint
- Chemical restraint
- Did not give marks for:
- Assess competence/obtain consent to leave
- A confused 14 yr old is not competent!
- Wrong sequence

Tips

- **Read the question – underline important words**
- **Write clearly**
- **Writing lists is easy - show consultant level thinking by prioritizing your answers/show perspective**

Question 8

1.

- Type of insulin – will affect duration of toxicity and observation
- Amount – will affect severity of duration of toxicity
- Multiple sites / one site – one site makes a depot with longer duration of release / toxicity
- Diabetic or not – affects how you wean glucose infusion

2.

- IV dextrose infusion – aiming for BSL above 3.5
- IV potassium infusion aiming for normal range

Question 9

A 23-month old boy is brought in by his mother after ingesting an unknown quantity of her iron tablet thirty minutes ago. The child was found with 3 tablets remaining from a bottle that was previously around half full.

a). Complete the following table for the dose-related risk assessment of iron (4 marks)

Elemental iron dose (mg/kg)	Effect
<20	Asymptomatic
20-60	GI symptoms
60-120	Systemic toxicity anticipated
>120	Potentially lethal

One hour later, the child starts vomiting profusely and you are concerned he has had a significant ingestion of iron.

b). Complete the following table listing four (4) investigations you would perform and the corresponding result that would confirm significant iron ingestion. (4 marks)

Investigation performed	Result confirming significant ingestion
Abdominal Xray	Multiple tablets with >40-60 mg/kg total elemental iron
Serum iron concentration	Rising levels, serum iron concentration at presentation and at ~4 hrs >60-90 micromol/L
Blood gas	HAGMA
LFTS and Coags	Hepatic failure
UEC	Renal failure

c). List two (2) methods of decontamination that are used in iron overdose and state when they would be used. (2 marks)

Whole bowel irrigation indicated for confirmed ingestions > 60 mg/kg (difficult and potentially hazardous in small children)
Surgical or endoscopic removal of tablets if lethal ingestion (e.g. >120mg/kg) or WBI not feasible

Clinical features and investigation results confirm significant iron poisoning with systemic toxicity. You consult with the on-call toxicologist who recommends starting chelation therapy.

d). State the drug and dose of the chelation therapy used in significant iron toxicity. (1 mark)

Desferrioxamine i.v.i. 15-40 mg/kg/hr

Question 10

A 2 year old boy has ingested iron tablets. He presents with his mother and he currently seems well. You calculate that he has possibly ingested 90mg/kg elemental iron.

- i. Complete the table (4 marks)

Elemental iron dose	System involved/Effects
<20mg/kg	Asymptomatic
20-60mg/kg	GIT
>60-120mg/kg	Multi organ failure
>120mg/kg	Potential lethal

- ii. Complete the table of classical stages of iron toxicity (5 marks)

Time post ingestion	Clinical features
0-6 hours	Vomit, diarrhea, abdominal pain, haematemesis, melaena
6-12 hours	Some improvement
12-48 hours	Multi organ failure: shock, AG metabolic acidosis, liver failure, renal failure
2-5 days	Fulminant liver failure
2-6 weeks	Delayed sequelae: cirrhosis, GIT strictures

- iii. You obtain an Xray. List 2 relevant findings (2 marks)

AN XRAY IS SHOWN IN THE PROPS BOOKLET, PAGE 5

- Right upper zone dense consolidation
- No evidence of gastric iron tablets

- iv. How does this xray alter your management plan (2 marks)

- PO iron unlikely - No need to plan decontamination via endoscopy or WBI
- Other complications - May need bronchoscopy to remove inhaled Fe tablets

- v. List 3 blood tests that you will order and your reasoning for doing so (3 marks)

- Serum Fe level at 4-6 hours – confirm absorption
- Lactate
- Acid base calculation on VBG
- EUC to calculate AG

Question 11

1. Agents – type of iron tablets (elemental iron varies)

Dose – ingested dose, single ingestion vs staggered

Time of Ingestion – determine time of peak toxicity

Clinical Course - ?any GI symptoms yet to suggest significant toxicity

Patient Factors – PMHx – determine cardiorespiratory reserve

Co-ingestion - ?other expected toxidromes

2. History: (large ingested dose $>120\text{mg/kg}$), gut dysfunction early – V&D, GIT bleed)

Examination: Shock (accept hypotension), Altered Mental State

Investigations: Serum iron levels high (>90) , HAGMA

3. Whole bowel irrigation

Endoscopy

4. Desferrioxamine

Question 12 (14 marks)

A 68 year old female presents to your tertiary emergency department intoxicated, 2 hours after deliberately ingesting 120 x 600mg tablets of slow release potassium. She has been vomiting and has a GCS of 14 (confused). An initial VBG is performed.

pH	7.32	(7.35-7.45)
pCO ₂	35 mmHg	(35-38)
Lactate	5 mmol/L	(0.6-1.5)
Creat	110 mcmol/L	(45-90)
BSL	6.3 mmol/L	(3.9-5.8)
Na	133 mmol/L	(136-146)
K	6.1 mmol/L	(3.9-5.2)
HCO ₃	18 mmol/L	(21-28)
BE	-4 mmol/L	(-1.5-3.0)

- i. Outline your risk assessment with regard to her ingestion (4 marks)

- Agent - Potassium potentially lethal OD
- Dose - 120 x 600mg - large ingestion
- Time - >1/24 post ingestion - absorption in progress ++
- Patient factors - GCS 14 and vomiting ?toxicity ?co-ingestion/alcohol etc
- Clinical - Potassium already elevated on VBG

