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## Osteomyelitis, DKA, and ESRD Complication Cases

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## Day 1 (5/2/22)

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### Admission Note

**CC:** "Worsening right foot wound infection"

**HPI:** Daniel Davis is a 62 years old male presenting to ED with ongoing left foot swelling, pain, and redness of the 5th right toe. This has been an ongoing and slowly progressing problem for the past couple months. Initially seen by his PCP last month and prescribed a course of Keflex without improvement. He was seen again about 2 weeks ago and was started on Doxycycline, also without improvement after completing the course. Patient is now presenting with worsening swelling, pain, redness of the same infected sites. Patient denies any recent fever or illness. Patient has limited ambulation due to the wound.

**PMH:** T2DM, ESRD on HD TThSat, hypertension, peripheral arterial disease, anuria, anemia, secondary hyperparathyroidism, hyperphosphatemia

**Medications:**

Aspirin	325 mg po daily
Rosuvastatin	20 mg po daily
Amlodipine	10 mg po daily
Pioglitazone	30 mg po daily
Sevelamer	800 mg po AC TID
Cinacalcet	30 mg po daily
Epoetin alfa	4,000 units SC TIW with HD sessions

**Allergies:** NKDA

**SH:** Former smoker (quit in 2016), lives with wife, work as a mechanic

**PE:**

Vitals: T 37.2 C, P 99, BP 150/89, RR 18, SpO2 96% on RA, Ht 5'9", Wt 182 lb

General: No acute distress, A&Ox3

HEENT: normocephalic, atraumatic, no scleral icterus

Neck: supple, no rigidity, no lymphadenopathy, bruits, or thyromegaly

Lungs: clear to auscultation bilaterally, no crackles or wheezes

CV: RRR, normal S1/S2, no gallops, no jugular venous distention

GI: soft, nontender, normoactive bowel sounds, no rebound, guarding, or masses

GU: no suprapubic or flank tenderness

Extremity: no cyanosis, clubbing. Erythematous and edematous wound on right lower extremity

Neuro: non-focal

**Pertinent Test Results:** Refer to EHR

**Assessment/Plan:**

1. Diabetic Foot Infection/Possible osteomyelitis & r/o DVT: purulent wound with possible bone involvement. Start empiric antibiotics. Obtain cultures and foot imaging.

2. Hyperglycemia: Uncontrolled T2DM and active infection, on oral antidiabetics at home. Start insulin sliding scale per protocol and consistent carbohydrate diet.
  3. ESRD and CKD complications: On intermittent hemodialysis, anuric. Continue home regimen. Consult nephrology for dialysis inpatient plan.
  4. HTN: continue home regimen.
  5. PAD: continue home regimen.
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#### **MRI Foot**

Indication: osteomyelitis

Technique: multiplanar, multi sequential MR images of the left foot without IV contrast

Comparison: None

Findings: there is abnormal marrow signal suggestive of acute osteomyelitis. There is no fracture. The common flexor and extensor tendons appear grossly intact. Dorsal foot soft tissue swelling is seen.

Impression: Presence of bone involvements suggesting osteomyelitis.

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#### **US Vascular Doppler Venous Lower Extremity**

Reason for exam: DVT

History: 62 years male evaluated for DVT

Technique: multiple transverse and longitudinal sonographic images of the left lower extremity deep venous system with gray-scale, color Doppler, and spectral Doppler flow. Compression and augmentation maneuvers were performed.

Findings: The deep venous system were evaluated for normal compressibility, color flow as well as spectral Doppler wave forms. Evaluation demonstrated normal compressibility, color flow as well as spectral Doppler wave forms.

Impression: No evidence of left lower extremity DVT

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#### **Nephrology Consult Note**

62 years old male with ESRD on HD TThSat complicated by anemia and mineral bone disease. Per records, patient was started dialysis treatment 3 months ago, along with initial management for anemia and mineral bone disease. He was initiated on ESA and phosphate binder.

Assessment/Plan:

1. ESRD: Continue intermittent HD while inpatient TThSat
2. Anemia: Hgb stable compared to CBC from 3 months ago. Consult pharmacy for medication management.
3. Secondary hyperparathyroidism: iPTH trends down compared to 3 months ago. Consult pharmacy for medication management.
4. Hyperphosphatemia: Phosphate elevated, stable from 3 months ago. Consult pharmacy for medication management.
5. Diabetic Foot Infection/Possible osteomyelitis: Refer to primary team
6. T2DM: Refer to primary team
7. HTN: Refer to primary team
8. PAD: Refer to primary team

Thank you for the consult request. We will continue to follow patient.

