SAQ 22

HIGH VOLTAGE ELECTROCUTION

Cabrini

A 24-year-old male arrives by ambulance to the ED post electrocution from exposure to a high voltage power line.

1. List six clinical findings (from history, examination, or investigation) that you will look for that are potential sequelae from a high voltage electrocution event.
   (6 marks)

Body system	2 findings for each system:
CVS	Arrhythmia: SVT, afib, VT, VF, bradycardia, sustained asystole myocardial ischaemia and/or necrosis, cardiogenic pulm oedema, thrombosis, autonomic dysfunction
Musculoskeletal	Joint dislocation, fractures, compartment syndrome, rhabdomyolysis
Neurological	Coma, encephalopathy, ICH, seizures, amnesia, spinal cord injury with paralysis/focal neurology, peripheral nerve injury, #skull & TBI

CARDIAC

Arrhythmias

- The commonest complication, supraventricular arrhythmias (sinus tachycardia, atrial extrasystoles, or atrial fibrillation) and ventricular arrhythmias (extrasystoles, tachycardia, or fibrillation)[6-8]
- Exposure to high voltage current is more likely to cause cardiac standstill (asystole), but even low voltage alternating current can cause cardiac arrest by ventricular fibrillation[9]
- There is a vulnerable period in every heart beat during which exposure to energy at a frequency of 50-60 Hz, used in most household and commercial electrical sources, can trigger fibrillation
- Although most life threatening events occur immediately after electric shock, delayed ventricular arrhythmias have been reported (up to 12 hours after the incident, with low as well as with high voltages)[10]
- The mechanism behind electrically induced cardiac arrhythmias is hypothesised to be initial damage to heart muscle and subsequent scar formation leading to abnormal electrical activation of the heart

Bradycardia

- Severe slowing of the heart rate can result from interference with the normal electrical (conduction) system, which can be delayed for months or years after the accident[11]
- The sino-atrial and atrio-ventricular nodes responsible for impulse generation and propagation within the heart may be more susceptible to damage by electrical injury than other cardiac cells[12,13] (necropsy shows widespread areas of cell death, mainly in these electrical pathways[14])

Heart muscle injury

- May result from reduction of blood supply (ischaemia) or direct tissue death (necrosis)
- Chest pain may be absent, and injury may manifest only as non-specific electrocardiographic changes (fig 4), increased levels of myocardial proteins in the blood (troponin) from damaged tissue, or abnormalities such as altered contraction patterns on echocardiography or cardiac MRI[15]
- Occasionally, mostly after high voltage accidents, myocardial infarction can be caused by occlusion of coronary arteries by blood clots or spasm[16]
- Cardiac function usually returns to normal shortly after the event, but cardiac abnormalities sometimes persist

RESPIRATORY ARREST

- Electric current, by interfering with usual transmission of nervous impulses, can paralyse the respiratory muscles (such as diaphragm) or cause them to seize up abruptly (tetanic contraction)
- Inhibition of the centre controlling breathing in the brain

SKIN BURNS

- Extensive burns can result in significant body fluid loss and infection, due to loss of skin barrier

NEUROLOGICAL

- Damage to nerve tissue may cause loss of consciousness, impaired recall, spinal cord injury, paralysis, or loss of sensations in limbs
- Neuropsychological problems are often underappreciated, but post-traumatic stress disorder, depression, and chronic neuropathic pain have been reported[17]

VASCULAR

- Clotting in blood vessels due to injury to vessel walls can compromise blood flow to organs

KIDNEY FAILURE

- Myoglobin tubular precipitation caused by damaged muscles releasing myoglobin to the circulation and thus to the kidneys

MUSCULOSKELETAL EFFECTS

- Bone fractures and luxations
- Direct muscle damage, rhabdomyolysis[18]
- Compartment syndrome

sourced from BMJ 2017;357:j1418

A 24-year-old male arrives by ambulance to the ED post electrocution from exposure to a high voltage power line.

