



NERDC Dialysis Orders OSCE Rubric

Objective: To assess proficiency in ordering acute RRT

Total Points: 58

Rubric: To guide scoring of questions and order sets

Evidence-based/Standard of care items are **bolded**. There are 2 per question scenario.

(Case 1) Objective: Order CRRT in a septic, hypotensive, acidotic, hypoxic, coagulopathic oncology patient with AKI in the ICU. (Total points: 20)

1. a. Anion gap metabolic acidosis (0.5 point) with
b. Appropriate compensatory respiratory alkalosis. (0.5 point)
In part a, examinee must recognize that correction for hypoalbuminemia must be made when calculating the anion gap (2.5 meq/L increase in anion gap for each 1 g/dL decline in albumin below the baseline of 4 g/dL). (Vichot AA, Rastegar A. Use of the anion gap in the evaluation of a patient with metabolic acidosis. Am J Kidney Dis. 2014 Oct;(64(4): 653-7.) The Winter's formula must be correctly used in part b, to assess respiratory compensation.
2. Initial CRRT orders (Use of standard order sets or forms is encouraged.) Examinee must recognize that this patient is severely hypotensive, acidemic (with a primary metabolic (lactic acidosis), coagulopathic, and hypoxic with probable pulmonary edema due to capillary leak/sepsis, but not markedly total body volume overloaded—although ongoing inputs must be handled in the setting of anuria. Must meet minimum of 20 ml/kg/hr effluent rate, and use bicarbonate dialysate/replacement fluid. Heparin anticoagulation is contraindicated. Orders as follows:
 - a. Indicate machine (NxStage, Prismaflex, Fresenius in CRRT mode; etc) and filter set. Options set by the individual training program or hospital. (1 Point)
 - b. Indicate access type (double-lumen femoral temporary dialysis catheter). (1 Point)
 - c. Indicate modality (i.e., convection only, convection + diffusion, diffusion only) (1 Point)
 - d. Must address coagulopathy with heparin free saline boluses/flushes, continuous saline infusions, pre-filter replacement fluid, or use regional citrate. **Heparin is contraindicated.** (2 points: 1 for correct intervention, 1 for details of intervention; -1 point if Heparin is used)
 - i. If regional citrate is chosen, pre-filter infusion of sodium citrate (concentration and rate) must be specified, monitoring of ionized calcium post-filter and systemically, provision for calcium replacement peripherally, and specification

of dialysate (if used) that does not contain calcium, and has appropriate Na (lower) concentration based on sodium concentration of citrate anticoagulant.

- ii. If regional citrate used with NxStage, RFP453 dialysate (130 meq/L Na, 25 meq/L HCO₃, 0 meq/L Calcium) is required.
 - e. Must address volume removal. Patient should be started isovolemic, or at low net volume removal (100-250ml/hr as tolerated), with advancement as tolerated. (1 Point)
 - f. Must address acidemia secondary to lactic acidosis, and use bicarbonate containing dialysate/replacement fluid, if available. (1 Point)
 - g. Must address vital signs, pressor titration parameters, and mean arterial pressure (MAP) threshold <55-60mmHg or state MAP goals. (1 Point—all must be present)
 - h. Must adjust Qb between 50-200ml/min (probably on the lower side due to hypotension). (1 Point)
 - i. For replacement fluid, indicate rate (1 pt), electrolyte components (1 pt), and pre- or post-filter infusion (1 pt). (Total: 3 Points) If dialysate not used, must use physiologic replacement fluid (i.e. NOT normal saline.) If not using replacement fluid (ie, CVVHD alone), give 3 points for free.
 - j. For dialysate, indicate rate (1 pt), electrolyte components (1 pt) (Must be calcium free if citrate is used). (Total: 2 Points) If not using dialysate (ie, CVVH alone), give 2 points for free.
 - k. **Must obtain at least 20 ml/kg/hr effluent (UF + dialysate) rate for any CRRT modality (Intensity of Renal Support in Critically Ill Patients with Acute Kidney Injury. NEJM 2008, 359:7-20.) (1 Point)**
3. Examinee must recognize that bicarbonate concentration should be physiologic range (25-35 mEq/L). If using citrate, bicarbonate should be on the lower side to avoid alkalosis, as citrate is an additional base source. If using high effluent rate, recognize that one should consider lower bicarbonate concentration to avoid alkalosis. (1 Point)
 4. Examinee must consider increase in volume removal rate, at least to keep even with input. (1 Point)
 5. Understanding of clearance calculation in the setting of CRRT and implications for drug dosing.
 - a. Examinee must calculate clearance based on volume of effluent per hour. The calculation would be [(volume effluent (ml)/hour)/60 minutes/hour]. (1 point)
 - b. Must recognized that drug doses should be based on clearance and known sieving coefficients, and not necessarily dosed for CrCl<10 ml/min. (1 points)

(Case 2) Objective: Order initiation of hemodialysis in a moderately uremic patient with an AV fistula.

