Hyperkalemia

Section 1: Case Summary

Scenario Title:	Hyperkalemia
Keywords:	Hyperkalemia. Goals of care.
Brief Description of Case:	Patient arrives to ED providing history of confusion and weakness. Wife reports this is how he always presents when fighting pneumonia or UTI. Initial ECG is abnormal. Patient is found to have severe acute hyperkalemia requiring calcium, Lasix, glucose and insulin. Patient has AKI with resultant fluid overload and does not tolerate bicarbonate infusion well due to volume status. Patient will either need dialysis or non-invasive positive pressure ventilation but MOST status challenges this.

Goals and Objectives	
Educational Goal:	Develop an approach to management of hyperkalemia.
Objectives: (Medical and CRM)	Initial stabilization of acute hyperkalemia Discussion with patient / family regarding level of intervention for frail elderly patient with acute reversible pathology that requires high level of care.
EPAs Assessed:	

Learners, Setting and Personnel				
Target Learners:	☐ Junior Learners	☒ Senior Learners		☐ Staff
	☐ Physicians	☐ Nurses	☐ RTs	☐ Inter-professional
	☐ Other Learners:			
Location:	☒ Sim Lab	☒ In Situ		☐ Other:
Recommended Number of Facilitators:	Instructors: 1			
	Confederates: 1			
	Sim Techs: 1			

Scenario Development	
Date of Development:	March 2020
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Last Revision Date:	
Revised By:	
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Section 2A: Initial Patient Information

A. Patient Chart					
Patient Name: Anthony Kay			Age: 78	Gender: Male	Weight: 100kg
Presenting complaint: Weakness. Confusion. "another infection"					
Temp: 36C	HR: 55	BP: 135/90	RR: 24	O_2Sat: 91%	FiO_2: room air
Cap glucose: 5.2			GCS: 13 (E3 V4 M6)		
Triage note: Patient brought in with EHS as wife found him confused today and unable to get out of bed due to weakness. Frequent bladder and lung infections. Currently on antibiotics but wife says getting worse.					
Allergies: NKA					
Past Medical History: Parkinsons Disease Hypertension CVA Recent admission for urosepsis			Current Medications: Levodopa/carbidopa Ramipril ASA Septra DS		

Section 2B: Extra Patient Information

A. Further History
Include any relevant history not included in triage note above. What information will only be given to learners if they ask? Who will provide this information (mannequin's voice, confederate, SP, etc.)? Wife / confederate or documented in chart. MOST – M3. No critical care intervention. No CPR. No mechanical ventilation.

B. Physical Exam	
List any pertinent positive and negative findings	
Cardio: 2/6 SEM	Neuro: Confused. No focal deficits.
Resp: Bilateral crackles with decreased air-entry to bases.	Head & Neck: Normal
Abdo: Soft. Obese. Non-tender	MSK/skin: Pitting edema
Other: Foley catheter in place.	

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Section 3: Technical Requirements/Room Vision

A. Patient
☒ Mannequin *(specify type and whether infant/child/adult)*
☐ Standardized Patient
☐ Task Trainer
☐ Hybrid
B. Special Equipment Required
None
C. Required Medications
IVF, Calcium gluconate, Insulin, Dextrose, Lasix, Sodium Bicarbonate, Antibiotics,
D. Moulage
None
E. Monitors at Case Onset
☐ Patient on monitor with vitals displayed ☒ Patient not yet on monitor
F. Patient Reactions and Exam
Include any relevant physical exam findings that require mannequin programming or cues from patient (e.g. – abnormal breath sounds, moaning when RUQ palpated, etc.) May be helpful to frame in ABCDE format. Crackles bilaterally GCS decreased. GC 13 E3V4M6

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Section 4: Confederates and Standardized Patients

Confederate and Standardized Patient Roles and Scripts	
Role	*Description of role, expected behavior, and key moments to intervene/prompt learners. Include any script required (including conveying patient information if patient is unable)*
Wife	Initially provides red herring that patient always presents like this when he has an infection. Later wife will be important in having a discussion about goals of care (dialysis, NIPPV)

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Section 5: Scenario Progression

