Emergencies in Hemodialysis Patients
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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, TBL, team-based learning, dialysis, ESRD, renal disease.
**Learner Audience:**

- **Level of Learners (select all that apply):**
  - Medical Students
  - Interns
  - Junior Residents
  - Senior Residents
  - Other _______________

**Time required for implementation:**

- **Instructor preparation:** 20-60 minutes
- **Learner responsible content (LRC):** 30 minutes
- **In class portion:** 45-60 minutes

**Recommended number of learners per instructor:** 15-50

**Recommended pre-reading for instructor:**

- Ch. 116, Dialysis-Related Emergencies in Adams *Emergency Medicine: Clinical Essentials*

**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

**Linked objectives, methods and results:**

Learner Responsible Content: Ch. 116, Dialysis-Related Emergencies in Adam’s *Emergency Medicine: Clinical Essentials*. This provides an overview of dialysis complications, after which learners should be able to describe primary dialysis complications.

iRAT 10-question quiz (10 min): The iRAT tests learners’ knowledge of primary dialysis complications, as well as their ability to consider a differential diagnosis in a hemodialysis patient and select appropriate treatments in these patients.
gRAT 10-question quiz (10 min): The gRAT allows groups to review correct answers for the questions covering hemodialysis complications, differential diagnosis and treatment.

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.

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 Q&A format.

Prepare:
1. Read and instruct learners to read Ch. 116, Dialysis-Related Emergencies in Adams Emergency Medicine: Clinical Essentials (optional).
2. Print one copy of iRAT for each learner
3. Print one copy of gRAT for each team (4-5 learners per team is ideal)
4. Print one copy of GAE exercise for each team (4-5 learners per team is ideal)
5. Print one copy of GAE exercise answers for each instructor
6. 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).

Pearls:
- See group application exercise instructor handout
References/Further Readings:
Ch. 116, Dialysis-Related Emergencies in Adams Emergency Medicine: Clinical Essentials
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, 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

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

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 patients 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 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

7) Which of the following is the most common complication of peritoneal dialysis?
   - a) Catheter dislodgment
   - 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

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) CXR, ECG, 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
    - b) applying firm but nonocclusive direct pressure
    - c) administration of DDAVP
    - d) application of a tourniquet
Group Readiness Assessment Test (gRAT)

Please see separate file

The 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 in the separate gRAT file.
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. 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

48yo M 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 tripoding with significant respiratory effort. His trachea midline without no stridor. He is tachycardic and has very course 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?
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. CXR is clear, UA 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?