

## Multisystem

By: [Audrey Snyder](#), Helen Miley, Damon Toczylowski

Snyder, A., Miley, H., & Toczylowski, D. (2019). Trauma and Multisystem Organ Dysfunction Chapter in Carpenter, Dawn, Ed. *Adult-Gerontology Acute Care Nurse Practitioner Q&A Review*. New York: Springer Publishing Company.

Made available courtesy of Springer: <https://www.springerpub.com/adult-gerontology-acute-care-nurse-practitioner-q-a-review-9780826164780.html>

\*\*\*© 2019 Springer Publishing Company, LLC. Reprinted with permission. No further reproduction is authorized without written permission from Springer. This version of the document is not the version of record and is subject to [Springer accepted manuscript terms of use](#). \*\*\*

### **Abstract:**

A 25-year-old male arrives to the ED with a complaint of right lower extremity deformity with swelling, pain, discoloration, and numbness, stating he fell 15 feet from a balcony and landed directly on his leg. Initial evaluation of his lower extremity reveals absent pulses, loss of color and sensation, and 4+ pitting edema. An initial radiograph of the extremity shows a compound fracture of the tibia and fibular distal heads with diffuse edema and soft tissue trauma. Compartment pressures below the fracture read to 40 mmHg. Based on these findings, what is the most appropriate first intervention?

**Keywords:** multisystem organ dysfunction | trauma | emergency department care

### **Article:**

### **Multisystem Questions**

1. A 25-year-old male arrives to the ED with a complaint of right lower extremity deformity with swelling, pain, discoloration, and numbness, stating he fell 15 feet from a balcony and landed directly on his leg. Initial evaluation of his lower extremity reveals absent pulses, loss of color and sensation, and 4+ pitting edema. An initial radiograph of the extremity shows a compound fracture of the tibia and fibular distal heads with diffuse edema and soft tissue trauma. Compartment pressures below the fracture read to 40 mmHg. Based on these findings, what is the most appropriate first intervention?
  - a. Reduction of fracture with surgical consult
  - b. Casting of leg for immobilization of extremity
  - c. Ultrasound of lower extremity to evaluate for DVT
  - d. Administration of tetanus prophylaxis and first-generation cephalosporin
2. While assessing a 29-year-old female involved in a motor vehicle crash with coup/counter coup injuries, the patient becomes hypotensive to 70/40 mmHg and bradycardic to 40 beats

per minute with worsening mentation and loss of sensation below her waist. Given the known mechanism of injury, what should the AG-ACNP expect to do next?

- a. Order 0.5 mg atropine and fluid bolus
  - b. Initiate dopamine after fluid optimization with crystalloids
  - c. Type and screen for transfusion of packed red blood cells
  - d. Order 1 mL of 1:10,000 epinephrine followed by fluid bolus
3. A 55-year-old male presents to the ED with traumatic amputation of his right hand sustained during repair of a lawn mower. Physical assessment reveals a missing right hand with a jagged stump at the wrist. Vital signs include sinus tachycardia with heart rate of 122, blood pressure of 80/40 mmHg, tachypnea, and altered mental status. The AG-ACNP initiates intravenous fluids with isotonic crystalloids based on the following rationale. Isotonic crystalloids are:
- a. Best for fluid resuscitation because the low sodium value helps ensure optimal intravascular volume via an osmotic gradient
  - b. Better than fluids rich in dextrose for resuscitation because high blood glucose can complicate critical illnesses and lower sodium
  - c. The fluid of choice for resuscitation because they are better at maintaining intravascular osmotic pressure than hypertonic saline (3% normal saline) or other colloid-based solutions
  - d. Best for maintaining a normal pH because they have an acid/base balance very similar to that of blood
4. A 45-year-old female trauma victim is undergoing resuscitation with blood products, isotonic crystalloids (normal saline), and vasoactive drips. The patient weighs 100 kg (220 lb). Which of the following values indicates the patient is properly resuscitated?