Scenario States, Modifiers and Triggers				
Patient State/Vitals	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State		Facilitator Notes
1. Baseline State Rhythm: Wide complex Junctional HR: 55 BP: 135/90 RR: 24 O_2SAT: 91% T:36 °C GCS: 13 (E3V4M6)	*Patient is confused, drowsy. Coarse crackles, occasional cough.*	Expected Learner Actions ☐ Identify team leader ☐ Delegate roles ☐ IV, O2, Monitors ☐ STAT ECG ☐ Blood glucose (5.2) ☐ Primary assessment ☐ Call for labwork	Modifiers *Changes to patient condition based on learner action* - If fluid bolus given→ declining O2Sat and inc. crackles Triggers *For progression to next state* -Completion of expected learner actions → **Phase 2**	
2. Initial management / stabilization Rhythm: Wide complex brady HR: 55 BP: 130/90 RR: 24 O_2SAT: 92%NRB T: 37°C GCS: 9 (E2V2M5)	*No visible change to patient status/appearance. Once treatment starts QRS will narrow*	Expected Learner Actions ☐ Identify wide complex bradycardia on ECG *(recent ECG available for comparison)* ☐ Calcium gluconate IV ☐ Insulin R 10units IV ☐ Dextrose 1-2 amps IV ☐ Lasix 40mg IV ☐ Salbutamol nebs ☐ Consult Nephrology	Modifiers Can provide learners with VBG (critical high K) result now if necessary to help progress Triggers -If no calcium given in 10 minutes then → **Phase 3 (arrest)** - Completion of expected learner actions → **Phase 4**	

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3. Optional Phase (only to be used if management plans are poor) Cardiac Arrest PEA rate 50 BP 0/0 RR 0	*Patient loses all vital signs and signs of life.*	Expected Learner Actions ☐ CPR ☐ Consider H'sT's ☐ Push Calcium Chloride IV ☐ Push Sodium Bicarb IV ☐ Dextrose 1amp ☐ Epinephrine PRN per ACLS	Modifiers Triggers -once team has address likely cause of PEA as due to hyperkalemia and initiated empiric tx → **Phase 2 (still will need more tx to stabilize and proceed to phase 4)**	
4. Goals of Care / Disposition Rhythm: Sinus HR: 60 BP: 150/90 RR: 24 O_2SAT: 90% w/ 10L T: 37°C GCS: 9 (E2V2M5)	*Patient still slightly drowsy and with respiratory distress but hemodynamics improved*	Expected Learner Actions ☐ Review Lab results ☐ Review 2nd ECG ☐ Start bicarb infusion (can be at recommendation of Nephro) ☐ Recognize fluid overload and inability to tolerate further IVF (including bicarb infusion) ☐ Discuss starting dialysis and biPAP with Nephro and patient family (MOST M3) ☐ Decide goals of care and thus disposition – dialysis vs palliative	Modifiers -can have family agree to proceed with BIPAP and Dialysis or refuse and transition to palliative approach based on objectives / preference of the facilitator Triggers - Completion of Expected Learner Actions – **END CASE**	

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Appendix A: Laboratory Results

CBC WBC 8.5 Hgb 105 (L) Plt 160 Lytes Na 3.4 K 7.5 (!) Cl 105 (L) HCO_3 24 AGap 5 Creat 206 (H) GFR 26 (L) Glucose 4.2 Extended Lytes Ca - pending Mg - pending PO_4 -pending Albumin - pending TSH - pending VBG pH 7.25 pCO_2 52 pO_2 89 HCO_3 22 Lactate 1.0	Cardiac/Coags Trop - pending INR 1.0 Biliary AST - pending ALT - pending GGT - pending ALP - pending Bili - pending Lipase - pending Tox EtOH - <2 ASA - 0 Tylenol <4

