

## Case based discussions 5<sup>th</sup> November 2019

### Case One

*A 58yo woman with sudden onset flank pain is being brought in by an ambulance. She is diaphoretic, hypothermic 34.8, and hypertensive 160/90. She is getting good pain control with morphine and methoxyflurane.*

#### **1. What are your differential diagnoses?**

- AAA rupture
- Retroperitoneal haemorrhage
- Renal colic
- Aortic dissection
- Perforated viscus, acute abdominal pathology

*On arrival she is triaged into a resuscitation room with on-going flank pain. Her initial vital observations are recorded:*

*HR 144, BP 90/60 RIGHT and 74/60 LEFT, GCS 15, temp 35.5, BGL 8*

#### **2. Discuss your initial emergency management and investigation?**

- Shocked state with wide differential? Aortic? haemorrhagic? Sepsis?
- Urgent large bore IVL
- Fluid resuscitation +/- BLOOD +/- PRESSOR
- Bedside investigation
  - ECG
  - VBG
  - RUSH POCUS
- Send bloods cardiac/abdo/sepsis profile, cross match
- Consider CT early to differentiate

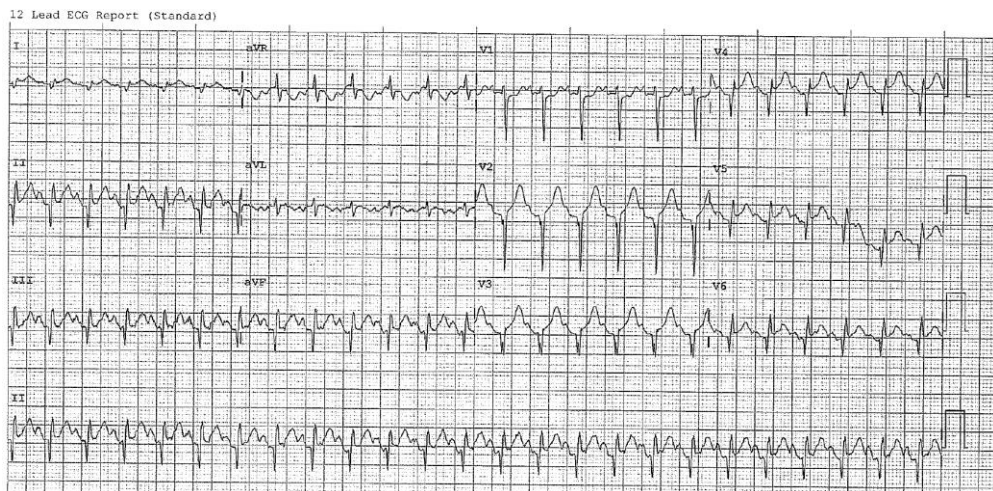
#### **Rapid Ultrasound in Shock and Hypotension = 3 step algorithm**

- PUMP : LV contractility, RV strain, pericardial effusion
- TANKS: IVC variation qualitative, leaks (pleural fluid, abdo free fluid, pulmonary oedema), tank compromise (pneumothorax)
- PIPES: AAA, dissection, proximal DVT
- Additional clinically focused, directed ultrasound: Hydronephrosis, Biliary pathology, IUP (ectopic), more detailed echo

