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Toohey, Shannon

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Emergencies in Hemodialysis Patients

Shannon Toohey, MD*

*University of California, Irvine, Department of Emergency Medicine, Orange, CA

Correspondence should be addressed Shannon Toohey, MD at stoohey@uci.edu

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ABSTRACT:

Audience: This classic team-based learning (cTBL) session is appropriate for medical students or emergency medicine residents.

Introduction: Over 380,000 patients have renal failure in the United States and 90% of these patients are managed on hemodialysis. Hemodialysis patients have high rates of morbidity and mortality. Understanding the management of emergencies unique to these patients is essential for any emergency physician.

Objectives: By the end of this session, the learner will: 1) describe primary dialysis complications; 2) construct a full differential for a dialysis patient presenting with complications; 3) formulate an appropriate treatment and resuscitation in an acutely ill dialysis patient; 4) plan appropriate disposition and utilization of consultants for dialysis complications.

Methods: The format of this educational session is cTBL.

Topics: Hemodialysis emergencies, team-based learning, TBL, dialysis, end-stage renal disease (ESRD), renal disease.





USER GUIDE

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Learner Audience:

Medical Students, interns, junior residents, senior residents.

Time Required for Implementation:

Instructor preparation: 20-60 minutes

Learner responsible content: 30 minutes

In class time: 45-60 minutes

Recommended Number of Learners per Instructor:

15-50

Topics:

Hemodialysis emergencies, TBL, team-based learning, dialysis, ESRD, renal disease.

Objectives:

By the end of this session learners will be able to:

1. Describe primary dialysis complications.
2. Construct a full differential for a dialysis patient presenting with complications.
3. Formulate an appropriate treatment and resuscitation in an acutely ill dialysis patient.
4. Plan appropriate disposition and utilization of consultants for dialysis complications

Linked objectives and methods:

Learner Responsible Content: Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisondi MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011. This provides an overview of dialysis complications, after which learners should be able to describe primary dialysis complications (objective 1).

iRAT 10-question quiz (10 min): The iRAT tests learners' knowledge of primary dialysis complications (objective 1), as well as their ability to consider a differential diagnosis in a

hemodialysis patient (objective 2) and select appropriate treatments in these patients (objective 3).

gRAT 10-question quiz (10 min): The gRAT allows groups to review correct answers for the questions covering hemodialysis complications, differential diagnosis and treatment (objective 3).

Brief discussion of answers (10 min): This allows the large group to discuss any questions about the iRAT and gRAT with the instructor and clarify any confusing points.

Group Application Exercises (15 min): Groups work through cases on patients presenting with dialysis complications. This allows the groups to apply their knowledge on hemodialysis complications. They discuss differentials, possible treatments, as well as appropriate disposition and utilization of consultants (objective 4).

Recommended pre-reading for instructor:

- Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisondi MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011.
- Himmelfarb J. Hemodialysis complications. *Am J Kidney Dis*. 2005;45(6):1122-1131.
- Padberg FT, Calligaro KD, Sidawy AN. Complications of arteriovenous hemodialysis access: recognition and management. *J Vasc Surg*. 2008;48(5 Suppl):55S-80S. doi: 10.1016/j.jvs.2008.08.067

Learner responsible content (LRC):

- Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisondi MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011.

Results and tips for successful implementation:

- If your learners do not have access to this content it can also be completed as mTBL without pre-class reading.
- The instructor should randomly assign groups instead of allowing learners to self-select groups.
- If multiple instructors are available, they should sit with the group to keep the group on topic and suggest new problems or considerations to allow further group discussion. The instructors should not take over the session into a question and answer (Q&A) format.



USER GUIDE

Prepare:

1. Read and instruct learners to read Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisondi MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011.
1. Print one copy of iRAT for each learner
2. Print one copy of gRAT for each team (4-5 learners per team is ideal)
3. Print one copy of GAE exercise for each team (4-5 learners per team is ideal)
4. Print one copy of GAE exercise answers for each instructor
5. Prepare the gRATs by making it an IF/AT (immediate feedback/assessment technique). You will need to buy scratch off stickers (http://www.amazon.com/Silver-rectangle-Scratch-Label-Stickers~dp/B00TO3WPY8?ie=UTF8&keywords=scratch%20off%20stickers&qid=1465429950&ref_=sr_1_4&sr=8-4) to prepare a gRAT-IF/AT for each group. Cut the stickers down to appropriate size and place the scratch off stickers over the letter choices on the gRAT. During the exercise, groups will scratch off their answer choice and get immediate feedback as to whether they got the right answer.

