Diabetic Ketoacidosis

Section 1: Case Summary

Scenario Title:	Diabetic Ketoacidosis
Keywords:	DKA.
Brief Description of Case:	Steve is a 21 year old man who is brought in by friends feeling unwell. Presents with "possible sepsis" triggered by triage. Declining GCS after triage should prompt intubation. After intubation start managing metabolic and hemodynamics derangements of DKA

Goals and Objectives	
Educational Goal:	Develop an approach to management of DKA
Objectives: (Medical and CRM)	Avoid fixation error of altered mental status / sepsis. Recognition and stabilization of diabetic ketoacidosis Demonstrate clear closed loop communication and shared mental model for airway management and treatment approach to diabetic ketoacidosis.
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: 0			
	Sim Techs: 1			

Scenario Development	
Date of Development:	March 2020
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Section 2A: Initial Patient Information

A. Patient Chart					
Patient Name: Steve Pearce			Age: 21	Gender: Male	Weight: 70kg
Presenting complaint: Abdominal pain, nausea and vomiting					
Temp: 37.7C	HR: 120	BP: 100/60	RR: 32	O_2Sat: 98%	FiO_2: room air
Cap glucose: 32			GCS: 12 (E3 V4 M5)		
Triage note: Steve's roommate at Wickannish Lodge in Tofino called EHS because he was feeling awful. There are other sick contacts in the dorm that he lives in. He has been unwell for 3 days with nausea, vomiting, fevers and abdominal pain.					
Allergies: NKA					
Past Medical History: Healthy			Current Medications: Ritalin		

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.)? None	
B. Physical Exam	
List any pertinent positive and negative findings	
Cardio: Tachycardic. Normal heart sounds	Neuro: Confused. No focal deficits.
Resp: Kussmaul breathing. Clear breath sounds.	Head & Neck: Normal
Abdo: Soft. Tender and groans in pain with palpation	MSK/skin: Normal. No rash.
Other:	

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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, Insulin, Sodium Bicarbonate?, Antibiotics, Vasopressors, Intubation drugs, Sedation drugs,
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. Kussmaul breathing. GCS decreased. GC 12 E3V4M5 Moans with abdominal exam

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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)*
	N/A

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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: Sinus tach HR: 120 BP: 100/60 RR: 32 O_2SAT: 98% T:37.7 °C GCS: 12 (E3V4M5)	*Patient is confused, groaning and tachypnic*	Expected Learner Actions ☐ Identify team leader ☐ Delegate roles ☐ IV, O2, Monitors ☐ Primary assessment ☐ STAT ECG ☐ STAT Blood glucose (glucometer error too high to read) ☐ Call for labwork	Modifiers *Changes to patient condition based on learner action* - Triggers *For progression to next state* -Completion of expected learner actions → **Phase 2**	
2. Initial management Rhythm: Sinus tach HR: 120 BP: 95/55 RR: 32 O_2SAT: 98% T:37.7 °C GCS: 8 (E2V2M4)	*Patient becomes less responsive*	Expected Learner Actions ☐ IVF bolus – pressure bag ☐ Emperic broad spectrum abx ☐ Interpret 1st VBG ☐ Recognize / verbalize potential for DKA ☐ Recognize / verbalize declining GCS and need for intubation ☐ Call for help if not done (ICU?)	Modifiers -Can make patient vomit to complicate airway plan due to risk of aspiration Triggers - Completion of expected learner actions → **Phase 3**	
3. Airway management		Expected Learner Actions ☐ Push-dose pressor available	Modifiers	