3. Below are some initial investigations findings discuss and interpret?



USS LUQ AND L KIDNEY LONG AXIS



ECG TAKEN

Spec type	W/hol.B	Venous		
Inspired O2		Not given		
<b>pH</b>	<b>7.16</b>		<b>L</b>	<b>7.36-7.44</b>
<b>H+</b>	<b>71</b>	<b>nmol/L</b>	<b>H</b>	<b>35-45</b>
<b>PCO2</b>	<b>9.4</b>	<b>kPa</b>	<b>H</b>	<b>4.6-6.0</b>
<b>PO2</b>	<b>2.2</b>	<b>kPa</b>	<b>L</b>	<b>10.6-13.3</b>
Actual Bicarbonate	25	mmol/L		20-28
<b>Base excess blood</b>	<b>-5</b>	<b>mmol/L</b>	<b>L</b>	<b>-3 to +3</b>
<b>Gases O2 Saturation</b>	<b>0.15</b>		<b>L</b>	<b>0.95-1</b>
Sodium blood	142	mmol/L		135-146
<b>Potassium blood</b>	<b>3.2</b>	<b>mmol/L</b>	<b>L</b>	<b>3.5-5.2</b>
Chloride Blood	102	mmol/L		95-110
<b>Glucose blood</b>	<b>18.0</b>	<b>mmol/L</b>	<b>H</b>	<b>3.0-11.0</b>
Anion Gap	17	mEq/L		10-20
Calcium (ionised)	1.21	mmol/L		1.15-1.30
<b>Lactate blood</b>	<b>5.7</b>	<b>mmol/L</b>	<b>H</b>	<b>0.3-1.3</b>
<b>Haemoglobin</b>	<b>112</b>	<b>g/L</b>	<b>L</b>	<b>115-155</b>
Comment				
Authorised by		CMDHBEDABL90		

- Amorphous renal mass or LUQ mass
- Anterior q waves with ant/lateral/inf STE – ischaemic looking ECG
- Acidotic raised lactate consistent with shocked state, low Hb ? bleeding

*Post 2L N saline BP 100 systolic. A decision is made for a CT aorta. During the CT she becomes hypotensive BP 60 requiring further IVF and metaraminol. Post CT she continues to have hypotension 60 systolic with temporary response to fluids and pressor.*

- 4. Her troponin is 1300, review her CT image and repeat blood gas, discuss your diagnosis, management plan?**



Large L retroperitoneal haemorrhagic mass with active contrast extravasation and haemoperitoneum

Spec type	Whol.B	Venous		
Inspired O2		Not given		
pH	7.01		L	7.36-7.44
H+	100	nmol/L	H	35-45
PCO2	10.3	kPa	H	4.6-6.0
PO2	2.3	kPa	L	10.6-13.3
Actual Bicarbonate	20	mmol/L	L	20-28
Base excess blood	-11	mmol/L	L	-3 to +3
Gases O2 Saturation	0.14		L	0.95-1
Sodium blood	140	mmol/L		135-146
Potassium blood	3.7	mmol/L		3.5-5.2
Chloride Blood	106	mmol/L		95-110
Glucose blood	12.2	mmol/L	H	3.0-11.0
Anion Gap	18	mEq/L		10-20
Calcium (ionised)	1.13	mmol/L	L	1.15-1.30
Lactate blood	8.0	mmol/L	H	0.3-1.3
Haemoglobin	67	g/L	L	115-155
Comment				
Authorised by		CMDHBEDABL90		

- Blood resuscitation activate MTP
  - TXA
  - Keep warm
  - Targeted permissive hypotension?



	13:17	14:56	15:09	15:55	16:58	18:24
Spec type Whol.B	Venous	Venous	Venous	Arterial	Arterial	Arterial
Inspired O2	Not given	Not given	Not given	Not given	Not given	Not given
pH	7.16	7.01	7.12	7.11	7.06	7.07
H+	71	100	77	77	83	83
PCO2	9.4	10.3	6.8	6.5	7.2	7.7
PO2	2.2	2.3	11.8	11.5	13.9	9.7
Actual Bicarbonate	25	20	17	15	15	17
Base excess blood	-5	-11	-12	-14	-14	-14
Gases O2 Saturation	0.15	0.14	0.95	0.95	0.97	0.92
Sodium blood	142	140	140	139	143	143
Potassium blood	3.2	3.7	3.6	4.2	4.0	4.6
Chloride Blood	102	106	110	112	111	112
Glucose blood	18.0	12.2	10.3	7.9	4.9	2.5
Anion Gap	17	18	17	17	20	20
Calcium (ionised)	1.21	1.13	1.08	1.05	1.07	1.06
Lactate blood	*5.7	*8.0	*7.1	7.1	7.7	6.6
Haemoglobin	112	67	61	101	92	109

