

1. Lead examiner

Candidate Number:

2. Co-examiner

Final Mark:

SCENARIO

A 30 year-old man was working at a Silicon Chip factory when hydrofluoric acid was spilt onto a hot surface and “exploded”. He has suffered chemical burns to his arms and chest. Decontamination was performed at the scene and he has been brought in by ambulance, complaining of severe pain.

Question 1: What are the important features in your history and examination?

(2 minutes)

Expected Response	Details & Comments	
Aims are to assess A. Risk of dermal / soft tissue necrosis and systemic toxicity, including hypoCa B. Need for treatment beyond topical Ca gluconate		
HISTORY		
Exposure	- Time of contact with HF - Concentration of HF solution (liaise with employer if possible) – in this industry, should be less than 50%. 100% solution carries high risk, but typically causes immediate pain. - Estimated BSA exposed – usually hands only. Greater than 10% is higher risk of systemic toxicity. - Protective gear - Decontamination- Delay between exposure and washing?	
Local Sxs	Severity of pain, extent of apparent injury Additional Sxs such as blistering, desquamation, joint or tendon involvement	
Systemic Sxs	Inhalational: mucosal irritation, cough, dyspnoea, wheeze Features of hypoCa –Tetany, muscle spasm, dizziness from arrhythmia	
Co-morbidities, or Implications for Rx	PHx – respiratory illness such as asthma Medications, allergies / adverse reactions	
EXAMINATION		
Hands	Pallor and blanching may be evident at this stage Erythema, blistering and dermal necrosis may be impending if untreated Neurovascular deficit or other complication	
Other systems	Seek signs of systemic fluorosis Vital signs – baseline pulse, rhythm, BP Oral mucosa, eyes Chest exam – wheeze or other adventitious sounds	

Question 2: Outline your initial management.

(1 minute)

Expected Response	Details and Comments	
Critical Care Scenario	Resus cubicle, team approach, assume team leadership Cardiorespiratory monitoring Protective gear for staff	
Supportive Care (A,B,C)	Skin decontamination (if incomplete). Remove contaminated clothing, irrigate skin and/or mucosal surfaces with copious amounts of water. Assess and treat airway burns, stridor, dyspnoea etc High flow oxygen, ventilatory support if required IV access – crystalloid IV infusion, aiming for normotension Titrated narcotic analgesia, may require large doses	
Chemical cutaneous burns	IV fluid requirements according to estimated BSA of burns Topical: Calcium chloride in water-based gel, applied liberally to affected areas	
Systemic toxicity	Anticipate hypocalcaemia, with / without ECG changes and dysrhythmias. IV Ca if confirmed.	

Question 3: A 12-lead ECG is performed. Describe and interpret the ECG.

(1 minute)

Expected Response	Details & Comments	
12 lead ECG with features suggesting electrolyte abNs		
Findings	SR 56bpm, sinus arrhythmia. Markedly prolonged (apparent) QTc in limb leads U waves in praecordial leads. Prolonged QTc in limb leads may reflect merged T and U waves. Non specific inferolateral ST depression. Meets voltage criteria for LVH.	
Relevant negatives	Normal axis, no ectopics.	
Interpretation	Features of low serum cation: K, Ca, Mg. In this setting, significant concern for hypoCa and / or hypoMg. This is indicative of systemic fluorosis. Serum K needs to be checked too! ST changes and LVH of uncertain significance in this context.	

Question 4: The patient has moderate hypocalcaemia and approximately 10% BSA cutaneous burns involving his arms and chest. There are no other injuries. Outline your ongoing management.

(1 minute)

Expected Response	Details & Comments	
HF exposure with dermal burns and systemic fluorosis. HypoCa and/or hypoMg warrant ongoing cardiac monitoring and parenteral Ca +/- Mg.		
Electrolyte abN	Parenteral regime: IV CaCl; IV Mg SO4 if associated hypoMg Titrate to normal QTc and serum levels of Ca and Mg	
Additional Pain Control	Refractory pain may require subcutaneous, intra-arterial or regional IV infusion of CaCl	
Enhanced elimination?	No role here; not indicated	
Disposition	To ICU or HDU. Involve toxicology service.	
Other	Workplace notification / documentation Liaison with NOK	

Question 5: In general, DISCUSS the options to administer local or regional calcium for pain refractory to topical gels, in dermal HF acid burns.

(2 minutes)

Topical Rx is limited because Ca is relatively impermeable to skin. Options: Subcutaneous, Regional Intravenous, or Intra-arterial. Ca gluconate is recommended, as Ca Cl too concentrated, and itself may cause tissue necrosis.		
	PROS	CONS
Subcutaneous Infiltration	5% Ca gluc via fine needle. Easy and rapid to administer, therefore 1 st line treatment of choice if small area affected. If suitable, pain relief is immediate.	Max dose of 1ml per square cm of affected skin Amount of Ca delivery limited by route of admin May cause initial pain from free Ca ions More tissue damage possible if Ca not bound to fluoride Limited penetration to nail bed (unless remove nail plate!) Excessive volumes around digits may compromise circulation
Regional Intravenous Infusion (Using Bier block method)	Greater penetration of Ca ions into affected tissue Technically requires only IV access and high pressure BP cuff, therefore easier than intra-arterial infusion.	Ischaemic pain for patient! Therefore difficult to assess if Rx effective. Poor pt acceptance. Iatrogenic tissue ischaemia may be harmful Rx time limited by limb ischaemia time. Risk of systemic hypercalcaemia if cuff deflates
Intra-arterial Infusion	Most effective for severe tissue fluorosis. In this case – brachial artery cannulation indicated. Ca gluc diluted in 5% Dex, administered via 3-way stopcock with pressure monitor transducer. Rx over 2 – 4 hours.	Deep tissue infiltration of Ca ions may exacerbate tissue damage. Risk of arterial spasm or thrombosis, causing limb ischaemia. Resource-intensive. Will need ICU admission.

Comments: (if you fail the candidate, please state why)

If the candidate fails the exam overall, what feedback would you suggest CIC provide for this SCE?

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Question 1: *What are the important features in your history and examination?*