2. You receive the VBG below. What pathological process is likely to be contributing to the hypocalcaemia, and what finding would confirm this on urinalysis? (2 marks)

Pathological process:	**Rhabdomyolysis (as RAGMA, hyperkalaemia, hypocalcaemia)**
Confirmation:	Dipstick positive for blood (indicating myoglobinuria)

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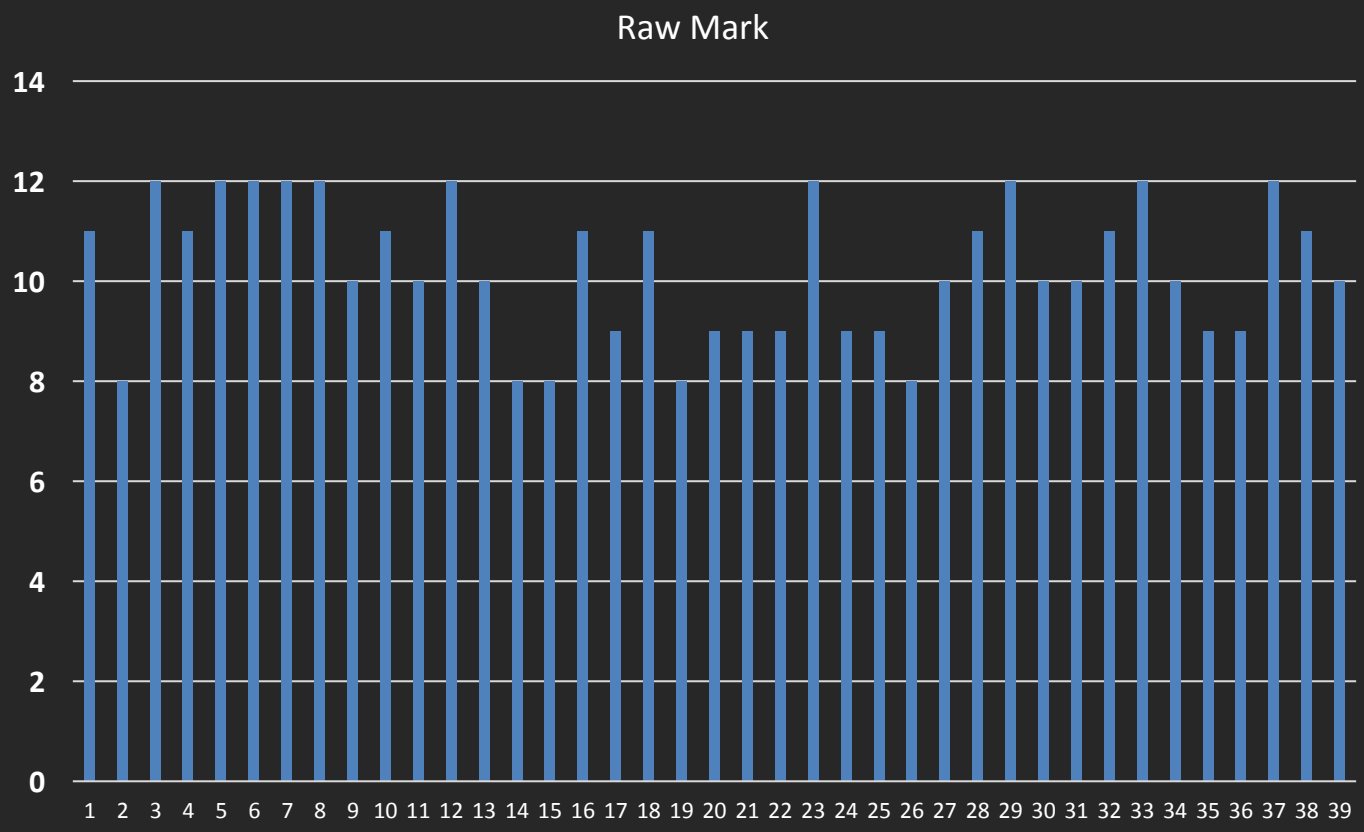
3. **The patient has extensive burns that include a full thickness circumferential burn to an upper limb. List 4 signs developing in a limb that may indicate the need for an escharotomy. (4 marks)**

ESCHAROTOMY :

https://aci.health.nsw.gov.au/__data/assets/pdf_file/0003/162633/Escharotomy-for-Burn-Patients.pdf

RESULTS FROM COHORT 2022.2: 26/39 gained 10/12 for a pass



Common mistakes:

- Being too general – especially “arrhythmia” without giving an example or picking “ventricular ectopics” rather than a more major finding in keeping with high voltage injury.
- Not listing the findings as per CVS/msk/neuro eg giving a respiratory finding, or stating “suspect injury causing raised ICP” without giving an actual clinical finding for this suspicion
- Giving an answer found on a test other than urinalysis, which was specified for Q2. Reporting haemaglobinuria, rather than stating the pathology we are testing for. Yes blood on the dipstick, but this indicates myoglobinuria in this context.
- Do not give more than one answer per line – this is a VERY common way to fail this exam. You are not going to receive more marks for the answer and will lack time to gather marks on subsequent SAQs. Answer only what is asked for and move on!