- Patient advocate
  - Get all SMO together to make a plan
    - Get them at the bedside in resus
    - If after hours call ED SMO in (hopefully already done)
  - Identify barriers to intervention and try to bridge
- 8. A decision is made to take her to interventional radiology. Discuss preparations and planning for her transfer and on-going care during the procedure?**
- Personnel
    - ICU/Anaesthetics Senior preferable
    - Nurse/s
  - Equipment and drugs, blood products
    - Infusions, pressors, on- going blood products (blood bank to be aware)
    - Airway equipment
  - A plan
  - Consider definitive airway/breathing control prior to transit
  - Ensure disposition plan in place ie. not back to ED

## **Case Two**

*24yo woman is brought into your resuscitation room by an ambulance. She has been found confused on the floor at home. According to family she has been unwell for a few weeks with some weight loss, diarrhoea, and more recently having fevers, and seemingly a bit confused in the last day. Her obs in the ambulance HR 140 sinus, BP 150/90, GCS 12 (M5), BGL 10, Sats 95% o/a, temp 38.*

### **1. What are your differential diagnoses and further history you want?**

- Sepsis- of any potential source
- Malignancy- hematologic possibly secondary infection
- Metabolic cause or endocrine : Diabetes, thyroid, adrenal
- Toxicological
  
- Full history
  - Recent hx of events
  - Travel and contacts
  - Past medical history
  - Social/drugs and alcohol
  - Trauma
  - Medications and allergies
  - Recent medical visits etc

### **2. Shortly after arrival in the ED resus she deteriorates. Discuss your initial investigations and management?**

BP 180/100, HR 180, RR 30, Sats 90% o/a, GCS 10 (M5), BGL 10, 38.9

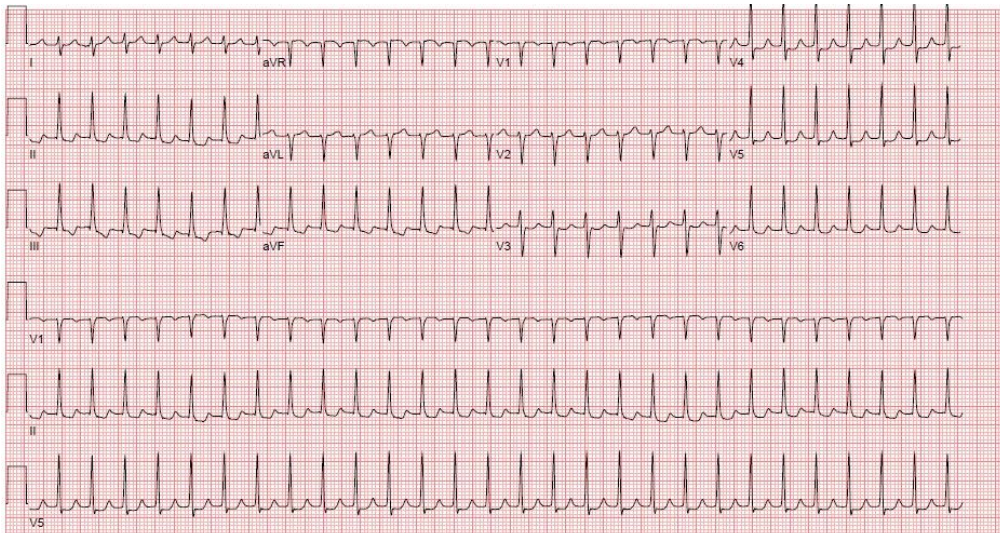
- High flow O<sub>2</sub>
- Emergency call get SMO help
- Empiric antibiotics – CNS cover ceftriaxone/vancomycin (MRSA)
- Consider steroids if concern for CNS pathology
  
- Investigations:
  - ECG ? tachyarrhythmia
  - VBG – pH, HCO<sub>3</sub>, lactate, Na, K
  - Bloods, cultures, TFTs, cortisol
  - IDC and urine
  - CXR
  - Bedside USS: volume status, pump status, lungs ? wet ? consolidation

*A bedside USS is performed showing some LVH, normal LV size, with moderate LV impairment. The IVC is full, and there are symmetrical multiple B lines in both lung fields.*

**3. Below is her VBG, ECG, Please interpret in context of the clinical presentation and the USS findings?**

VBG

pH 7.0  
CO<sub>2</sub> 6  
HCO<sub>3</sub> 14  
Na 140  
K 5  
Gluc 9  
Lactate 6.4  
AG 22