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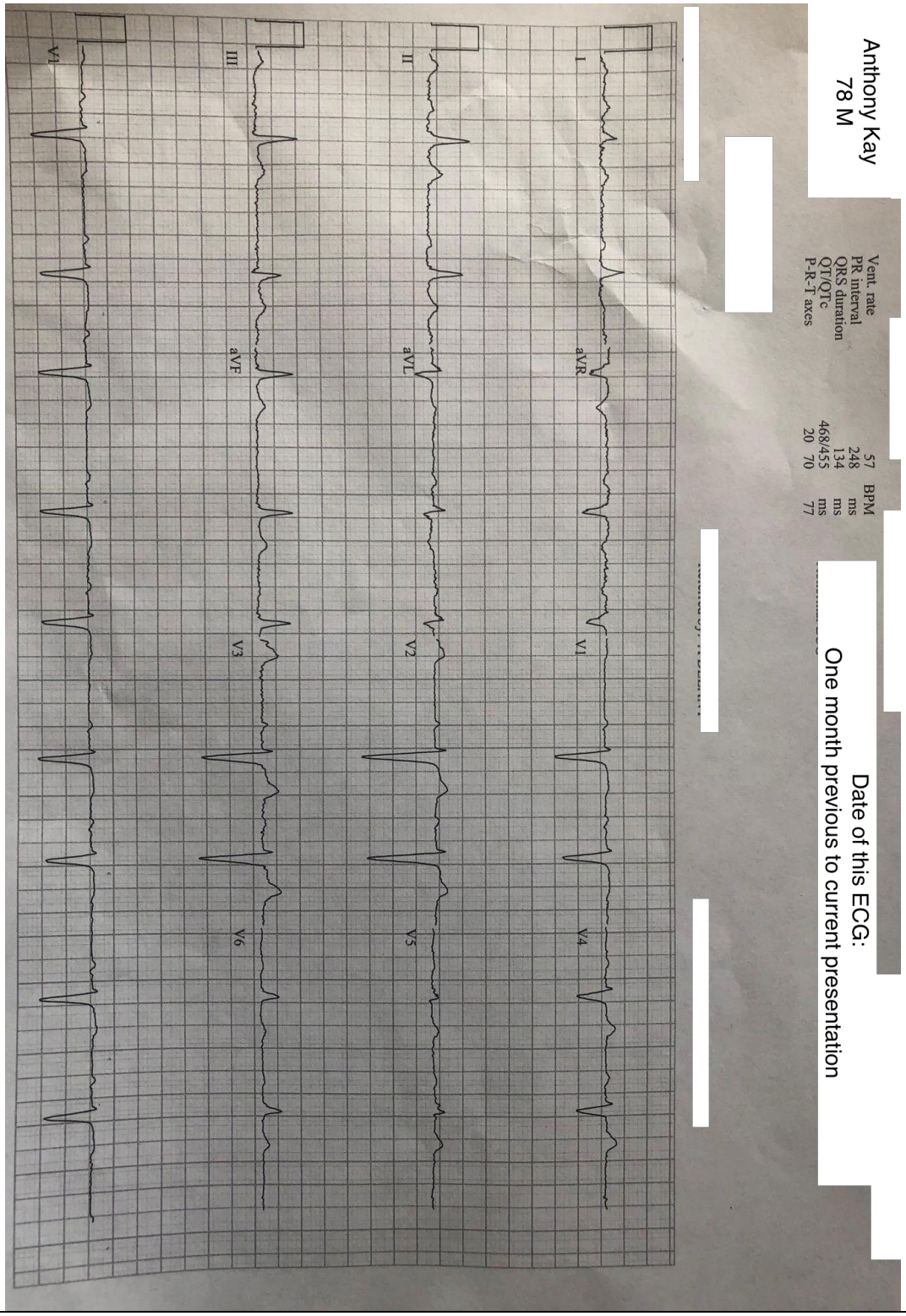
Appendix B: ECGs, X-rays, Ultrasounds and Pictures

Original ECG'S:



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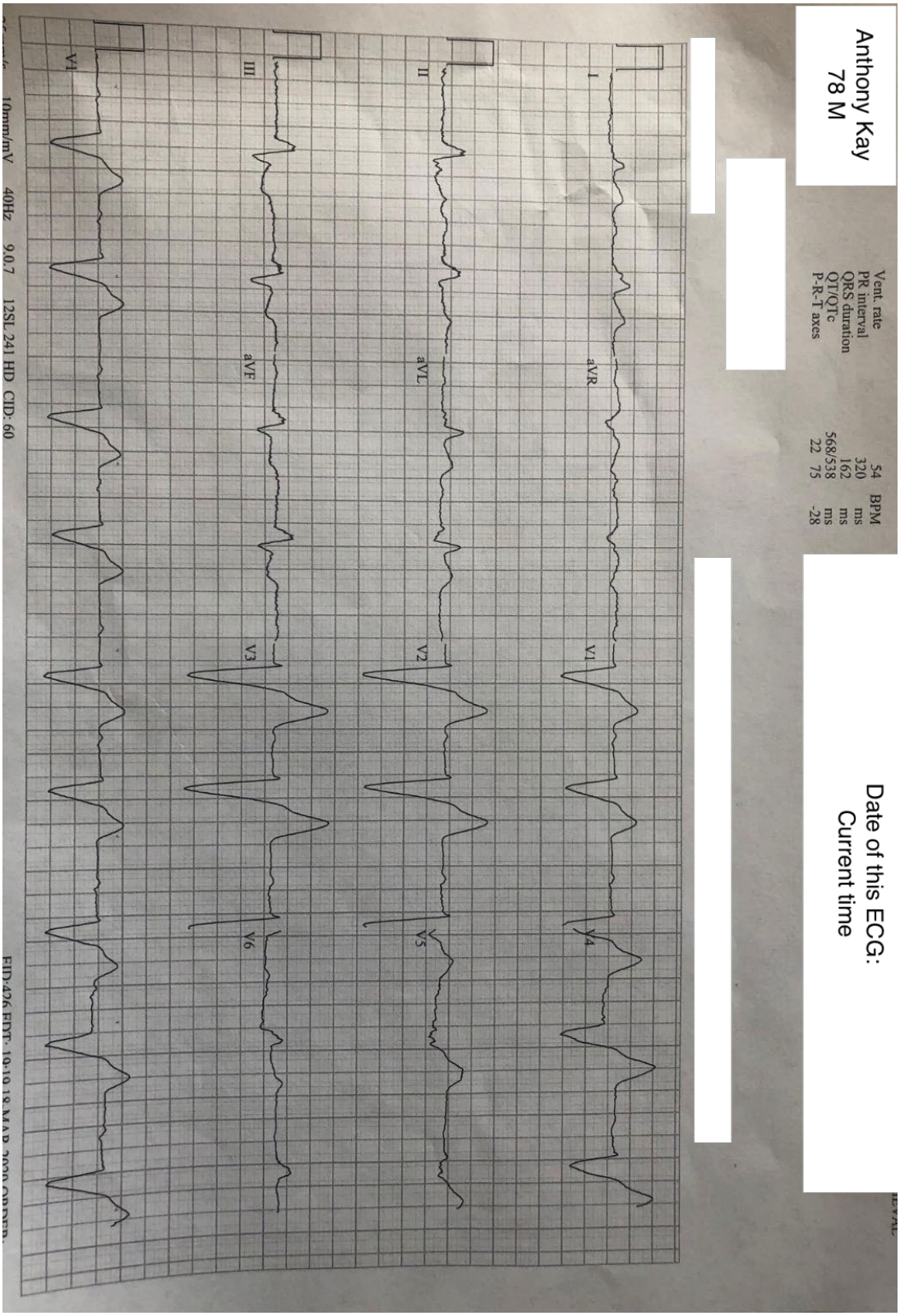