- ii. List and briefly describe 2 specific toxicological interventions that may be used to manage her potassium ingestion (2 marks)

- GI decontamination – Whole bowel irrigation (Picoprep/PEGELS)
- Increase clearance – Dialysis, via vascath in ICU

iii. List an advantage and disadvantage for each of the methods listed above (4 marks)

- GI decontamination
 - decrease potassium load and often negates dialysis requirement in the setting of normal renal function
 - compliance - intubate pt for WBI - resources/staff/gastric tube placement/aspiration etc
- Dialysis
 - definitive therapy
 - invasive via vascath/central line, not in ED

iv. List 4 other management priorities (4 marks)

- IDC - urine output and strict fluid balance
- Check BSL/temp/ECG/blds- para/ETOH
- Xray ?confirm ingestion
- Consult with poisons/tox
- Specific to K
 - Elevated K+, ?ECG changes - fluids/renal excretion with e.g. u/o >1ml/kg/hr, insulin/dextrose/Ca²⁺
 - Serial K measure

Question 13

Your Registrar has asked you to review a 28 year old man who is having a reduction of his fractured left radius performed under Bier's block using Prilocaine. 15 minutes into the procedure he is complaining of shortness of breath and light-headedness.

On examination, he appears cyanotic with oxygen saturation of 85% on pulse oximetry.

SAQ 1 Answer

Q1: 1. Methemoglobinemia (need to mention to pass) – SE of Prilocaine

- 2. Anaphylaxis/ Bronchospasm
- 3. Accept VT/ arrhythmia
- 4. Seizure

Local anaesthetic toxicity is not sufficient unless they give specific cause such as arrhythmia or seizure

Q2:

ABG (must for pass)	Saturation gap. Normal Pao ₂ (with low SpO ₂ on pulse oximetry)
ECG	To check for ischemia/ arrhythmia

Accept CXR to check for aspiration/pneumothorax instead of ECG

Q3:

- 1. Methylene blue 1 to 2 mg/kg IV over 15 min (must for pass – dose not required)
- 2. Exchange transfusion
- 3. Hyperbaric Oxygen
- 4. NAC
- 5. Vitamin C

Q4:

- a) Open fracture
- b) Local Anaesthetic allergy
- c) Severe hypertension – SBP >180
- d) Sick Cell
- e) Raynauds
- f) uncooperative/confused patient
- d) unable to obtain access in both arms

Question 14

An 8yo boy presents with right thigh pain after falling 2m out of a tree. Primary survey is unremarkable. He has obvious swelling of his right thigh, but no other apparent injuries.

An XR reveals a midshaft # femur, that is off-ended and significantly shortened.

As part of his management the registrar decides to perform a femoral nerve block. They use 20ml of 0.75% Ropivocaine, with ultrasound guidance.

Q1

What is the maximum safe dose of ropivocaine for this child?

3mg/kg, 75mg or 10ml of 0.75%

Outline the clinical features of local anaesthetic toxicity.

i) Early symptoms

Perioral paraesthesia, tinnitus, anxiety, confusion, dizziness

ii) Severe toxicity

seizure, coma, arrhythmia, hypotension, cardiac arrest, respiratory depression

Q3 The patient shows signs of severe toxicity. Outline your resuscitative measures.

Intubation, ventilate to pH, Na bicarb, fluids->inotropes for hypotension, benzodiazepines for seizures, lipid emulsion

Q4 List 5 measures to improve safety of nerve blocks in your department?

Limit LA options (no bupivacaine in department, single strength of ropivocaine)

Reminder of dose, especially for paediatrics (poster, note on drug box)

Double checking of doses for paediatrics

Credentialling for procedures

Education (more limited usefulness)

More senior staffing on the floor

Question 15 (14 marks)

A 50 year old female presents with chronic lithium poisoning. Investigations reveal a lithium level of 3.1 mmol/L, and serum creatinine 180 micromol/L.

- i. What is the volume of distribution of lithium (1 mark)

- 0.7 – 0.9 L/kg

- ii. List 6 possible signs or symptoms of chronic lithium poisoning (6 marks)

- Tremor, hyperreflexia, agitation, muscle weakness, ataxia
- Stupor, rigidity, hypertonia, hypotension
- Coma, convulsions, myoclonus

- iii. Outline the principles of management in this patient (5 marks)

- Manage coma and seizures as required
- Aim to restore renal function to normal with attention to water and sodium deficits
- IV fluid resuscitation/hydration with 0.9%NaCl
- Tox consult/admission
- Consider haemodialysis in setting of neuro symptoms, and Li level > 2.5

iv. List 2 major differences between ACUTE and CHRONIC lithium poisoning (2 marks)

- GI vs neuro
- Lethality
- Elimination ie sufficient hydration in normal renal function vs haemodialysis

Question 16 (10 marks)

A 21 year old man is brought into the ED from a music festival complaining of shortness of breath and chest pain. His lips are cyanosed and vital signs are as follows:

T 36.2

P 121

BP 130/88

RR 34

SaO₂ 85% (10L/min)



What is the likely diagnosis? (1 mark)

Methaemoglobinaemia

What is the pathogenesis of the patient's symptoms? (2 marks)

Fe 2+ portion of haem is changed to Fe 3+ causing red haemoglobin to be converted to methaemoglobin

Reduced O₂-carrying capacity and resultant hypoxia

Name 4 agents that can cause this condition (4 marks)

Exposure to oxidising agents:

- **Local anaesthetics: Prilocaine / Lignocaine**
- **Nitrites e.g. amyl nitrate**
- **Dapsone**
- **Antimalarials e.g. chloroquine**

Outline your management of this patient (3 marks)

Apply oxygen via non-rebreather mask (NRBM)

Methylene blue 1mg/kg over 5min, repeat dose at 30-60min

Remove precipitating agent / admit to HDU / seek & treat complications and consider DDx

Question 17 (19 marks)

A 28 year old male with a known history of ice abuse has been brought into your tertiary ED by ambulance having required pre-hospital sedation with intramuscular droperidol.