	<b>Heart rate</b>	<b>Blood pressure</b>	<b>Urine output last hour</b>	<b>Lactate</b>	<b>ABG: pH/PaCO<sub>2</sub>/PaO<sub>2</sub>/Sat/ Bicarb/Base excess</b>
a)	115	100/50	40 mL	4.5 mmol/L	7.25/33/90/16/-6
b)	110	88/55	30 mL	3.5 mmol/L	7.30/38/88/18/-4
c)	100	95/60	50 mL	2.0 mmol/L	7.40/41/94/24/-4
d)	105	90/60	15 mL	5.0 mmol/L	7.20/28/92/20/-8

5. In caring for an elderly male who has had a motor vehicle crash sustaining a suspected hypoxemic-ischemic brain injury, which supportive measure is the AG-ACNP likely to order?
- a. Therapeutic hypothermia to 32°C
  - b. Anticonvulsive medications
  - c. Analgesic and sedative medications
  - d. Hypertensive agents to keep cerebral perfusion pressure less than 40 mmHg
6. When caring for a patient with a suspected C-spine injury with TBI, the AG-ACNP notices the patient has waxing/waning mentation with a Glasgow Coma Scale score reduction to 8.

The patient also has irregular breathing, increased systolic blood pressure with a widening blood pressure, and bradycardia. The AG-ACNP understands the highest priority is to order:

- a. C-spine precautions
  - b. Benzodiazepines
  - c. BiPAP
  - d. HOB at greater than 30 degrees
7. A postsurgical otolaryngology patient who had sustained facial trauma reports to the ED 14 days postoperative with complaints of dizziness, nausea, diarrhea, fever, chills, and night sweats for 4 days. Vital signs reveal blood pressure 80/60, heart rate 122 (sinus tachycardia), O<sub>2</sub> saturation 88%, respiratory rate 26, and temperature 103.0°F. Physical examination reveals paranasal sinus, purulent nasal discharge, and altered mental status. CT of the head reveals paranasal sinus mass thought to be retained surgical packing. The AG-ACNP should anticipate the following antimicrobial after cultures and resuscitation has begun:
- a. Clindamycin (Cleocin) 900 mg IV every 8 hours
  - b. Levofloxacin (Levoquin) 750 mg IV daily
  - c. Metronidazole (Flagyl) 500 mg IV BID
  - d. Fluconazole (Diflucan) 200 mg IV daily
8. An elderly patient from an assisted living facility presents to the ED in January, following a fall. The patient complains of fever, malaise, cough, nausea, and vomiting for 2 days. She is found to be febrile to 101.5°F, blood pressure to 85/40, and heart rate to 120, and a fluid bolus is given. Which of the following should the AG-ACNP do first?
- a. Place the patient in droplet precautions with influenza testing.
  - b. Order metronidazole (Flagyl) 500 mg IV TID due to concern for bowel perforation.
  - c. Place a central line and order norepinephrine (Levophed) due to concern for septic shock.
  - d. Order loperamide (Immodium) 2 mg by mouth to treat acute viral gastroenteritis.
9. A 60-year-old female motor vehicle crash victim presented to the ED with a fractured humerus and evisceration of the small bowel. Vitals were stable upon arrival and she had immediate restorative surgery to correct her injuries. Preoperatively she was placed on empiric antibiotic coverage, had a urinary catheter placed, and was intubated. While conducting rounds on postoperative day 2, the AG-ACNP notices the patient has developed mild hypotension, fever, and leukocytosis. Understanding the patient is at risk for hospital-acquired infections, what is the best way to prevent development of an iatrogenic infection for this patient?
- a. Daily cultures while IV antibiotics are escalated to treat suspected infections
  - b. Adhere to evidence-based care bundles and review daily in multidisciplinary rounds
  - c. Replace invasive lines every 7 days
  - d. Adopt policies from larger institutions to help reduce rates of infection because they have reduced their hospital acquired infection rate
10. A patient presents to the ED with complaint of trauma to the right foot after dropping a 15-lb bowling ball on his foot. He has a past medical history significant for chronic pain syndrome and is on high-dose narcotics/atypical medications (with a known pain contract per his pain manager). Other past medical history includes insulin dependent diabetes, CHF, and chronic

kidney disease Stage III with a baseline Cr 2.05. X-ray of the foot reveals soft tissue damage to the ankle with a partial fracture to the lateral malleolus. The AG-ACNP implements the following pain management strategy:

- a. Order IV acetaminophen (Ofirmev) 1 g IV every 8 hours, orthopedic consult for reduction and splinting, and consult to pain specialist for further evaluation.
  - b. Order ketoralac (Toradol) 60 mg IV every 6 hours for pain, hydromorphone (Dialudid) IV as needed for pain, with consult to pain specialist.
  - c. Order a PCA of hydromorphone (Dilaudid) in addition to the patient's home medications and consult neurology.
  - d. Consult pain management team for nerve block to lower extremity and consult to internal medicine/endocrinology to evaluate for neuropathy.
11. A patient with septic shock is on multiple vasoactive medications, intubated on mechanical ventilation, and on IV antibiotics, an insulin drip, sedation, and analgesia. After the insulin drip was discontinued, the glucose level continued to decline. The AG-ACNP understands:
- a. The antibiotics are likely causing a rebound hypoglycemic effect in the setting of septic shock.
  - b. The patient likely has diabetes at baseline and is not getting enough feeds to compensate for the high dose of insulin they are on.
  - c. The patient likely has ischemic liver (shock liver), with gluconeogenesis failing to respond to the stressors on the body.
  - d. The insulin drip is taking too long to clear out of the patient's system, causing a downward trend in the patient's blood sugars.
12. While rounding in the ICU, an AG-ACNP correctly differentiates a patient who is at risk for developing sepsis and identifies which of the following patients requiring early goal-directed sepsis therapies: A patient
- a. Who is tachycardic and tachypneic with a history of anxiety
  - b. Who is tachypneic, hypothermic, and tachycardic but just arrived from the OR
  - c. With leukocytosis, fever, and tachycardia with a known bloodstream infection
  - d. With hypothermia and tachycardia post-cardiac arrest
13. When writing admission orders for a 65-year-old female patient with septic shock from a urinary source, which of the following actions and rationale are part of the surviving sepsis campaign?
- a. Serum lactate levels every 12 hours while blood pressure is unstable to evaluate for adequate fluid resuscitation
  - b. Sliding scale insulin if the patient has DMII, knowing that hyperglycemia has a higher risk for mortality than hypoglycemia in the ICU
  - c. Blood cultures are drawn after antibiotics are started, but both are done in the first 3 hours of sepsis or septic shock recognition
  - d. Two large-bore IVs are placed and possible placement of a central catheter if vasoactive agents are required
14. An elderly woman arrives to the ED confused, lethargic, and coughing after being rescued from an apartment fire by a neighbor. The AG-ACNP completes a physical examination and

notices the patient continues to exhibit confusion and lethargy for the next hour despite having started O<sub>2</sub> at 4 L/min via nasal cannula and IV fluids (normal saline [NS] at 75 cc/hr). The AG-ACNPs next immediate order is:

- a. Order CT head to evaluate for an acute cerebral hemorrhage, as an altered mental status can be a sign of a CVA.
  - b. Increase oxygen to high flow/non-rebreather mask (NRB) 100%, as this patient is likely suffering from CO toxicity.
  - c. Order a STAT blood glucose to evaluate for hypoglycemia, as this could be the source of her confusion and lethargy.
  - d. Order a urine culture and start empiric community-acquired UTI monotherapy.
15. A 27-year-old male self-presented to the ED with a report of an SSRI overdose (sertraline suspected). He states he took a handful of pills (number unknown) and continues to feel suicidal. After placing the patient on a 1:1 watch and obtaining (complete blood count and basic metabolic profile), he is admitted to the ICU for monitoring. When reviewing the admission orders, an AGACNP notices the inclusion of an antiemetic odansetron (Zofran). What should the AG-ACNP do when discovering this medication?
- a. Nothing, as this is routine supportive care for these patients; serotonin syndrome can present, which is an uncomfortable state often accompanied by nausea.
  - b. Ask the patient if he is allergic to odansetron (Zofran), and if he indicates no, then plan to continue the medication and update the medication reconciliation form.
  - c. Discontinue the medication odansetron (Zofran), as a known side effect of the medication can lead to a fatal arrhythmia.
  - d. Look at the dosing of the medication, and if the medication dosing or frequency is incorrect, make any corrections needed.
16. An anxious and tachycardic patient who sustained blunt chest trauma presents with JVD, narrowing pulse pressure and distant heart tones. Immediate intervention for this patient would include:
- a. Chest tube insertion
  - b. Needle decompression
  - c. Pericardiocentesis
  - d. Intubation
17. In a patient with inability to move his lower extremities and no sensation below the nipple line, the AG-ACNP suspects a spinal lesion at or above which of the following levels:
- a. Cervical 7
  - b. Thoracic 4
  - c. Thoracic 10
  - d. Sacral 1
18. An elderly man fell 15 feet off a ladder, landing on his right side. He has fractures of rib 4 and rib 5, which are fractured both laterally and anteriorly. When he takes a deep breath, the injured area of his lung moves inward. The AG-ACNP diagnoses this as a/an:
- a. Tension pneumothorax
  - b. Hemothorax

- c. Open pneumothorax
  - d. Flail chest
19. What diagnostic/physical exam findings support an aortic injury?
- a. Widened mediastinum
  - b. Distinct aortic knob
  - c. Fractures of rib 3 and rib 4
  - d. Transverse process fractures of the thoracic spine
20. A trauma patient with a grade III splenic laceration complains of acute pain in the tip of the shoulder when he is lying down with legs elevated. The AG-ACNP knows this as which of the following signs:
- a. Cullen sign
  - b. Kehr's sign
  - c. Rovsing's sign
  - d. Psoas sign
21. A patient sustains a penetrating injury to the right eye when a pellet from a pellet gun entered the right orbit. The AG-ACNP is relieved when the ophthalmologist informs her the intraocular pressure is:
- a. 30 to 40 mmHg
  - b. 15 to 25 mmHg
  - c. 20 to 30 mmHg
  - d. 10 to 20 mmHg
22. Using the rule of nines, calculate the percentage of TBSA burned in a 60 kg male with burns covering his entire right leg, anterior thorax including the abdomen, and entire surface of both arms.
- a. 18%
  - b. 35%
  - c. 54%
  - d. 44%
23. Which of the following is part of the primary survey in a trauma patient?
- a. Head-to-toe exam
  - b. Airway assessment
  - c. Laboratory data
  - d. GI exam
24. Which of the following types of thoracic trauma requires a #36 French pleural chest tube to be placed:
- a. Flail chest
  - b. Cardiac tamponade
  - c. Hemothorax
  - d. Pneumothorax 40%

25. In an unstable trauma victim following a motor vehicle crash, a chest x-ray demonstrates a widened mediastinum, left second rib fracture, and deviation of the trachea to the right. The AG-ACNP is most concerned for a/an:
- Tension pneumothorax
  - Aortic rupture
  - Hemothorax
  - Flail chest
26. An AG-ACNP assesses a trauma during the secondary survey and notes the patient has right flank bruising and pain with inspiration. The AG-ACNP recognizes this is most commonly associated with injury to which organ?
- Kidney
  - Spleen
  - Liver
  - Gallbladder
27. Which of the following burn patients can be safely managed outside a level I trauma center?
- 44-year-old male diabetic with second-degree burn to his leg
  - 35-year-old with inhalation injury
  - 29-year-old with 15% third-degree burns
  - 25-year-old with 30% first-degree burns
28. Which of the following is most consistent with high-grade splenic trauma?
- Kernig's sign
  - Vomiting blood
  - Decreased WBC count
  - Positive focused assessment with sonography
29. A patient has been admitted from home with a peripherally inserted central catheter line for parenteral nutrition. She is lethargic, febrile, tachycardic, and hypotensive, requiring fluid resuscitation and vasopressor support. Blood cultures revealed heavy growth of Gram-positive cocci at 10 hours and the PICC line was immediately removed. This is an example of:
- Resuscitation therapy
  - Source control
  - Early goal-directed therapy
  - Inotrope therapy
30. Which of the following parameter(s) is an endpoint in the resuscitation of a patient in septic shock?
- Central venous pressure 4 to 8 mmHg
  - Lactate less than 2
  - Urine output less than 0.5 mL/kg/hr
  - Oxygen saturation greater than or equal to 95%