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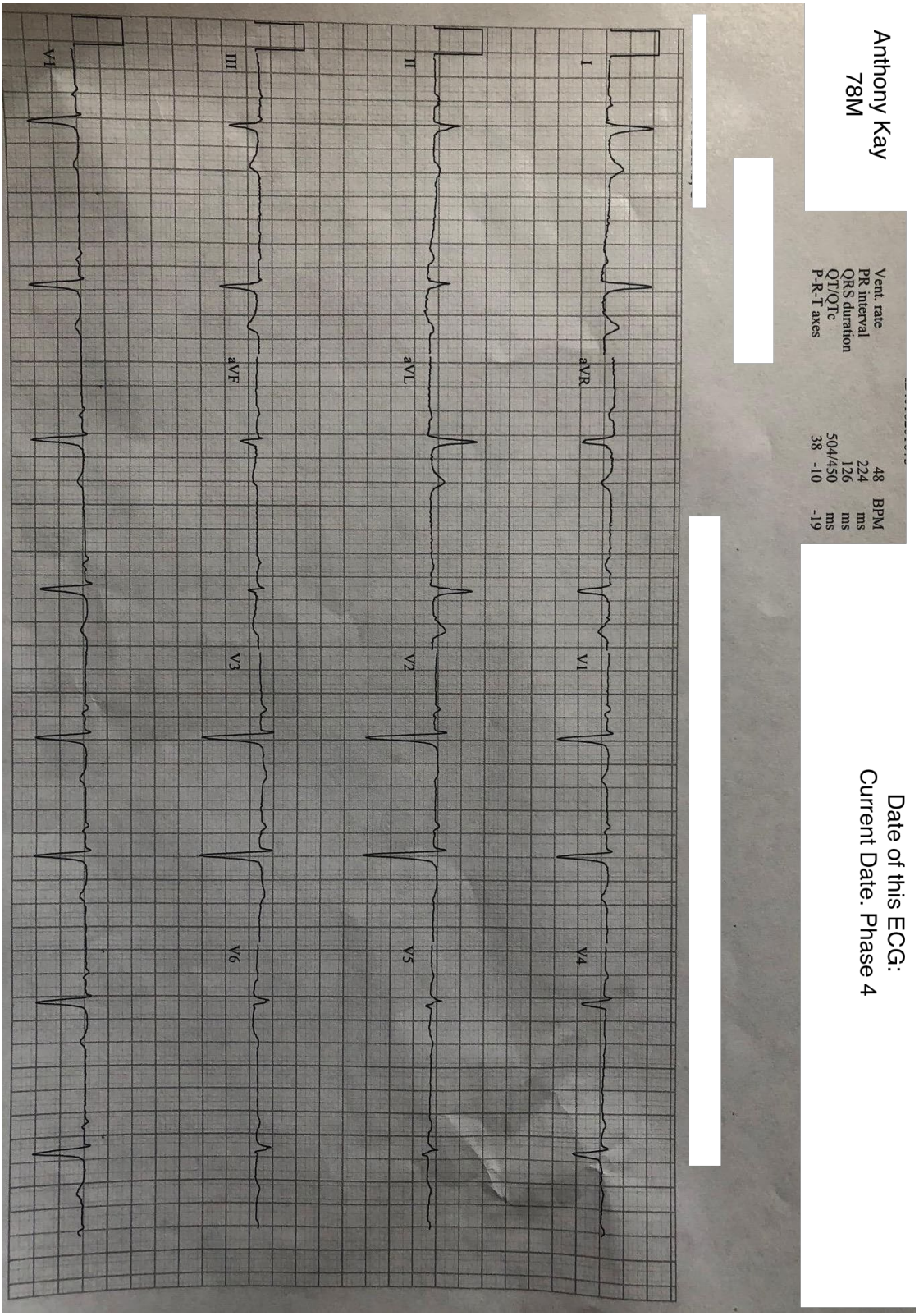

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https://radiopaedia.org/articles/heart-failure-summary

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Appendix C: Facilitator Cheat Sheet & Debriefing Tips

Include key errors to watch for and common challenges with the case. List issues expected to be part of the debriefing discussion. Supplemental information regarding any relevant pathophysiology, guidelines, or management information that may be reviewed during debriefing should be provided for facilitators to have as a reference.

HYPERKALEMIA MANAGEMENT

MEMBRANE STABILSATION

Calcium gluconate or chloride – 10mL IV
-antagonises the membrane excitability of heart
-does not lower serum K+
-can cause: bradycardia, arrhythmias, tissue necrosis if extravasated

SHIFT K+ INTO CELLS

HCO3- infusion – often run as 3 amps of Bicarb in 1L of D10W
-decreases the concentration of H+ in the extracellular fluid compartment -> increases intracellular Na+ via the Na+/H+ exchanger and facilitates K+ shift into cells via the Na+/K+ ATPase

Insulin R -10U IV with 50mL of 50% glucose (2 amps)
-insulin increases uptake by stimulating the Na+/K+ ATPase
-reduces K+ by 0.65-1mmol/L/hr

Salbutamol puffer/nebulisers/IV
-binds to the beta-2-receptor -> stimulated adenylase cyclase converting ATP->cAMP -> stimulation of Na+/K+ ATPase with subsequent increase in intracellular K+

INCREASE K+ ELIMINATION

Lasix - 40mg IV

- theoretically work but no clinical trials to support use in hyperkalaemia

Dialysis
-dependent on stability, availability / resources and response to other treatment.

References

1. Hyperkalemia Management. Lifeinthefastlane. C.Nickson. https://litfl.com/hyperkalaemia-management/

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