Content:

- iRAT
- gRAT
- GAE
- RAT Key
- GAE Key

References/suggestions for further reading:

2. Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisondi MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011.
3. Himmelfarb J: Hemodialysis complications. *Am J Kidney Dis*. 45:1122-1131 2005; PMID: 15957144
4. Padberg FT, Calligaro KD, Sidawy AN. Complications of arteriovenous hemodialysis access: recognition and management. *J Vasc Surg*. 2008;48(5 Suppl):55S-80S. doi: 10.1016/j.jvs.2008.08.067



LEARNER MATERIALS

Learner Responsible Content (LRC)

Chng Y-M, Gilbert GH. Dialysis-related emergencies. In: Adams JG, Barton ED, Collings JL, DeBlieux PM, Gisoni MA, Nadel ES, eds. *Emergency Medicine: Clinical Essentials*. 2nd ed. Philadelphia, PA: Elsevier; 2013:1003-1011.



Emergencies in Hemodialysis Patients Individual Readiness Assessment Test (iRAT)

- 1) A dialysis patient presents with altered mental status and fever. What is the most likely source of infection?
 - a) Pneumonia
 - b) Urinary tract infection
 - c) Meningitis
 - d) Vascular access infection

- 2) A dialysis patient presents with shortness of breath, hypertension, and peripheral edema. On history he reports he missed his last two dialysis sessions. Which of the following is the most appropriate definitive treatment?
 - a) Labetolol
 - b) Nitroglycerin
 - c) Hydralazine
 - d) Dialysis
 - e) Antibiotics

- 3) A dialysis patient starts having shortness of breath and hypotension during his first dialysis session at a new dialysis center. Vitals are BP 85/49, HR 123, T 37.4°C, RR 20, 95% on room air (RA). On exam, he has urticaria and wheezing. Which of the following is the most likely cause?
 - a) Sepsis
 - b) Anaphylactoid reaction
 - c) Excessive removal of fluid during dialysis
 - d) Flash pulmonary edema

- 4) Which of the following should be covered for infections related to hemodialysis?
 - a) Gram positives
 - b) Gram negatives
 - c) Anaerobes
 - d) Gram positives and gram negatives



LEARNER MATERIALS

- 5) A patient presents to the emergency department after a failed dialysis session, she was told that the pressures on the machine were too high and they were unable to complete dialysis. On exam, there is no palpable thrill or bruit over the patient's fistula. Which of the following is the next best step in management?
- a) Consultation with vascular surgery for thrombectomy
 - b) Consultation with vascular surgery for surgical revision
 - c) Administration of alteplase
 - d) Any of the above
- 6) A renal failure patient on dialysis presents five hours after his dialysis session with rapid bleeding from his fistula site. On exam, there is pulsatile, bright red, rapid bleeding from the site. If pressure alone is inadequate to stop the bleeding, desmopressin (DDAVP): 0.3mcg/kg with 50ml saline over three minutes can be given. Why does this decrease bleeding in dialysis patients?
- a) It reverses the heparin used during dialysis
 - b) It increases platelet production
 - c) It improves platelet function
 - d) It increases production of fibrinogen
- 7) Which of the following is the most common complication of peritoneal dialysis?
- a) Catheter dislodgement
 - b) Hernia
 - c) Bowel obstruction
 - d) Peritonitis
- 8) For patients with suspected peritoneal dialysis related peritonitis, the antibiotics should be administered:
- a) Orally
 - b) Intravenously
 - c) Intraperitoneally
 - d) Intramuscularly



LEARNER MATERIALS

9) A 56yo M presents with retrosternal chest pressure and shortness of breath. He has a history of ESRD on dialysis, hypertension and diabetes. Which of the following is the most appropriate next step in work-up?

- a) Chest X-ray, electrocardiogram, troponin
- b) Computed tomography (CT) angiogram
- c) Arterial blood gas
- d) Pericardiocentesis

10) What is the first step in controlling bleeding from a dialysis puncture site?

- a) Applying occlusive direct pressure
- b) Applying firm but nonocclusive direct pressure
- c) Administration of DDAVP
- d) Application of a tourniquet



Emergencies in Hemodialysis Patients Group Readiness Assessment Test (gRAT)

The subsequent gRAT is intended to be an IF/AT. Ideally, you will purchase “scratch off stickers” (available at amazon.com) and place the stickers over the index letters as shown below (1st photo is the gRAT to be given to the learning team and the 2nd photo is the completed gRAT. If you do not want to create an IF/AT form, you can use the iRAT instead for your gRAT

1) A dialysis patient presents with altered mental status and fever. What is the most likely source of infection?