31. A 28-year-old patient is admitted to the ICU after being found in a motel room slumped over in a chair and unresponsive. He is intubated and now is being evaluated by the AG-ACNP. Laboratory evaluation shows a pH of 7.14, potassium 7.2 mEq/L, and a creatinine phosphokinase (CPK) of 40,000 U/L. He is producing little urine, which is dark and concentrated. Initial treatment includes:
- Aggressive volume resuscitation
  - Hemodialysis
  - Alkalization of urine
  - Diuretics
32. Upon completing a focused assessment with sonography for trauma examination in a multitrauma patient it is discovered that she has an acute splenic laceration with active bleeding. The patient's vital signs continue to downtrend despite administration of warmed 2 liters of lactated ringers and her blood pressure is now 70/50, heart rate 120 sinus tachycardia, and Glasgow Coma Scale score 12. Laboratory analysis reveals CBC of hemoglobin 6.0, hematocrit (HCT) 18.0, platelet count (PLT) 100k, international normalized ratio (INR) 3.0; chemistries reveal potassium 3.4, creatinine 2.0, lactate 3.0, calcium 8.5. A type and cross match was obtained for this patient. What is the best intervention for the AG-ACNP to take?
- Initiate the massive transfusion protocol and consult surgery.
  - Order 2 units of packed red blood cells and 1 unit FFP to supplement the active bleed.
  - Order 40 mEq of potassium and an ABG to assess for an anion-gap metabolic acidosis.
  - Attempt to contact the patient's family members to ascertain code status.
33. A 37-year-old male was brought to the ED. It was reported that he was a street performer who was seen on a street hunched over after he inhaled a large amount of fire. Upon arrival to the scene paramedics assessed his airway as intact, found second- and third-degree burns to his face, and noticed burn marks to his mouth and nares. His vital signs on initial assessment were stable with an SPO2 to 95% on room air. Upon arrival the ED he is found to have increasing oxygen demands, decreased breath sounds with wheezing bilaterally, and a hoarse voice that started upon arrival to the ED. What is the best initial intervention the AG-ACNP should complete?
- Obtain chest x-ray to assess for acute intrapulmonary findings.
  - Administer nebulized albuterol via cool mist nebulizer.
  - Prepare for rapid sequence intubation.
  - Request a bronchoscopy to evaluate for trauma to tracheobronchial tree.
34. The AG-ACNP is working at an urgent care clinic at a ski resort. She receives a report from the ski patrol that a 26-year-old snowboarder was found off the ski trail next to a tree. He was alert and oriented sitting next to the tree when the ski patrol arrived. He appeared to have lost control, flew off the trail, striking the tree. As the snowboarder appeared to be stable, he was requested to walk up the hill to the ski trail, which he did. This demonstrates:
- Assessment based on appearance rather than mechanism of injury
  - Appropriate request of the ski patrol, as using a toboggan to pull the patient up the hill would put their safety at risk
  - Standard protocol for emergency services