- Metabolic AG lactic acidaemia (note CO<sub>2</sub> – concerning decompensation)
- Narrow complex tachycardia with inferior ST depression ? ischaemic
- USS – wet lungs, euvolaemic or hyper, LVH suggest hypertension

**Putting it together suggestive of high output state with SVT and LV failure/cardiogenic shock and pulmonary edema.**

*Her blood tests are available below:*

*WBC 20 , CRP 80, Cr 100,  
TFT : TSH <0.2, T4 15 (8-22), T3 180  
Cortisol 300 (random)*

**4. What is your likely diagnosis and how are you going to manage this woman?**

- **Hyperthyroid storm with high output cardiac failure**
  - Medical emergency
  - Potential rapid deterioration and CV collapse
  
- Supportive cares
  - Manage airway and oxygenation
  - Urgent intervention to manage catecholamine effects
  - Temperature control
  - Antimicrobials
  - Fluid/volume management
- Aims to manage hyperthyroidism:
  - Block thyroid hormone release (PTU)
  - Block receptor effects of catecholamine surge (beta blockade)
  - Block peripheral conversion T4 to T3 (PTU, Hydrocortisone, propranolol)
  - Block mobilisation of stored hormone in thyroid (lugols iodine)
- Airway and breathing:
  - High flow O2 consider escalation NIV or RSI
  - Risk cardiac decompensation
  - Ideally start tx for hyperthyroidism and control hypertension/svt
- Hydrocortisone 200mg IV stat then regular dosing
  - Often secondary cortisol deficiency
  - Depression of the hypothalamic-pituitary axis commonly occurs in the setting of thyroid storm
  - Helps reduce activation of T4 to T3
- Beta blockade
  - Esmolol best option in this situation short ½ life, titrateable, B1 selective
  - Risk exacerbation failure so best avoid propranolol/metoprolol/labetalol
  - 50-200mcg/kg/min (can load with 50mcg/kg bolus) titrate to reasonable HR and BP
- PTU NG/PO/PR
  - Inhibit thyroid peroxidase, an enzyme involved in the production of T3 and T4 through the iodination of tyrosine residues on thyroglobulin
  - PTU preferred to (carbimazole/methimazole) as reduces T4-T3 conversion
  - Loading dose: 600 to 1000 mg
  - Maintenance dose: 200 to 250 mg q4
  
- Lugols iodine
  - prevent the release of pre-formed thyroid hormone from the thyroid gland
  - 8 drops PO, NG, or PR q6h
  - Should be delayed 1-2hrs post PTU to avoid exacerbation of thyroid hormone synthesis (iodine can be used a substrate by thyroid)



### **Case Three**

R40 55yo man BIBA collapsed at home. GCS 10, BP 80, HR 90. He will be in the department in 5minutes. Her has no knoww past history

#### **1. What is your concern and how are you going to prepare for his arrival?**

- Differential broad
  - Sepsis, cardiac, metabolic, trauma, cns pathology
  - Metabolic and electrolyte
  - Tox – overdose
- Medical emergency call
- Team
- Equipment and drugs preparation
  - IVF, RSI drugs, pressor in pocket, antibiotics, glucose
  - Airway equipment/plan/team

*On arrival in the resus he is disorientated, agitated, he is maintaing his airway currently. BP is 90/60, HR 90 sinus rhythm on the ECG, RR30, GCS 11 (M), Sats 94% o/a*

#### **2. Discuss your initial investigation and mangement?**

- Address life threats
  - IVF resus careful
  - Empiric abs
- VBG and BGL
- CXR
- Beside USS – shock scan

#### **3. Below is his VBG please discuss yor interpretation?**

pH 7.25  
CO2 4  
HCO3 18  
Na 162  
K 6.1  
Gluc 55  
AG 16  
Lactate 2.4

- Normal anion gap mild metabolic acidaemia
  - Severe hypernatraemia, hyperkalaemia, hyperglycaemia
- Corrected Na =  $162 + 55/3 = 180$
- Calculated osmolality =  $2 \text{ Na} + 2 \text{ K} + \text{Glucose} + \text{Urea} + \text{ETOH}$  (all mmol/L).