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## Day 2 (5/3/2022)

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### Inpatient Progress Note

#### Impression:

Patient seen today at bedside. Endorse R foot pain with associated with warmness. There were no acute overnight events per RN.

#### Physical Exam:

General: Nontoxic, no acute distress, A&Ox3

HEENT: Normocephalic, atraumatic, no scleral icterus or conjunctival injection

Neck: Supple, no rigidity, no lymphadenopathy

Lungs: Clear to auscultation bilaterally, no crackle or wheezes

CV: RRR, no murmur

GI: soft, nontender, normoactive bowel sounds, no rebound, guarding, or masses

GU: no suprapubic or flank tenderness

Ext: RLE erythematous and warm to touch

Skin: RLE warm to touch, R 5th toe ulceration

Neuro: no gross motor deficits, moves all extremities

#### Plan:

1. Osteomyelitis: MRI show evidence of osteomyelitis. Continue with empiric therapy. Follow up on cultures.

2. Hyperglycemia/T2DM: Continue insulin sliding scale per protocol

3. ERSD & CKD complications: HD today. Continue medication management per nephrology team

4. HTN: continue home regimen

5. PAD: continue home regimen

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## Day 3 (5/4/2022)

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### Inpatient Progress Note

#### Impression:

Patient reported pain improvement on the infected foot. Late afternoon yesterday, patient developed DKA and was initiated on insulin drip protocol. Blood sugar is better this morning and patient continues carbohydrate consistent diet without issue.

#### Physical Exam:

General: Nontoxic, no acute distress, A&Ox3

HEENT: Normocephalic, atraumatic, no scleral icterus or conjunctival injection

Neck: Supple, no rigidity, no lymphadenopathy

Lungs: Clear to auscultation bilaterally, no crackle or wheezes

CV: RRR, no murmur

GI: soft, nontender, normoactive bowel sounds, no rebound, guarding, or masses

GU: no suprapubic or flank tenderness

Ext: RLE erythematous and warm to touch

Skin: RLE warm to touch, R 5th toe ulceration

Neuro: no gross motor deficits, moves all extremities

#### Plan:

1. Osteomyelitis: Continue with empiric therapy. Follow up on cultures.
  2. DKA/T2DM: Consult pharmacy to transition to SC basal bolus insulin
  3. ESRD & CKD complications: Completed 1 HD session yesterday and plan for another session tomorrow. Continue management per nephrology team
  4. HTN: continue home regimen
  5. PAD: continue home regimen
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### Summary of Labs/Vitals/Cultures/Glucose/Inpatient Medications:

Actual BW: 82.7 kg

IBW: 70.7 kg (BMI 26.9)

### Labs:

	3 months prior	Day 1	Day 2	Day 3
<b>CBC</b>				
WBC (cell/ml)	7,000	18,900	15,200	11,800
Hgb (g/dl)	8.3	8.8	9.1	8.7
Hct (%)	24.8	25.2	28.4	26
Plt	234,000	189,000	245,000	202,000
RBC (mL)	5.1	5.2	5.4	4.9
MCV (fL/cell)	77	78	81	75
MCHC (%)	26	29	32	28
MCH (pg/cell)	25	26	27	29
<b>BMP</b>				
Na (mEq/l)	137	138	134	135
K (mEq/l)	5.1	4.8	5	4.4
Cl (mEq/l)	102	99	100	103
CO2 (mEq/l)	22	22	14	20
Glu (mg/dl)	124	186	215	122
BUN (mg/dl)	87	78	85	64
SCr (mg/dl)	7.8	5.5	6.1	4.2
Tbili (mg/dl)	0.4	0.5		
ALT (IU/l)	21	19		
AST (IU/l)	20	15		
Alkphos (IU/l)	102	94		
Ca (mg/dl)	6.7	7.2	7.1	7.4
Mg (mg/dl)	2.8	2.3	1.8	2.1
P (mg/dl)	8.6	6.9	7.8	6.2
Alb (g/dl)	2.6	2.8	2.5	2.8
iPTH (pg/ml)	827	636		
Serum iron (mcg/dl)	28	26		
TSAT (%)	18	19		
Ferritin (ng/dl)	198	205		
A1C (%)		7.8		
CRP (mg/dl)		5.4		
ESR (mm/hr)		68		
Vancomycin level (mcg/ml)			18 (AM lab – pre-HD)	
<b>ABG (at DKA onset)</b>				
PaO2 (mmHg)			80	
PaCO2 (mmHg)			44	

pH			7.17	
HCO3 (mEq/l)			12	
<b>Urinalysis (at DKA onset)</b>				
Color			Yellow	
Clarity/turbidity			Clear	
pH			6.5	
Specific gravity			1.019	
Glucose (mg/dl)			>1000	
Ketones			Large	
Nitrites			Negative	
Leukocyte esterase			Negative	
Bacteria			None	
Yeast			None	