(Total points: 21)

1. Anion gap metabolic acidosis (0.5 point) with underlying metabolic alkalosis (0.5 point).
2. Orders for patient's first day of hemodialysis. The examinee must acknowledge the risk (albeit low) of dialysis disequilibrium syndrome, and decrement dialysis efficiency accordingly. Also must recognize the risk of cardiovascular events/symptoms appearing during first dialysis (esp. in this patient with cardiomyopathy), and consider dialysate K concentration of 3 mEq/L or greater and 2.5 mEq/L Calcium. Recognize that AV fistula is being used for the first time. Recognize patient has an anion gap acidosis, but an underlying metabolic alkalosis, and is at risk for tetany--use a 25 mEq/L HCO₃ dialysate (or lowest available at facility). Patient is volume overloaded, but volume removal should be extremely gentle on the first day (if at all), and isolated UF (which does not involve clearance of urea) may be considered.
 - a. EKG before initiation, nasal cannula O₂, and cardiovascular monitoring plan during treatment. (1 point)
 - b. Low blood flow and dialysate rates (Not more than 200-250 ml/min Q_b; Q_d no more than 2X Q_b). (1 point).
 - c. Smaller surface area (lower clearance) kidney: (Lowest available or not more than 1.2 m²). (1 point)
 - d. Dialysate: 140 mEq/L Na (or standard Na bath) (1 pt); 3-4 mEq/L K (1 pt); 25-32 mEq/L HCO₃ (1 pt); 2.5 mEq/L calcium (1 pt) dialysate. (Total: 4 points. Note here that patient has underlying alkalosis and marginally low serum calcium (about 8.0 mg/dL corrected for albumin). Higher HCO₃ dialysate should not be used, due to risk of tetany. The patient has a normal serum potassium, so low potassium dialysate should be avoided, unless there is only a standard dialysate available. Dialysate K < 3 meq/L has been associated with an increased risk of sudden cardiac death in retrospective cohort studies, although prospective data is lacking. (Jadoul M, et al. Modifiable practices associated with sudden death among hemodialysis patients in the DOPPS. Clin J Am Soc Nephrol. 2012 May;7(5):765-74.)
 - e. Concurrent flow (optional)
 - f. Short time (1-3 hours)—no more. (1 point)
 - g. Limited volume removal first treatment (No more than 10ml/kg/hr), or use isolated UF. (1 point)
 - h. Mannitol +/-, 0.5-1 gm/kg, but must be stopped 15-30 minutes before end of procedure. Another way is to give 5-10 gm mannitol bolus if symptoms occur—but it shouldn't be done as a prn order. (UpToDate is no longer recommending mannitol.) (Optional use with no points for use or no use, but minus 1 point if used incorrectly)
 - i. Tight Low dose heparin or heparin free—She is at (low) risk for hemorrhagic pericarditis. (1 point)
 - j. Indicate access (AV fistula) (1 point). Bonus point for using 17 g needles for first use of access and/or limiting number of attempted needle sticks before calling physician . (Bonus 1 point)
3. Must recognize that uremic encephalopathy (mild-severe) and serositis (pleural, pericardial) are urgent/absolute indications for initiation of chronic dialysis in ESRD. (Daugirdas, Blake and Ing, Handbook of Dialysis (5th Ed); 2015, Wolters Kluwer Health, Philadelphia, PA. Singh A, Kari J. Chapter 2. Management of CKD Stages 4 and 5. Pp29-31, Table 2.3) (2 points—1 point for each)
4. May chose from the following: Intractable and not responsive to conservative therapy: a) volume overload/CHF/HTN; b) hyperkalemia; c) acidosis; d) hyperphosphatemia; e) weight loss/malnutrition; f) gastrointestinal dysfunction/nausea/vomiting; g) decline in function and/or well-being; h) uremic platelet dysfunction. (4 points—1 point for each)

5. Must indicate that patient is at risk for dialysis disequilibrium syndrome. Early symptoms include nausea, vomiting, disorientation, restlessness, and headache. Seizures and coma can occur in severe cases. The physiology appears to be due to a rapid decrease in plasma solute concentration (osmolality) due to dialytic clearance, with water translating across the blood brain barrier to allow for osmotic equilibrium, with resultant cerebral cellular swelling and cerebral edema. Unclear as to the relative contribution of slower urea removal from brain relative to serum vs. existing idiogenic osmols vs. development of intracerebral acidosis. Dialysis should be stopped immediately if symptoms occur. (3 points: 1 for DDS, 1 for symptoms and signs (0.5 for mild; 0.5 for severe, which must include seizures), 1 for pathophysiology)