- pneumonia
- urinary tract infection
- meningitis
- vascular access infection

2) A dialysis patient presents with shortness of breath, hypertension, and peripheral edema. On history he reports he missed his last two dialysis sessions. Which of the following is the most appropriate definitive treatment?

- Labetolol
- Nitroglycerin
- Hydralazine
- Dialysis
- Antibiotics

3) A dialysis patient starts having shortness of breath and hypotension during his first dialysis session at a new dialysis center. Vitals are BP 85/49, HR 123, T 37.4, RR 20, 95% on RA. On exam, he has urticaria and wheezing. Which of the following is the most likely cause?

- Sepsis
- Anaphylactoid reaction
- Excessive removal of fluid during dialysis
- Flash pulmonary edema

4) Which of the following should be covered for infections related to hemodialysis?

- Gram positives
- Gram negatives
- Anaerobes
- Gram positives and Gram negatives

5) A patient presents to the emergency department after a failed dialysis session, she was told that the pressures on the machine were too high and they were unable to complete dialysis. On exam, there is no palpable thrill or bruit over the patient's fistula. Which of the following is the next best step in management?

- Consultation with vascular surgery for thrombectomy
- Consultation with vascular surgery for surgical revision
- Administration of alteplase
- Any of the above

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- Consultation with vascular surgery for surgical revision
- Administration of alteplase
- Any of the above



Emergencies in Hemodialysis Patients Group Readiness Assessment Test (gRAT)

- 1) A dialysis patient presents with altered mental status and fever. What is the most likely source of infection?
- a) Pneumonia
 - b) Urinary tract infection
 - c) Meningitis
 - ★ Vascular access infection
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- a) Labetolol
 - b) Nitroglycerin
 - c) Hydralazine
 - ★ Dialysis
 - e) Antibiotics
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 - b) Gram negatives
 - c) Anaerobes
 - ★ Gram positives and gram negatives



LEARNER MATERIALS

- 5) A patient presents to the emergency department after a failed dialysis session, she was told that the pressures on the machine were too high and they were unable to complete dialysis. On exam, there is no palpable thrill or bruit over the patient's fistula. Which of the following is the next best step in management?
- a) Consultation with vascular surgery for thrombectomy
 - b) Consultation with vascular surgery for surgical revision
 - c) Administration of alteplase
 - ★ Any of the above
- 6) A renal failure patient on dialysis presents 5 hours after his dialysis session with rapid bleeding from his fistula site. On exam, there is pulsatile, bright red, rapid bleeding from the site. If pressure alone is inadequate to stop the bleeding, DDAVP 0.3mcg/kg with ml saline over three minutes can be given. Why does this decrease bleeding in dialysis patients?
- a) It reverses the heparin used during dialysis
 - b) It increases platelet production
 - ★ It improves platelet function
 - d) It increases production of fibrinogen
- 7) Which of the following is the most common complication of peritoneal dialysis?
- a) Catheter dislodgement
 - b) Hernia
 - c) Bowel obstruction
 - ★ Peritonitis
- 8) For patients with suspected peritoneal dialysis related peritonitis, the antibiotics should be administered:
- a) Orally
 - b) Intravenously
 - ★ Intraperitoneally
 - d) Intramuscularly



LEARNER MATERIALS

9) A 56yo M presents with retrosternal chest pressure and shortness of breath. He has a history of ESRD on dialysis, hypertension and diabetes. Which of the following is the most appropriate next step in work-up?

- ★ Chest X-ray, electrocardiogram, troponin
- b) CT angiogram
- c) Arterial blood gas
- d) Pericardiocentesis

10) What is the first step in controlling bleeding from a dialysis puncture site?

- a) Applying occlusive direct pressure
- ★ Applying firm but nonocclusive direct pressure
- c) Administration of DDAVP
- d) Application of a tourniquet



Emergencies in Hemodialysis Patients Group Application Exercise (GAE)

Case 1: 23-year-old female presents with headache and hypertension. She has a history of severe hypertension and end-stage renal disease on dialysis. She missed her last dialysis and has been not compliant with her blood pressure medications. On arrival her blood pressure is 261/156 mmHg. She is neurologically intact but has photophobia. On exam, there is no peripheral edema and lungs sound clear.