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Rhythm: Sinus tach HR: 115 BP: 100/60 RR: 32 (vent setting should match pre-intubation rate) O_2SAT: 98% T:37.7 °C GCS: 3T	*Patient tolerates intubation*	☐ Consider /proceed with awake intubation or RSI ☐ Post-intubation sedation ☐ Norepinephrine infusion ☐ Consider arterial line insertion ☐ Post intubation xray	- Reasonable to allow team to proceed with awake intubation and have patient tolerate this despite low GCS <u>Triggers</u> -completion of expected learner actions → **Phase 4**	
4. DKA Management Rhythm: Sinus HR: 110 BP: 105/70 RR: 32 (vent setting should match pre-intubation rate) O_2SAT: 98% ETCO2 : 50 T:37.7 °C GCS: 3T	*Patient intubated and sedated*	<u>Expected Learner Actions</u> ☐ Interpret 2nd VBG ☐ Optimize IVF choice ☐ Start IV Insulin infusion (0.1unit/kg/hr) ☐ Replace K ☐ Review DKA etiology / differential ☐ Consult ICU +/- Endocrin	<u>Modifiers</u> <u>Triggers</u> -completion of expected learner actions → **Phase 5**	
5. Resolution HR: 100 BP: 110/70 RR: 32 (vent setting should match pre-intubation rate) O_2SAT: 98% GCS: 3T	*Patient intubated and sedated*	<u>Expected Learner Actions</u> ☐ Interpret 3rd VBG ☐ Optimize IVF choice ☐ Continue Insulin infusion ☐ Increase K supplementation ☐ Start dextrose infusion ☐ Review DKA etiology / differential ☐ Consult ICU +/- Endocrin	<u>Triggers</u> -completion of expected learner actions → **END CASE**	

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Appendix A: Laboratory Results

VENOUS BLOOD GAS	TIME : A	TIME : B	TIME : C
pH	7.02 (!)	7.15 (L)	7.25 (L)
PCO2	23 (L)	23 (L)	25(L)
PO2	50	50	55
Bicarbonate calculated	10 (L)	11 (L)	14 (L)
Lactate	3.7 (H)	2.2 (H)	2.0 (H)
Sodium	130 (L)	135	142
Potassium	5.4 (H)	3.9	3.3 (L)
Chloride	106 (L)	110	112
Anion Gap	26 (H)	23 (H)	19 (H)
Glucose	34 (!)	20 (H)	12 (H)

<u>CBC</u>
WBC 16.4 (H)
Hgb 144
Plt 220

<u>Lytes</u>
Na 132 (L)
K 5.4 (H)
Cl 106 (L)
HCO_3 10 (L)
AG 26 (H)
GFR 90
Cr 60
Glucose 33 (H)

<u>Cardiac/Coags</u>
Trop <4
INR 1.0

<u>Biliary</u>
AST 18 (14-20 U/L)
ALT 19 (10 – 55U/L)
GGT 30 (0-50 U/L)
Alk Phos 79 (25-100 U/L)
Bili 10 (2- 20mcm/L)
Albumin 40 (38 -53 g/L)

<u>Tox</u>
EtOH <2
ASA <0.1
Tylenol <4

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

https://litfl.com/sinus-tachycardia-ecg-library/

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https://radiopaedia.org/cases/normal-frontal-chest-x-ray

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https://jetem.org/ettcxr/

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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.

DIABETIC KETOACIDOSIS MANAGEMENT

Goals
(1) establish precipitant and treat
(2) assess severity of metabolic derangement
(3) cautious fluid resuscitation
(4) provision of insulin
(5) replacement of electrolytes

Acid-base and Electrolyte abnormalities

- will have a severe metabolic acidosis with probable incomplete respiratory compensation
- K+ may be normal but patient will have a whole body K+ deficiency -> needs to be replaced once < 5mmol/L
- Na+ may be deranged
- acidemia rarely requires HCO3- therapy and will respond to other treatments

Specific therapy

- start insulin infusion (avoid bolus) 0.1u/kg/hr
- aim to lower glucose by 1-2mmol/L/hr
- once glucose < 15mmol/L -> provide dextrose (5%) 100mL/hr
- monitor AGAP

Underlying cause

- treat infection
- review compliance of insulin use
- ischemia (ACS, CVA, PVD, mesenteric ischaemia)
- pregnancy

References

1. Dominating the acidosis in DKA. https://emcrit.org/pulmcrit/bicarbonate-dka/
2. Diabetic Ketoacidosis. C. Nickson. https://litfl.com/diabetic-ketoacidosis/

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