(Case 3) Objective: Manage acute and life-threatening hyperkalemia and volume overload in an ESRD patient on chronic dialysis (Total points: 17)

1. Examinee must recognize need to start acute medical therapy for hyperkalemia immediately.
 - a. Patient should be placed on a monitor, EKG done (1 point).
 - b. 1 gm of calcium (gluconate or chloride) should be administered over 2-3 minutes (1 point—0.5 point for Ca gluconate, 0.5 point for time (no greater than 5 minutes)).
 - c. Amp of 50% dextrose with 5-10 units regular insulin (with subsequent 10% dextrose infusion at 50 ml/hour optional). (1 point)
 - d. Transfer to the ICU, or maintain in a monitored setting in the ER, if that is the standard procedure for the hospital. (1 point)
 - e. Albuterol neb (10 mg in 4 ml saline over 10 minutes) may be used, but recognize the potential for tachycardia, and should not be used without prior insulin/dextrose. (1 point, 0 points if no insulin or dextrose.) (Epinephrine is NOT recommended: -1 point.)
 - f. Bicarbonate therapy is not indicated—he is not acidotic, and has been shown to have negligible effect in patients with ESRD. (-1 point) He is already volume overloaded. (Allon M, Shanklin N. Effect of bicarbonate administration on plasma potassium in dialysis patients: Interactions with insulin and albuterol. AJKD. 1996. Oct;28(4): 508-14.)
 - g. Potassium must be repeated 30-60 minutes after therapy, and monitored thereafter. (1 point)
 - h. (-1 point) for IV Lasix, as the patient is 20 years at ESRD, and is anuric, unless the examinee indicates that it could be used if the patient is not anuric, in which case, 0 points.
 - i. No points for sodium polystyrene sulfonate (Kayexalate™). It will not have an effect for 4-6 hours.
2. Must recognize the need for acute dialysis→ You must be able to remove the potassium. Diuretics will not help—as the patient is anuric. Potassium binders will not begin their effect for at least 4-6 hours. He is significantly volume overloaded (7 kg over dry weight), hypoxic, and anuric. (2 points. 1 point for recognizing need for acute dialysis. 1 point for correct explanation, i.e. hyperkalemia (0.5 point) and significant volume overload (0.5 point). No points for other options which do not include dialysis)
3. At minimum 1-2 hours. (1 point) The nurses should come in immediately. Recognize that it will take at least 30-60 minutes minimum to turn on and rinse the machine and prepare it for dialysis. Then, it must be brought to the ICU (or ER), and the patient must be accessed.
4. Examinee must decide on appropriate K concentration in the dialysate, and monitor appropriately, as well as plan for volume removal.
 - a. No 0 K bath. 1 or 2 mEq/L K dialysate are both fine. 30-60 minute iStat potassium after one at the beginning of therapy to guide therapy and adjust K+ in dialysis appropriately. Once K is in the 6-7 mEq/L range, switch to 2 mEq/L K dialysate, if on 1 mEq/L K bath. (2 points, 1 for dialysate selection, 1 for monitoring)
 - b. Up to 1-1.5 liter per hour or 10 mg/kg/hour volume removal. (He is 7 kg above dry weight) (1 point)
 - c. Continue dialysis and UF for at least 3-4 hours. (1 point)
 - d. Otherwise, standard orders: LUA AVF access. Na constant or Na modeling; Qb and Qd per standard prescription. Dialyzer per standard prescription. HCO₃ and Calcium per standard prescription. Heparin per standard prescription—1000 units at beginning of dialysis. (No points)

5. Examinee must recognize that potassium should be NORMAL ($< 4\text{-}5$ mEq/L) (1 point) and at least 3 hours must elapse (1 point) before discontinuation, as rebound is expected, especially as the medical therapy used will shift K into cells, thus preventing clearance. 3-4 hours of dialysis will allow removal of 3-4 liters of volume—leaving him still at 3-4 liters above dry weight.
6. After dialysis is completed, must recognize need to repeat K+ in 2-4 hours, once again at 6 hours, as rebound is likely to occur. May need to repeat dialysis daily (especially due to volume overload). (1 point: 0.5 point for 2-4 hours post, 0.5 point for 6 hours post) (Blumberg A, Roser HW, Zehnder C, Muller-Brand J. Plasma potassium in patients with terminal renal failure during and after hemodialysis: Relationship with dialytic potassium removal and total body potassium. NDT. 1997; 12(8): 1629.)
7. Other potential contributors (1 point):
 - a. Medications: Telmisartan, Lopressor (0.5 point—must include telmisartan)
 - b. Access Recirculation (unlikely in view of history, but a possibility) (0.5 point)
 - c. No points for hemolysis, as there are two successive values of approximately 8 meq/L.