1. What diagnostic tests are necessary?
2. What drugs should be used to decrease the blood pressure?
3. What should your initial goal blood pressure be?
4. Do you think the patient is volume overloaded and dialysis will help with treatment? Why or why not?
5. What level of care will the patient require?

Case 2: 48-year-old male brought in by ambulance from dialysis center with shortness of breath.

The patient was receiving his first session of dialysis for end-stage renal disease secondary to poorly controlled diabetes. The patient was about 30 minutes into dialysis when he became suddenly short of breath. He was hypoxic to the 80s in the field, which improved with oxygen. He also had a few episodes of coughing up pink, frothy sputum.

On exam patient is awake and alert but is tripodding with significant respiratory effort. His trachea midline without no stridor. He is tachycardic and has very coarse breath sounds with decreased air movement bilaterally.

1. How concerning is the patient's respiratory distress?
2. What is the most likely diagnosis?
3. What drug will improve symptoms most rapidly?
4. What are the first steps in treating that distress? If your first steps fail, what would subsequent steps be?
5. If intubation is required, what about this case might make the procedure difficult?
6. What secondary airway equipment would you like at bedside?



LEARNER MATERIALS

Case 3: 62-year-old male presents with fever and chills at home. On arrival his vitals include T 39.2°C, HR 130, BP 65/42, RR 18, oxygen saturation 98% on RA. On exam he looks ill, but has no evidence of cellulitis, lungs are clear, abdomen is benign and fistula has a bruit without signs of infection. Chest X-ray is clear, urinalysis is negative.

1. What is the most likely etiology of infection?
2. Should the patient receive antibiotics? Which ones?
3. Should the patient receive IV fluids?
4. After IV fluids patient starts having shortness of breath and has bilateral crackles on exam, oxygenation drops to the 80s. Repeat chest X-ray is consistent with volume overload, however his blood pressure is still 80s/50s. What is the next best step? Should you continue giving fluids?
5. What is the likely disposition and level of care for this patient?



Emergencies in Hemodialysis Patients RAT Key

1) A dialysis patient presents with altered mental status and fever. What is the most likely source of infection?

- a) Pneumonia
- b) Urinary tract infection
- c) Meningitis
- d) Vascular access infection

d) Vascular access infection

Vascular access is the most common source of bacteremia in dialysis patients, accounting for 48-73% of infected hemodialysis patients.

2) A dialysis patient presents with shortness of breath, hypertension, and peripheral edema. On history he reports he missed his last two dialysis sessions. Which of the following is the most appropriate definitive treatment?

- a) Labetolol
- b) Nitroglycerin
- c) Hydralazine
- d) Dialysis
- e) Antibiotics

d) Dialysis

In a patient who has missed dialysis, these symptoms are consistent with volume overload, which can cause edema, pulmonary edema, chest pain, shortness of breath, and significant hypertension. While anti-hypertensive medications can cause temporary improvement in hypertension or shortness of breath, the definitive management is dialysis to resolve the volume overload.



INSTRUCTOR MATERIALS

3) A dialysis patient starts having shortness of breath and hypotension during his first dialysis session at a new dialysis center. Vitals are BP 85/49, HR 123, T 37.4, RR 20, 95% on RA. On exam, he has urticaria and wheezing. Which of the following is the most likely cause?

- a) Sepsis
- b) Anaphylactoid reaction
- c) Excessive removal of fluid during dialysis
- d) Flash pulmonary edema

b) Anaphylactoid reaction.

Patients undergoing their first dialysis session or changing to a new dialyzer may experience anaphylaxis or anaphylactoid reactions. Treatment is the same as any patient with anaphylaxis or anaphylactoid reactions: epinephrine, antihistamines and steroids.

While sepsis is always a consideration in dialysis patients, the urticaria is less consistent with infectious etiology. Excess removal of fluids is also a consideration in a dialysis patient presenting with hypotension, however again, the allergic symptoms are less consistent. Flash pulmonary edema may present with shortness of breath and wheezing but less likely to present with urticaria.

4) Which of the following should be covered for infections related to hemodialysis?

- a) Gram positives
- b) Gram negatives
- c) Anaerobes
- d) Gram positives and gram negatives

d) Gram positive and Gram negatives

Infections related to hemodialysis can be either gram-positive, including MRSA (up to 2/3 of cases), enterococcus or gram-negative rods.