Vital signs are:

T	38.4 deg C
HR	128 bpm
BP	158/80 mmHg
RR	18 bpm
SaO2	100% on 6L via HM
GCS	9 (E2V2M5)

i. Describe 5 possible causes of his presentation (5 marks)

- Drug ingestion/withdrawal (serotonin or NM syndrome less likely) – sympathomimetics, anticholinergics, aspirin etc
- Meningo-encephalitis
- Post-ictal
- Dyselectrolytaemia
- Heat illness
- Subarachnoid haemorrhage
- Traumatic ICH

ii. List 5 investigations you would perform and provide your reasoning (5 marks)

- Glucose – hypo/hyperglycaemia rapidly reversible
- A/VBG – occult sepsis, hypercarbia, glucose, electrolytes
- CTB – SAH/ICH/CVA (SOL)
- Electrolyte panel (biochemistry ALF/ARF)
- Blood ETOH/measured-calculated osmolarity
- ECG – QT prolongation post droperidol
- Consider LP after CTB – for infection/xanthochromia
- Must provide an answer with reasoning to score one mark

iii. The patient promptly suffers a grand mal seizure. Describe your initial management, including drug doses where appropriate (5 marks)

- Midazolam 0.15mg/kg (possibly in two divided doses) +/- phenytoin/keppra (15-20mg/kg)
- Manage airway, assess need for ETT and GA
- Early antibiotics +/- anti-virals

iv. His Na⁺ level is 116 mmol/L. Outline the initial management of his hyponatraemia and plan for the next 24 hours (4 marks)

- Bolus 100 mls 3% HTS, repeat x 1 if remains altered mental state with airway threat, further seizure (and Na⁺ not climbed over 6mmol/L)
- Aim total Na⁺ increase 6-12 mmol/24 hours (0.5-1.0 mmol/L/hr including bolus Rx); or calculate deficit and aim to replace half the deficit in appropriate timeframe
- Will require HDU/ICU management

Question 18

Time ingestion

Dose ingested

Formulation – immediate vs sustained

release Staggered vs one-off ingestion

Co-ingestants

Self-decontamination ie vomiting

2

- Within 2 hrs for immediate release ingestion >200mg/kg
- Within 4 hrs for sustained release >200mg/kg
- Massive (>30g) ingestion – within 4 hours immediate release and all SR

3

- INR > 3.0 at 48 hours or > 4.5 at any time
- oliguria or creatinine > 200 mmol/L
- persistent acidosis (pH < 7.3) or arterial lactate > 3 mmol/L
- systolic hypotension with BP <80 mmHg, despite resuscitation
- hypoglycaemia
- severe thrombocytopenia
- encephalopathy of any degree, or ALOC (GCS < 15) in the absence of sedatives.

Question 19 (12 marks)

A 3-year-old boy is brought in by his mother after ingesting an unknown quantity of liquid paracetamol. He had been playing quietly in his room for 10 minutes and was found with the empty bottle that previously was around three quarters full. The time of ingestion was 30 minutes prior to presentation. The entire 200ml bottle of paracetamol contains 10g of paracetamol. The child weighs 14kg.

a). What is your approach to decontamination of this child? (1 mark)

Decontamination is not indicated in well children <6yo with isolated liquid paracetamol ingestions as they have rapid absorption.

As part of your risk assessment you calculate the possible dose of paracetamol ingested.

b). What is the threshold ingested dose of paracetamol (in mg/kg) at and above which a serum paracetamol level should be measured ? (1 mark)

200mg/kg of liquid paracetamol

You decide this child DOES require a paracetamol level to be checked.

c). How long after ingestion will you check a paracetamol level in this child? (1 mark)

2 hours for a well child <6yo with an isolated accidental liquid paracetamol ingestion

The child's parents are appropriately concerned for their child and want to ensure there is no further risk to the child from accidental ingestions in the home. They ask you more questions about dangerous ingestions in children.

d). List 4 medications that may be life threatening if a small child ingested one or two pills. (4 marks)

Sodium channel blockers
diphenoxylate/ atropine
Calcium channel blockers
Theophylline SR
Sulfonylureas

Recreational sympathomimetic drugs
Opiates

After completing the appropriate testing, you have decided this child needs treatment with N-acetylcysteine. Soon after commencing the appropriate first infusion, the child develops wide spread erythematous flushing and wheeze.

e). List 5 steps in your immediate management. (5 marks)

Stop the N-acetylcysteine infusion
Give bronchodilator: salbutamol 2.5mg nebulized with O2 6L/min via nebulized mask – aim O2 sats >94%
Give antihistamine : certirizine 2.5mg – 5mg PO
Give prednisone: 1mg/kg PO
Once wheeze and rash has settled, restart acetylcysteine infusion at SLOWER rate and carefully monitor.