**HYPEROSMOLAR HYPERGLYCAEMIC STATE**

#### 4. Discuss the clinical and biochemical differences between DKA and HHS?

- Clinical can be cross over and biochemical no absolutes
  - HHS usually in T2DM, can occur in T1DM or mixed picture
  - HHS usually slower onset
  - HHS greater fluid deficit
  - HHS associated higher mortality due to often underlying comorbidity or other precipitating illness

	DKA	HHS
Plasma Glucose	> 13 mmol/L (NOT ALWAYS)	> 33 mmol/L
pH; HCO <sub>3</sub>	pH < 7.3 ; HCO <sub>3</sub> < 15	pH > 7.3 ; HCO <sub>3</sub> > 15
Ketones, Anion Gap	+ve ; Raised AG	Trace or -ve ; Normal AG
Plasma Osmolality	Mild hyperosmolar	Marked hyperosmolar (>320)
Volume deficit	Mild to moderate (3-6 L)	Moderate to severe (8-10 L)
Insulin Tx	Absolutely needed	Very rarely needed (see note about cerebral edema below)

#### 5. How would you manage this patient?

- Goals
  - correct dehydration (often 6-9 L of H<sub>2</sub>O loss)
  - provide insulin
  - replace electrolytes
  - correct metabolic acidosis
- Treat underlying medical issues/ infections
- Resuscitate shock with isotonic fluid then slow replacement of deficit over 48-72 hours
  - H<sub>2</sub>O deficit = 0.6 x premorbid weight x (1 - 140/corrected Na<sup>+</sup>)
- If significant hypernatremia consider using 0.45% saline for deficit replacement after resuscitation (usually safer to stick with N saline)
- Avoid > 0.5-1mmol drop in Na per hour, max 12-15mmol/24hrs
- Slow correction of glucose 2-3mmol per hour with insulin infusion
- Admit to ICU/HDU

## Case Four

22yo Indian man self presents to ED lethargic, dizzy and nauseated. His initial observations are below:

BP 90/50, HR 90, RR 20, GCS 14, BGL 6, Sats 98%, 36.5

On standing to transfer into a bed in the ED he collapses to the ground with a brief LOC. He is placed into a bed and transferred to a resus room. His GCS improves to 14 again, his BP is 60/40, HR 120. He is given 1l IVF without any effect on the BP.

### **1. What are your differential diagnoses and discuss your initial investigations and management?**

- Broad differential: Hypotensive ? volume status
  - Hypovolaemia, sepsis
  - Tox or OD
  - Metabolic cause
  - Medical – cardiac, dysrhythmia
  
- Investigations:
  - ECG
  - VBG
  - BGL
  - Bloods and cultures
  - MSU
  
- Resuscitation
  - IVF on going
  - IV abs empiric
  - Pressor ?
  - Consider steroid

*His ECG shows a sinus rhythm, his BGL is 6, and his exam shows he is mildly dehydrated. He remains hypotensive and tachycardia despite 2 L saline and bolus metaraminol on going. His VBG result is as shown:*

pH 7.2, HCO<sub>3</sub> 20, Na 128, K 5.0, Gluc 6, Lactate 3.1

*He has no other medical history of note, denies any OD. He has had a cough for the last 1/12, lost 2 kg of weight. He recently emigrated from India.*

### **2. What other history might be useful to know?**

- Medication use/drugs
- Fhx
- Tb exposure? or prior Tb

### 3. What do you think may be the diagnosis?

- Resistant shock state
  - Think sepsis always
  - Other medical cause
  - **Adrenal insufficiency**
- Given history concern about TB with adrenal involvement
  - Adrenal destruction
  - Uncommon cause in developed countries
  - Most common cause primary adrenal disease is autoimmune

### 4. What do you need to do for this man?

- Steroids
  - 200mg IV bolus Hydrocortisone
  - Peripheral pressors
  - IVF
- Treat any infection
- Contact precautions ? Tb
  - Consult ID re possible Tb and management
- TFTs