INSTRUCTOR MATERIALS

5) A patient presents to the emergency department after a failed dialysis session, she was told that the pressures on the machine were too high and they were unable to complete dialysis. On exam, there is no palpable thrill or bruit over the patient's fistula. Which of the following is the next best step in management?

- a) Consultation with vascular surgery for thrombectomy
- b) Consultation with vascular surgery for surgical revision
- c) Administration of alteplase
- d) Any of the above

d) Any of the above

Inability to dialyze, elevated pressures during dialysis, or loss of palpable thrill or bruit are suggestive of graft or fistula thrombosis. Success of treatment decreases with time and a vascular surgeon should be consulted immediately. Thrombectomy, surgical revision or administration of alteplase can all be used to treat thrombosed grafts.

6) A renal failure patient on dialysis presents 5 hours after his dialysis session with rapid bleeding from his fistula site. On exam, there is pulsatile, bright red, rapid bleeding from the site. If pressure alone is inadequate to stop the bleeding, DDAVP (0.3mcg/kg with 50ML saline over 3 minutes) can be given. Why does this decrease bleeding in dialysis patients?

- a) It reverses the heparin used during dialysis
- b) It increases platelet production
- c) It improves platelet function
- d) It increases production of fibrinogen

c) It improves platelet function

Bleeding from dialysis puncture sites or around tunneled catheters can occur hours after hemodialysis is complete. Patients are more prone to bleeding due to anticoagulation during dialysis, and platelet dysfunction secondary to uremia, this is only partially corrected with dialysis. DDAVP improves hemostatic function of platelets.



INSTRUCTOR MATERIALS

7) Which of the following is the most common complication of peritoneal dialysis?

- a) Catheter dislodgement
- b) Hernia
- c) Bowel obstruction
- d) Peritonitis

d) Peritonitis

The most common and life-threatening complication is peritonitis, which causes the dialysis effluent to be turbid and cloudier than usual. Patients are typically afebrile and otherwise well appearing. They do not have a rigid abdomen, findings on physical exam are usually unimpressive.

8) For patients with suspected peritoneal dialysis related peritonitis, the antibiotics should be administered:

- a) Orally
- b) Intravenously
- c) Intraperitoneally
- d) Intramuscularly

c) Intraperitoneally

Intermittent or continuous antibiotic therapy can be used with continuous ambulatory peritoneal dialysis, it is infused directly into the dialysate. Dosing varies depending on intermittent or continuous therapy.



INSTRUCTOR MATERIALS

9) A 56-year-old male presents with retrosternal chest pressure and shortness of breath. He has a history of ESRD on dialysis, hypertension and diabetes. Which of the following is the most appropriate next step in work-up?

- a) Chest X-ray, electrocardiogram, troponin
- b) CT angiogram
- c) Arterial blood gas
- d) Pericardiocentesis

a) Chest X-ray, electrocardiogram, troponin

Acute coronary syndrome is still a serious risk in end-stage renal disease patients. It should be considered in all ESRD patients with chest pain. While PE, uremic pericarditis, and cardiac tamponade are considerations in an ESRD patient with chest pain or shortness of breath, they are less likely given the presentation of this patient. Arterial blood gas may provide information about acid-base status, but this could also be achieved through a BMP or venous blood gas.

10) What is the first step in controlling bleeding from a dialysis puncture site?

- a) Applying occlusive direct pressure
- b) Applying firm but nonocclusive direct pressure
- c) Administration of DDAVP
- d) Application of a tourniquet

b) Applying firm but non-occlusive direct pressure

The first step in controlling bleeding from a dialysis site is direct **non-occlusive** pressure. Administration of DDAVP can be an adjunct if direct pressure is insufficient. Application of a tourniquet should be avoided.



INSTRUCTOR MATERIALS

Emergencies in Hemodialysis Patients Brief Wrap Up (GAE answers)

Case 1: 23-year-old female presents with headache and hypertension. She has a history of severe hypertension and end-stage renal disease on dialysis. She missed her last dialysis and has been not compliant with her blood pressure medications. On arrival her blood pressure is 261/156. She is neurologically intact but has photophobia. On exam, there is no peripheral edema and lungs sound clear.

1. What diagnostic tests are necessary?

Given her severely elevated blood pressure with headache, a CT head would be appropriate to rule out intracranial hemorrhage. Chest X-ray, electrocardiogram (ECG), troponin, BMP would also be appropriate to evaluate for other evidence of end-stage organ damage consistent with hypertensive emergency.