REFERENCES:

- Guidelines for the management of paracetamol poisoning in Australia and New Zealand
https://www.mja.com.au/sites/default/files/issues/203_05/Guidelines_paracetamol_Aus_NZ_2015.pdf
- <https://litfl.com/two-pills-can-kill/>

Question 20

Non-massive ingestions - <4hrs post ingestion

Massive (>30gm) – AC indicated up to 24hrs

2.

Repeat paracetamol at another 4 hrs (10hrs) – must be BELOW line and FALLING (indicates non-toxic ingestion) **1 mark**

OTHERWISE IF TOXIC INGESTION,

Has completed NAC therapy AND **1 mark**

ALT <50 and Paracetamol <10 prior to completion **1 mark**

3.

- INR > 3.0 at 48 hours or > 4.5 at any time
- oliguria or creatinine > 200 mmol/L
- persistent acidosis (pH < 7.3) or arterial lactate > 3 mmol/L
- systolic hypotension with BP <80 mmHg, despite resuscitation
- hypoglycaemia
- severe thrombocytopenia
- encephalopathy of any degree, or ALOC (GCS < 15) in the absence of sedatives.

Question 21 (19 marks)

A 30 year old 90kg lady presents to your emergency department having taken a poly-pharmacy overdose including panadeine forte, carbamazepine and temazepam. You are considering treating her with activated charcoal (AC).

- i. What dose would you use if you decided to administer AC (1 mark)

- 50g (1g/kg in a paediatric patient)

- ii. List 5 general contraindications for this therapy (5 marks)

- Patient requiring active resuscitation
- OD > 1hr ago (controversial)
- OD of non binding agent – (Metals/Hydrocarbon/Alcohols/Acids/Alkalis)
- Aspiration risk - potential for seizures or decreasing LOC
- Benign agent
- Sub-toxic dose
- Corrosive agent

After a short period, she becomes drowsy, tachycardic (120 bpm) and hypotensive (85/43 mmHg). Further history reveals that she has taken up to 9g of carbamazepine.

- iii. List 4 investigations that should be performed in this patient (4 marks)

- ECG
- BSL
- Paracetamol level
- HCG
- Carbamazepine level

iv. List 5 clinical features you would expect from a significant carbamazepine overdose (5 marks)

- CNS - decreased LOC/seizures/ataxia/nystagmus
- CVS - hypotension/tachy-or-brady-arrhythmias, prolonged PR/QRS/QT, pulmonary oedema
- Anti-cholinergic effects - retention/tachycardia/delirium etc

v. During your management, the patient has a generalized tonic-clonic seizure. List 4 conditions that should be excluded (4 marks)

- Hypoglycaemia
- Hyponatraemia
- Intracranial pathology
- Pregnancy with eclampsia
- Co-ingestant
- Acute withdrawal

Question 22 (16 marks)

A 54 year old lady presents with alcohol intoxication. 2 hours after arrival you are asked to review her as she is increasingly drowsy.

Vital signs HR 75 bpm
 BP 102/64 mmHg
 SaO2 93% RA
 GCS 9
 Temp 36.5 deg C

- i. List 5 differentials for her condition (5 marks)

- Tox
 - Antidepressants - TCA (tachy more likely)
 - Sedative - benzos, opiates
 - Cardiac - clonidine, beta blocker, antiarrhythmics
 - Alcohol
 - Recreational - heroin, GHB
- Head injury
- Sepsis
- Metabolic - hypoglycaemia, addisonian

- ii. List 3 relevant findings on the ECG (3 marks)

A 12 LEAD ECG IS SHOWN IN THE PROPS BOOKLET, PAGE 4

- B Blocker effects:
 - Prolonged PR, note not yet bradycardic
- Sodium channel blocker:
 - Broad QRS (>100ms)
 - Right axis deviation of the terminal QRS in aVR

iii. List 4 immediate life threats following a propranolol overdose and a specific treatment for each (8 marks)

Life threat	Specific treatment

- | | |
|---------------------------|--|
| • Coma | Airway protection |
| • Seizures | Benzodiazepines |
| • Bradycardia/hypotension | Atropine, adrenaline, isoprenaline, HIET etc |
| • Na channel blockade | Na bicarb appropriate dose |

Question 23

Questions:

1- For the table below, List three common conditions and their treatments that need to be addressed in the resuscitation of a patient following an overdose?

(6 Marks)

Seizures- benzodiazepines

Hypoglycaemia- dextrose if BSL < 4

Hyper/hypothermia- treat with cooling if temp > 38.5, emergent if > 39.5

Tox handbook page 4

2- The patient is unconscious with nil response to vocal stimuli but with painful stimulation is withdrawing bilaterally and moaning. His respiratory rate is 8 with an obstructed pattern and saturations of 90% on room air.

What initial interventions are required to manage his low Sat?

(3 Marks)

Basic airway manoeuvres- head tilt, chin lift, airway adjuncts

Supplemental oxygen titrated to saturations > 94%

Positioning in left lateral position

ARC guidelines 2014, guideline 4, guideline 10.4

3- Describe and interpret his ECG:

(4 Marks)

ECG changes:

Interventricular conduction delay- QRS > 100msec

Terminal R wave > 3mm in aVR and R/S ratio > 0.7 in aVR

Tachycardic rate ~110, sinus rhythm- p waves in T waves- best seen in V1, R axis deviation

Interpretation:

Sodium channel blockade

DDx hyperkalaemia

4- This patient's repeat vital signs include:

GCS 4/15 (E1, V2, M1)
HR 100
BP 75/60
RR 12
Sat 96% on a Hudson mask.