### Microbiology

All obtained on admission	<b>Day 1</b>	<b>Day 3</b>
Blood culture 1	Pending	negative
Blood culture 2	Pending	<i>S. epidermidis</i> (pan sensitive)
R foot wound culture	Pending	<i>E. coli</i>

#### ***E. coli* sensitivity (Day 3)**

Ampicillin & Sulbactam/S (<1)

Cefazolin/S (<4)

Cefepime/S (1)

Ceftazidime/S (1)

Ceftriaxone/S (1)

Ciprofloxacin/S (<0.25)

Ertapenem/S (<0.5)

Gentamicin/S (<1)

Piperacillin & Tazobactam/S (<2)

### Vitals

DATE	TEMPERATURE	PULSE	RESPIRATION	BLOOD PRESSURE	PULSE OXIMETRY
05/04/2022 12:20	36.8 C	61	14	179/88	98 %
05/04/2022 06:00	37.3	56	17	168/86	100 %
05/03/2022 22:40	36.8 C	65	17	165/87	100 %
05/03/2022 18:24	37 C	58	17	169/84	100 %
05/03/2022 12:45	36.9 C	63	16	178/92	98 %
05/03/2022 08:12	37.1 C	55	12	176/85	100 %
05/02/2022 22:08	37.5 C	61	12	175/82	100 %
05/02/2022 19:30	36.9 C	59	14	168/89	98 %
05/02/2022 13:15	37.2 C	62	15	170/87	99 %

### Student Instructions

1. Please provide complete SOAP for the main problems with specific instructions as follows.
  - Osteomyelitis: complete plan on antibiotic therapy based on most updated lab results and comprehensive inpatient care pertinent to the problem
  - DKA/T2DM: complete plan for transitioning IV to SC basal bolus insulin and outpatient diabetes management (other comorbidities plans to be addressed under secondary problems)
  - ESRD & CKD complications (anemia & mineral bone disease): address current regimens for CKD complications and provide interventions, if applicable
2. Please provide assessment and plan on secondary problems
3. Please review patient's course of hospitalization (including appropriateness of medications initiated, monitoring during hospitalization, or any necessary follow-ups) to assist in responding to the OOB questions

### Discussion Questions

1. (a) Was the choice of the empiric therapy (vancomycin and piperacillin/tazobactam) started on admission appropriate? Why or why not?  
  
(b) Are the dosing for empiric therapy appropriate?
2. (a) What vancomycin monitoring strategy would you recommend for this patient for the initial empiric therapy? Why?  
(b) Was the patient monitored appropriately for the vancomycin regimen and why or why not?
3. (a) What would be your anticipated post-HD level with the vancomycin level obtained? Consider how much vancomycin will be dialyzed, assuming HD is high-flux.  
  
(b) What would be your recommendation in terms of vancomycin therapeutic goal, dosing, and further monitoring based on the resulted vancomycin level?
4. (a) What is the difference between traditional and extended infusion for piperacillin/tazobactam? What is the benefit of extended infusion?  
(b) What is the difference between time-dependent vs. concentration-dependent antibiotics? List at least 2 examples each.
5. Based on patient's DKA treatment, what was missing from the regimen during the whole time insulin is infusing? What would have been your recommendation at any point (provide rationales)?
6. (a) What specifically do you need to monitor while patient with DKA is on insulin infusion? Why? How often do you need to monitor these parameters?  
  
(b) When can continuous IV insulin for DKA be transitioned to subcutaneous insulin? What are the specific criteria? Can this patient be switched to SC insulin at this time?
7. (a) Do you agree with the initiation of ESA therapy 3 months ago? Why or why not?

(b) Do you agree with the initial ESA dose?

(c) If your hospital only carry darbepoetin alfa but not epoetin alfa, what would be your ESA therapy recommendation during inpatient stay (provide your rationale)?

8. What factors should be considered when initiating or making adjustment to ESA therapy and how are these factors help determining ESA dose? (HINT: what are benefits and risks of ESA therapy? How is it dosed?)

9. (a) What is your assessment for hypertension and what therapeutic recommendations do you have (provide rationales)?

(b) List antihypertensive agents that will be contraindicated or not good options for this patient and why?

10. (a) What is Daniel's ASCVD risk (low or high? - provide rationales)? Is he indicated for primary prevention of ASCVD?

(b) Do you have any recommendations on patient's management/prevention of ASCVD (provide rationales)?