**2016 ACCP StuNews September Case**

**Reviewed by 2016 ACCP Clinical Pharmacy Exam Panel**

Vignette: A 54-year-old man presents to the emergency department with a 3-day history of shortness of breath, decreased oral intake, and general malaise. He is hypotensive on admission and remains hypotensive, despite having received 3 L of fluid. Given the patient’s arterial blood gas results, the medical intensive care unit team is consulted for intubation and to admit the patient for further care.

Past Medical History: Hypertension, insomnia

Social History: Lives at home with his wife. Denies smoking, drinking, and illicit drug use

Current medications: Hydrochlorothiazide 25 mg daily, zolpidem 10 mg at bedtime as needed for sleep

Allergies: Sulfa drugs (hives)

Vital Signs (after fluid resuscitation): HR 115 beats/ minute, BP 95/40 mm Hg (mean arterial pressure 58 mm Hg), RR 31 breaths/minute, Temp 101.5°F (38.6°C)

Laboratory Values: White blood cell count 18.3 x 103/mm3 (18.3 x 109/L); hemoglobin 9.1 g/dL (91 g/L); hematocrit 28.3% (0.283); platelet count 222,000/mm3 (222 x 109/L); sodium 144 mEq/L (144 mmol/L); potassium 5.8 mEq/L (5.8 mmol/L); chloride 108 mEq/L (108 mmol/L); bicarbonate 16 mEq/L (16 mmol/L); blood urea nitrogen (BUN) 44 mg/dL (15.7 mmol/L); serum creatinine (SCr) 2.14 mg/dL (189.2 micromoles/L); glucose 144 mg/dL (7.99 mmol/L); aspartate aminotransferase 1238 IU/L; alanine aminotransferase 1108 IU/L; alkaline phosphatase 1561 IU/L; international normalized ratio 1.8

Arterial Blood Gas: pH 7.13; Pco2 92 mm Hg; Po2 87 mm Hg; O2 saturation 89%

Procedures: None – intubation planned

**Question 1- 100 points**

Which intervention is MOST likely to reduce this patent’s risk of mortality?

1. Inhaled bronchodilators
2. Initiation of norepinephrine
3. Insertion of a central venous catheter
4. Rapid administration of antibiotics

Answer: 4. Rapid administration of antibiotics

Rationale: This patient is in septic shock (hypotension refractory to fluid administration). Early antibiotics (ideally within 1 hour) are the idealistic standard in the management of septic shock and are associated with reduced mortality. Although inserting central catheters and norepinephrine are common maneuver in the management of septic shock, their use is not necessarily associated with reduced mortality. Inhaled bronchodilators are also not associated with reduced mortality in this setting.

Citation: Dellinger RP, Levy MM, Rhodes A, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med 2013;41:580-637.

**Question 2 – 200 points**

Which rapid sequence intubation medication is **LEAST** appropriate for use in this patient?

1. Etomidate
2. Ketamine
3. Rocuronium
4. Succinylcholine

Answer: 4. Succinylcholine

Rationale: Given the patient’s acute kidney injury and hyperkalemia, succinylcholine would further increase his potassium concentration, potentially to life-threatening levels. The other rapid sequence intubation medications would be appropriate in this scenario, if used.

Citation: Stollings JL, Diedrich DA, Oyen LJ, et al. Rapid-sequence intubation: a review of the process and considerations when choosing medications. Ann Pharmacother 2014;48:62-76.

**Question 3 – 200 points**

The patient is heavily sedated on propofol with continued poor oxygenation, and the decision is made to try an infusion of a neuromuscular blocker. Which agent is most appropriate for this patient?

1. Cisatracurium
2. Pancuronium
3. Rocuronium
4. Vecuronium

Answer: 1. Cisatracurium

Rationale: In a patient with concomitant renal and hepatic dysfunction, cisatracurium is the neuromuscular blocker of choice. Cisatracurium undergoes Hoffmann elimination, and its clearance is unaffected by renal or hepatic dysfunction. The other options listed would accumulate to some extent with either organ system impaired.

Citation: Murray MJ, Cowen J, DeBlock H. et al. Clinical practice guidelines for sustained neuromuscular blockade in the adult critically ill patient. Crit Care Med 2002;30:142-56.

**Question 4- 300 points**

The patient remains hypotensive despite vasopressor support, and the decision is made to add steroids. What is the guideline-recommended daily dose (in milligrams) of hydrocortisone?

1. 100
2. 200
3. 300
4. 400

Answer: 2. 200 mg

Rationale: The guideline-recommended dose of steroids in septic shock is 200 mg daily, although 300 mg has traditionally been noted as “stress dose” steroids. Doses of 100 mg and 400 mg are not recommended, nor are they routinely used.

Citation: Dellinger RP, Levy MM, Rhodes A, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: . Crit Care Med 2013;41:580-637.

**Question 5 – 300 points**

The patient experiences hypertriglyceridemia and is changed to a midazolam infusion. Which, if any, are likely to accumulate in this patient with prolonged use?

1. Active metabolite
2. Parent drug
3. Both parent drug and active metabolite
4. No accumulation of parent drug or active metabolite

Answer: 3. Both parent drug and active metabolite

Rationale: Given the data presented, the patient appears to have some degree of hepatic impairment. If the liver metabolism is impaired, the parent drug has the potential to accumulate significantly, given that midazolam is extensively metabolized by the liver. This accumulation of midazolam in patients with reduced liver function has been shown to occur even after short courses of procedural sedation, and it would be even more likely to occur in this setting with prolonged use. This patient also has renal impairment, as evidenced by his BUN/SCr. The active metabolites of midazolam have sedative properties and can accumulate significantly in renal impairment and lead to a prolonged sedative effect (even up to days).

Citations:

Barr J, Fraser GL, Runtillo K, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med 2013;41:263-306.

Bauer TM, Ritz R, Haberthur C, et al. Prolonged sedation due to accumulation of conjugated metabolites of midazolam. Lancet 1995;346:145-7.

Khanaysi I, William N, Olga A, et al. Sub-clinical hepatic encephalopathy in cirrhotic patients is not aggravated by sedation with propofol compared to midazolam: a randomized controlled study. J Hepatol 2011;54:72-7.

Spina SP, Ensom MH. Clinical pharmacokinetic monitoring of midazolam in critically ill patients. Pharmacotherapy 2007;27:389-98.