What are the priorities for this patient in the initial management? (6 Marks)

Increase oxygen delivery for preparation prior to intubation

Administer IV Sodium Bicarbonate 1-2mEq/kg- assume 80kg male- 100mEq initially and assess response with BP improvement and QRS < 100msec

IV fluid bolus- 500mls N Saline and repeat with aims of SBP > 90mmHg and no evidence of pulmonary oedema, if nil improvement or signs of pulmonary oedema use vasopressors to maintain SBP

Intubate to assist in management of pH with aim 7.5-7.55

Place NGT and consider administering 50g charcoal

Treat seizures with benzodiazepines

Question 24

You are the consultant working in an urban district ED. The ambulance bring in a 14 year old girl on an involuntary order after her mother found her in the bathroom with some empty pill packets.
She weighs 40kg.

Observations:

HR 105
RR 21
Sats 97% RA
BP 105/60
GCS 13/15 E3V4M6

The ambulance also bring in some empty pill packets, which were all prescribed yesterday. The missing pills include:

20 x 20mg Citalopram
20 x 300mg Quetiapine
50 x 25mg Amitriptylline
24 x 500mg/30mg Paracetamol/Codeine

I. List four (4) key aspects of your risk assessment based on what she has taken?

(4 marks)

Answer

1. Taken multiple serotonergic medications – risk of serotonin syndrome
2. Multiple medications that may cause sedation – ALOC/need for airway protection
3. tCA overdose >30mg/kg – associated with severe toxicity
4. Paracetamol potential toxic dose ie >10g, or >150mg/kg

II. For the table below, List three (3) key investigations that you would perform to help refine your risk assessment, including your reasoning

(6 marks)

Answer

ECG – signs of sodium channel blockade or QT prolongation in context tCA and SSRI/antipsychotics – QRS broadening, R prime in aVR
VBG – metabolic acidosis and/or resp acidosis in setting ALOC
Paracetamol level – help determine need for NAC in this potentially toxic ingestion

III. What specific toxidrome would you assess this patient for?

(1 mark)

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Serotonin syndrome

IV. List 4 clinical features consistent with this toxidrome

(4 marks)

Mental Status Changes

Delirium

Psychomotor agitation

Autonomic stimulation

Diarrhoea

Flushing

Hypertension

Hyperthermia

Mydriasis

Sweating

Tachycardia

Neuromuscular excitation

Clonus – especially ankle/ocular

Hyperreflexia

Increased tone – lower limbs>upper

Rigidity

Bold points are those significantly associated

Ideally candidates would give at least one sign from each of the 3 areas

Clonus/hyper-reflexia/increased tone/rigidity – probably all count as one point ie almost similes

Same as

hypertension/tachycardia

Sweating/flushing

Further information

She clinically deteriorates, with GCS now 9, and BP 80/40

V. List 4 key treatments you would provide, including details

(4 marks):

Answer

1. Intubate, hyperventilate aiming for pH>7.5
2. Fluid bolus 20ml/kg 0.9% NaCl
3. Sodium bicarbonate 100mmol IV
4. Activated charcoal 50g via NGT post intubation

Would also accept inotropes if given as answer

Question 25 (12 marks)

You have been tasked to retrieve a 42-year-old female from a rural base hospital to a tertiary referral centre 400km away. The estimated flight time is 75 minutes. She was brought into ED after a polypharmacy overdose 90 minutes ago and is presumed to have ingested:

- Paracetamol 15 tablets x 500mg (7.5 grams)
- Olanzapine 25 tablets x 10mg (250mg)
- Diazepam 5 tablets x 5mg (25)

Her observations are;

SaO₂ 92%RA
 BP 100/60 mmHg
 Pulse 110 bpm
 RR 22breaths/min
 GCS 10 E2V4M4

a). State how you would manage this patient to enable safe transportation. For each decision provide a justification. (8 marks)

Decision	Justification	
Intubate and ventilate - drugs/doses required - Any reasonable choice	Airway protection due to predicted sedation Agitated patient is a safety risk on a flight	
Ongoing sedation - Any reasonable choice	Minimize complications during transfer	
Ongoing Relaxation - Vecuronium 10 mg IV PRN	Minimize complications during transfer e.g tube dislodgement/chewing on tube	
IV fluids	Maintenance + bolus for predicted hypotension	
Cardiac monitoring with defibrillation pads on	Possibility of arrhythmia/QT prolongation	
2x IV access with long extensions (more than 2 preferred)	Easier drug administration	
Vasopressors prepared and ready to give - drug/dose required - Any reasonable choice	Predicted hypotension	
NG tube insertion	Decompress stomach	
IDC insertion	Patient care on long flight, decompress bladder	Pat

b). Complete the following table for the dose-related clinical effects that you would anticipate from an Olanzapine overdose. (4 marks)

Dose	Clinical features

Answer**TABLE 3.55.1 Dose-related risk assessment: Olanzapine**

Dose (adult)	Effect
<40 mg	Therapeutic sedation and antipsychotic effects
40–100 mg	Mild to moderate sedation with possible anticholinergic effects
100–300 mg	Sedation with intermittent marked agitation
>300 mg	Increasing sedation progressing to coma likely to require intubation Hypotension secondary to peripheral alpha blockade

Reference:

The Emergency Medicine Manual - Dunn et. al.

The Toxicology Handbook - 3rd edition

Question 26

1.