2. What drugs should be used to decrease the blood pressure?

With a blood pressure this elevated a drip would be most appropriate, and there are several possible choices:

- Nicardipine
- Nitroprusside can be used but cautiously due to possibility of cyanide accumulation
- Nitroglycerin drip would be appropriate, particularly in the setting of pulmonary edema as it will decrease edema until dialysis can be done.
- Labetalol

3. What should your initial goal blood pressure be?

20-25% decrease in MAP over 1-2 hours

4. Do you think the patient is volume overloaded and dialysis will help with treatment? Why or why not?

The patient in this case has clear lungs and no peripheral edema, making volume overload less likely. Dialysis is unlikely to resolve her hypertension.

5. What level of care will the patient require?

Intensive care unit as this patient will require close monitoring and an adjustable medication drip to control her blood pressure.



INSTRUCTOR MATERIALS

Case 2: 48-year-old male brought in by ambulance from dialysis center with shortness of breath

Patient was receiving his first session of dialysis for chronic kidney disease that had progressed to end-stage renal disease due to poorly controlled diabetes. Patient was about 30 minutes into dialysis when he became suddenly short of breath. He was hypoxic to the 80s in the field, which improved with oxygen. He also had a few episodes of coughing up pink, frothy sputum.

On exam patient is awake and alert but is tripodding with significant respiratory effort. His trachea midline without no stridor. He is tachycardic and has very coarse breath sounds with decreased air movement bilaterally.

1. How concerning is the patient's respiratory distress?
Very concerning, he is tripodding, with diffuse crackles on his lungs and increased respiratory effort. The description sounds like a patient who may require intubation.
2. What is the most likely diagnosis?
Flash pulmonary edema related to the first session of dialysis.
3. What drug will improve symptoms most rapidly?
Nitroglycerin may decrease pulmonary edema and improve symptoms.
4. What are the first steps in treating that distress? If your first steps fail, what would subsequent steps be?
You may try high-flow oxygen, Nitroglycerin, or bilevel positive airway pressures (BiPAP) to improve the patient's symptoms. However, given that this patient is already in a significant amount of respiratory distress it is likely he will require intubation.
5. If intubation is required, what about this case might make the procedure difficult?
The flash pulmonary edema is resulting in pink, frothy sputum. This may cause difficulty visualizing the airway, or may make oxygenation difficult despite successful intubation.
6. What secondary airway equipment would you like at bedside?
Glidescope and Bougie (endotracheal introducer) as airway adjuncts in case direct laryngoscopy is technically difficult. It may also be appropriate to keep a cricothyrotomy tray available in case intubation attempts fail.



INSTRUCTOR MATERIALS

Case 3: 62-year-old male presents with fever and chills at home. On arrival his vitals include T 39.2, HR 130, BP 65/42, RR 18, oxygen saturation 98% on RA. On exam he looks ill, but has no evidence of cellulitis, lungs are clear, abdomen is benign and fistula has a bruit without signs of infection. Chest X-ray is clear, urinalysis is negative.

1. What is the most likely etiology of infection?
Vascular access is the most common cause of bacteremia in infected hemodialysis patients.
2. Should the patient receive antibiotics? Which ones?
Yes, they should receive broad-spectrum antibiotics. Vancomycin plus a third-generation cephalosporin would be appropriate.
3. Should the patient receive IV fluids?
Yes, the patient is septic, and studies have shown that early antibiotics and aggressive fluid resuscitation improve mortality. Although you would generally be judicious in giving a patient with ESRD fluids, you must first ensure his blood pressure is adequate for perfusion. If the fluids third-space and cause pulmonary edema, you can always intubate the patient until he can receive dialysis. The pulmonary edema from fluids is reversible with dialysis, while end-stage organ damage due to hypoperfusion is not.
4. After IV fluids patient starts having shortness of breath and has bilateral crackles on exam, oxygenation drops to the 80s. Repeat chest x-ray is consistent with volume overload, however his blood pressure is still 80s/50s. What is the next best step? Should you continue giving fluids?
You should continue giving fluids and intubate the patient. Again, the pulmonary edema from fluids is reversible, but end-stage organ damage due to hypoperfusion is not.
5. What is the likely disposition and level of care for this patient?
He will require admission the intensive care unit and likely central line placement to ensure adequate resuscitation.