Severe hyperkalaemia – cellular shift due to metabolic acidosis, renal failure, cell death with rhabdo

High anion gap metabolic acidosis – renal failure, lactic acidosis most likely

Renal failure – urea/creat less than 100 – suggests intrinsic renal failure – most likely due to rhabdo

1 mark for each process, 1 mark for explanation (no marks for just saying X is high or Y is low)

Pass 4 of 6

2.

Rhabdomyolysis due to prolonged period on floor following sedative overdose

(accept compartment syndrome)

1 mark for rhabdo, 1 mark for why

Pass 1 of 2

3.

Ca gluconate (membrane stabilisation) – 20mL 10%

Intra-cellular shift

- Serum alkalinisation (hyperventilation and HCO_3^-) aim pH high normal
- Insulin / dextrose – 10U/50mL 50%
- Salbutamol – 5mg nebs via ETT

Removal

- NG resonium 30g

(consider dialysis in refractory cases)

Pass 3 of 4

Total pass 8 of 12 corrects to **6.5/10**

Question 27

1.

*Initial hyperventilation**Nausea**Vomiting**Tinnitus**Dehydration**Pyrexia**Confusion**Pulmonary oedema*

2.

Management	Indication(s)	Dosing instructions
1. Decontamination	Ingestion >150mg/kg within last 6hrs	50g oral charcoal (+/- repeat doses in large ingestions)
2. Urinary alkalinisation	Symptomatic patient	1-2mmol/kg bolus NaHCO ₃ Then 25mmol/hr NaHCO ₃ Aim urinary pH >7.5 (Need 2/3)
3. Haemodialysis	In severe toxicity: • Pre-existing renal/cardiac failure precluding urinary alkalinisation • Pulmonary oedema • Severe acidosis • Elevated salicylate level > 700mg/L or 5.1 mmol/L (Need 2/4)	

Question 28

FEx Net 2022 Collated SAQs

MET-HB

i) VBG or ABG with **MetHB level (mandatory)**

- + Two of ECG, BSL, lactate, Reasonable Toxicological Blood panel
- + Mobile CXR accepted given low SATS
- + No Marks for Urine, non specific blood tests

ii) MET HB

- + G6PD Deficiency

iii) Methylene Blue IV

iv) One of Citric Acid, Exchange Transfusion or Hyperbaric O2.

High flow O2 not accepted

v) Local Anaesthetics, Nitrates, Nitrites, Analine Dye, Dapsone, Acetone, GTN

Question 29**1. What is your initial risk assessment?****(3 marks)**

Max taken = $50 \times 25 = 1250$ mg, likely 1000 mg / 60 kg = 16-20 mg/kg of tricyclic antidepressant.

Potential for all major effects to occur within 2- 4 hours: tachycardia suggestive of anticholinergic effects. Seizure, coma, hypotension, cardiac dysrhythmias. Potentially fatal.

Requires close observation for at least 6 hours if does not develop toxicity, in acute area with cardiac monitoring.

2. Name and justify one (1) key investigation and two (2) other investigations you would perform?**(6 marks)**

Investigation	Justification
<u>Key investigation</u> ECG	Evaluate cardiotoxicity. Look for QRS widening (Na ⁺ channel blockade) with prominent r wave in aVR. QRS >100 at risk of seizures; QRS >160 at risk of VT
<u>Other Investigations</u> Paracetamol level b-HCG VBG	Screening test in overdose Young woman – may complicate management, impact on disposition Development of any acidaemia

3. 40 minutes after arriving in the emergency department, the patient has a generalised tonic-clonic seizure.**Her vital signs are now:****GCS 3****HR 120/min****BP 90/50****O2 sats 98% NRBM****List your 5 immediate management priorities, including endpoints of therapy.****(5 marks)**

- Seizure management – Indication for Sodium bicarbonate 1-2mmol/kg IV. Midazolam 2.5-5mg IV if seizure ongoing. Endpoint = termination of seizure.
- Repeat ECG looking for signs of toxicity. If QRS prolongation and/or hypotension, indication for use of sodium bicarbonate 100 mmol 8.4%, with end point of QRS narrowing and haemodynamic stability.
- Early intubation to control airway and ventilation with predicted clinical course of coma and respiratory acidosis contributing to worsening sodium channel blockade. Appropriate use of RSI drugs.

- End point of: Hyperventilate TV 6-8mL/kg, PEEP 5, FiO₂ to maintain sats >95%, RR targeted to achieve pH 7.50-7.55
- Fluids: 20 mL/kg 0.9% saline/Hartmann's, repeat. Consider vasopressors if ongoing hypotension.
- Activated charcoal 50g, once airway secured given significant ingestion.
- Supportive – K⁺ replacement with alkalinisation

Pass mark: 9/14

Question 30 (20 marks)

Give 5 differentials for this patient's presentation. Each should be in a different category (5 marks)

- Infectious - Sepsis, Meningitis, Encephalitis, Cerebral malaria
- Toxidrome- Neuroleptic malignant syndrome, Serotonin syndrome, Malignant hyperthermia, Sympathomimetic toxicity (cocaine, amphetamine, ketamine), Anticholinergic toxicity
- Endocrine - Thyroid storm
- Environmental- Heat stroke
- Delirium tremens
- Hypothalamic stroke
- Pheochromocytoma

List the Hunter Toxicity Criteria Decision Rule (5 marks)

- Serotonergic agent (must have to score full points) plus at least 1 of the following:
 - Spontaneous clonus
 - Inducible clonus AND (agitation or diaphoresis)
 - Ocular Clonus AND (agitation or diaphoresis)
 - Tremor AND hyperreflexia
 - Hypertonia AND temperature >38 AND (ocular clonus or inducible clonus)

Fill in the table with respect to the different Toxidromes (10 marks)

Table 4. Signs And Symptoms Of Toxidromes

Toxidrome	Mental Status	Eyes	Lungs	Vital Signs	Bowel Sounds	Bladder	Neurological
Sympathomimetic / GABAergic withdrawal	• Agitated • Delirious	• Mydriasis	Normal	↑ HR, ↑ BP ↑ Temp ↑ RR	Normal or increased	Normal or increased	• Nonfocal • Hyperreflexia
Cholinergic	• Normal	• Miosis • Mydriasis	Bronchorrhea	HR ↓ or ↑ BP ↓ or ↑ RR ↓ or ↑	Increased	Increased	• Fasciculations • Weakness
Anticholinergic	• Agitated • Delirious	• Mydriasis	Normal	↑ HR, ↑ BP ↑ Temp	Decreased	Decreased	• Nonfocal • Ataxia
Opioid withdrawal	• Dysphoric	• Mydriasis	Normal	↑ HR (mild)	Increased	Increased	• Nonfocal • Ataxia
Neuroleptic malignant syndrome	• Agitated • Delirious	• Oculogyric crises (rare)	Normal	↑ HR, ↑ BP ↑ Temp ↑ RR	Normal	Normal	• Lead-pipe, cog-wheel rigidity
Serotonin syndrome	• Agitated • Delirious	• Ocular clonus	Normal	↑ HR, ↑ BP ↑ Temp ↑ RR	Normal or increased	Normal or increased	• Hyperreflexia • Clonus

Abbreviations: BP, blood pressure; HR, heart rate; GABA, gamma-Aminobutyric acid; RR, respiratory rate; temp, temperature.

Question 31

A 22 year old male is brought to your emergency department following the ingestion of 'some pills' at a nightclub.

He is diaphoretic, pale and complaining of chest pain.

1. Describe 3 main features on his ECG

(3 Marks)

Narrow complex tachycardia
Widespread ST elevation
ST depression aVR
Intervals normal

He remains GCS 15 but agitated,

His vital signs are:

HR 120
BP 180/95
Sats 100% NRB.

2. List 2 illicit drugs and their class are likely to be responsible for his presentation.

(4 Marks)

Sympathomimetic- amphetamines, cocaine and ecstasy
Hallucinogenic- LSD and psilocybin
Volatile agents

3. Outline your management of this patient specifically in regards to his cardiovascular status.

(5 Marks)

Benzodiazepines- iv midazolam/diazepam
Calm environment
GTN- SL or infusion
Phentolamine if refractory to GTN/benzos
If ongoing chest pain and ECG changes- for intra-coronary thrombolytics/vasodilators

* Can also consider nitroprusside for HTN

Question 32

1.

Broad QRS – between 160-200ms (**CRITICAL**)

Terminal right axis deviation of QRS

Absolute QT prolonged about 480ms

Pass 2 of 3

2.

Tri-cyclic anti-depressants

Pass 1

3.

Terminate seizure

– midazolam 2.5mg aliquots

Serum alkalisation aiming for pH 7.5 (2 steps below so 4 marks)

Intubate

○ – ketamine 100mg, rocuronium 100mg

IV HCO₃

○ – initial bolus 100mmol

IV N/S bolus

– 1000mL repeat if needed, for systolic BP >90mmHg (MAP >65mmHg)

Noradrenaline infusion if needed for BP goal

(3% saline if refractory hypotension, aiming for Na 150)

1 mark for each concept, 1 mark for action details

Pass 6 of 10

Total pass 9/14 corrects to **6/10**

- Question 33 (22 marks)

i) 2 marks

- HAGMA
- Cannot calculate Osmolality
- Respiratory Alkalosis

Sodium	136	mmol/L
Chloride	99	mmol/L
Bicarbonate	14	mmol/L
Albumin	40	g/L

23.0 mmol/L Anion Gap	1.1 mmol/L Delta Ratio Suggests pure Anion Gap Acidosis Delta Gap: 11.0	23 mmol/L Corrected Anion Gap for Albumin High anion gap acidosis
---------------------------------	--	---

ii) 1 mark

WINTERS = Expected $\text{Co}_2 = 1.5 \times \text{HCO}_3 + 7 \pm 3$ - need to calculate - not just write 'Winters'

iii) State the three (3) MOST likely causes of the abnormal blood gas in this case (3 marks)

ACCEPTABLE

Methanol, Eth Glycol, Aspirin

Other reasonable toxins accepted (below) - Paraldehyde, Prop. Glycol, Isoniazid, Ibuprofen, Paracetamol, Iron

Qualified statement about 'atypical' sepsis accepted

Causes of a widened anion gap: CAT MUDPILES.

Cyanide or carbon monoxide
 Acetaminophen (massive), aspirin, or alcoholic ketoacidosis
 Toluene
 Methanol, metformin, or massive overdoses
 Uremia
 Diabetic ketoacidosis
 Paraldehyde or propylene glycol
 Iron, isoniazid, or ibuprofen (massive)
 Lactic acidosis
 Ethylene glycol
 Salicylates

UNACCEPTABLE

Unlikely - sepsis (without qualifier), CO, uraemia, DKA

iv) Textbook answer:

- The high lactate can 'mimic' ethylene glycol
- Lactate gap (difference between gas and lab values)
- Osmolar Gap

We can also accept ethylene glycol levels or ETOH levels (as they are not available on the gas)

v) 8 marks

Investigation	Justification
(1) Osmolality	(1) OG Calculation /Contribution
(2) Ethanol Level	(2) AS PER (1)
(3) Calcium	(3) Oxalic Acid COMplexes interacting with calcium leading to hypocalcaemia
(4) Creatinine	(4) Renal Failure from above, acid
Urine for Crystals	Oxalate Crystals

vi) 6 marks

Management	Justification
Ethanol via NGT 3-4 SD loading 1 SD per hour Aim 0.1% ETOH level	ADH inhibition Slow metabolism
Dialysis - CRRT - Intermittent Dialysis	Removes Toxic Metabolites Definitive Management Rx of Acidosis, Renal failure and Hyperkalaemia
Pyridoxine 50mg IV QID for 2 days	Cofactor in metabolism of glyoxylic acid
Thiamine 100-300mg IV TDS-QID for 2 days	As Pyridoxine
Fomepizole (ethanol substitute) 15mg/kg loading 10mg/kg every 12 hours maintenance for 4 doses	ADH inhibition (as ETOH)

Question 34

A 33yo male is brought to ED following a suicide attempt with ingestion of an unknown substance 4hrs prior to presentation.

Vital signs:

HR 105

BP 142/79

RR 30

SaO₂ 94% 6L HMO₂

GCS E2V3M4 = 9

An urgent ABG and bloods are collected with the following results:

pH	7.02
pCO ₂	20
pO ₂	85
HCO ₃	8
Lactate	8.2
Glucose	8
Urea	24
Creatinine	210
Osmolarity	299
Na	142
K	4.0
Cl	106
Ca	1.9
Mg	0.8

- i. Describe the acid-base disturbances (2 marks)

Severe acidaemia

RAGMA

$$AG = 142 - (106 + 8) = 142 - 114 = 28$$

$$\text{Delta ratio} = (28 - 12) / (24 - 8) = 1 \rightarrow \text{isolated RAGMA with elevated lactate}$$

$$\text{Expected PCO}_2 = (1.5 \times 8) + 8 = 20 \rightarrow \text{compensatory respiratory alkalosis (appropriate)}$$

- ii. What 3 other abnormalities are present on the ABG? What is the likely diagnosis and why? (5 marks)

1. elevated osmolar gap

$$\text{Calc osm} = 2 \times 142 + 24 + 8 = 316$$

$$\text{Osmolar gap} = 316 - 299 = 17 > 10$$

2. hypocalcaemia

3. renal impairment

(4. elevated lactate)

→ **ETHYLENE GLYCOL TOXICITY**

- **RAGMA with elevated lactate and elevated osmolar gap, associated with hypocalcaemia and rising creatinine = pathognomonic of EG toxicity**

iii. List 2 other investigations you would request and your rationale for each. (4 marks)

Blood alcohol level - ?co-ingestion

Serum ethylene glycol level – to determine need for haemodialysis (>8mmol/L) though usually not readily available and decision to haemodialyse based on other factors

Urine microscopy - ?Ca oxalate crystals in urine

- ii. The patient goes on to have a generalised tonic-clonic seizure lasting 5mins. Describe 6 steps in your management of this patient. (6 marks)

Transfer to RR and attach non-invasive monitoring

IV diazepam (5-10mg) for termination of seizure

RSI/intubation for airway protection with seizure and poor GCS: maintain hyperventilation to continue respiratory compensation

Administer antidote: ethanol IV 8ml/kg loading 10% ethanol, continue 1-2ml/kg/h

Correct hypocalcaemia: CaCl 10ml IV over 5mins

IV NaHCO₃ 1-2mmol/kg for correction of acidosis

Arrange for haemodialysis – indications:

- *large EG ingestion with osmolar gap>10*
- *pH<7.3*
- *acute renal failure*
- *EG level >8mmol/L*

Admit patient to ICU for monitoring and haemodialysis treatment

Question 35

A 32 yr old female presents 6 hours after ingesting 20 x 240mg SR verapamil tablets.

She is vomiting and listless, GCS 14

HR 40 BP 75/40

(a) What is your risk assessment of this patient ? (1 mark)

Potentially lethal overdose, already showing signs of ingestion and toxicity.

(b) What are the pathotoxicological mechanisms of this agent ? (2 marks)

Prevents opening of L-type Ca channels, decreases Ca influx into cells and decreases contractility

Negatively inotropic and chronotropic

Peripheral vasodilatation

Impairs insulin release (therefore early sign of OD is raised BSL).

(c) Her BSL is 12, what is the significance of this?

Shows toxicity, Ca channels blocked in pancreas causing impaired insulin release and high BSL, therefore early sign of OD is raised BSL

(d) As you assess her, she deteriorates further, has a poorly palpable pulse, GCS drops to 9/15.

Repeat ECG shows a junctional rhythm at 30 bmp. Outline your management steps (give doses of any medications used) (6 marks)

ABC

IV fluid bolus

Ca Boluses : 10-20ml CaCl₂, or 30-60ml Ca gluconate

Inotropes : - adrenaline, noradrenaline

High dose insulin/dextrose:

Bolus 50ml 50% dextrose, plus bolus insulin 0.5-1 unit/kg.

Infusion 0.5-1 unit/kg/hour, plus infusion of 25-50ml 50% dextrose/hr

Monitor BSL every 20mins for 1st hour, then hourly. (hypoglycaemia is rare)

Replace K + and Mg++

(note : insulin/dextrose takes 15-45 mins to work, therefore need noradrenaline initially , then can wean noradrenaline)