- d. Assessment based on mechanism of injury rather than appearance
35. A 36-year-old female is transported to the ED by the ambulance. The ambulance crew states that the patient was reported to have been skiing at a nearby ski resort when she fell and slid down the ski slope into a tree, striking the left side of her chest. She has been complaining of shortness of breath and left-sided chest wall and abdominal pain since the accident. She was wearing a helmet, denies head trauma or loss of consciousness, and has been hemodynamically stable during transport. Upon arrival, she is awake, alert, and oriented  $\times 4$ . She is holding the left side of her chest and appears to be in mild respiratory distress. She is able to talk and states, "I just had the wind knocked out of me," and continues to complain of difficulty breathing and extreme lateral chest wall and abdominal pain. What injuries would the AG-ACNP expect when evaluating this patient?
- Cardiac contusion
  - Liver laceration
  - Pneumothorax
  - Aortic injury
36. The AG-ACNP is caring for an older adult trauma patient who just arrived in the ED. She has the following injuries: left anterior/lateral rib fractures 1–7, left pulmonary contusion, small left pneumothorax, grade I splenic laceration. What is the best plan of care for this patient?
- Discharge home with Vicodin, rest, and follow-up in 24 hours.
  - Admit to ICU for monitoring and consider invasive pain management.
  - Admit to the inpatient acute care floor.
  - Observe in the ED for 6 hours and discharge home if stable.

### Multisystem Answers and Rationales

- a) Reduction of fracture with surgical consult.** The patient has compartment syndrome below the level of the complex fracture and needs immediate reduction to allow for appropriate blood flow to the area along with surgical consultation for repair. Pain relief is important but is not the initial therapy, nor is tetanus/IV administration. Although a DVT can present with decreased blood flow/pallor, the patient presented with symptoms to suggest compartment syndrome.
- b) Initiate dopamine after fluid optimization with crystalloids.** This patient is suffering from vasomotor deficits with lowering vascular tone that necessitates need for fluid optimization and subsequent addition of vasoactive agents (phenylephrine, dopamine, norepinephrine) or inotropes (dobutamine). Atropine is appropriate for symptomatic bradycardia but not for neurogenic shock. The administration of blood products is not appropriate since as this is not hemorrhagic shock. Although anaphylactic shock is a variation of distributive shock; epinephrine is not indicated in this given instance known mechanism of injury.
- b) Better than fluids rich in dextrose for resuscitation because high blood glucose can complicate critical illnesses and lower sodium.** Isotonic crystalloids are more acidic than blood (pH of lactated ringers (LR) is close to 7.0 and pH of normal saline (NS) is close to

5.5). Isotonic crystalloids are not better at osmotic regulation as they do not cause as much of an osmotic shift as hypertonic saline, and isotonic crystalloids do not cause hyponatremia.

4. c)

Heart rate	Blood pressure	Urine output last hour	Lactate	ABG: pH/PaCO <sub>2</sub> /PaO <sub>2</sub> /Sat/ Bicarb/Base excess
100	95/60	50 mL	2.0 mmol/L	7.40/41/94/24/-4

Good end points of resuscitation include closing of a metabolic acidosis via lactic acidosis, good urine output (reduction of a prerenal state) and stable hemodynamics. Trauma patients in the ED frequently present with a lactate greater than 4.0 accompanied by a metabolic acidosis on ABG and poor urine output, which may be in the setting of stable or unstable vital signs.

5. **b) Anticonvulsive medications.** Anticonvulsive medications are indicated to prevent and treat seizures which helps prevent secondary brain injuries, which can exacerbate primary injuries and increase mortality. Analgesics and sedatives can mask reduce the best neurological examination. The goal is to keep cerebral perfusion pressure greater than 40. Therapeutic hypothermia is not indicated; however, the literature remains controversial regarding targeted temperature management.
6. **d) HOB at greater than 30 degrees.** This patient is having increased intracranial pressure, thus raising the head of bed to greater than 30 degrees allows for drainage of the third and fourth ventricles which is necessary to allow adequate cerebral perfusion pressures (this is in reference to the Monro-Kellie Doctrine). BiPAP is insufficient to manage this patient's airway. Intubation is indicated. Failure to establish a permanent airway can exacerbate secondary brain injuries due to hypoxemia/hypercapnia. Maintaining c-spine precautions is appropriate but will not treat the life-threatening condition of increased intracranial pressure. Benzodiazepines can further depress mental status and are not indicated. They are also known for causing ICU delirium, but are essential if seizure activity is present.
7. **a) Clindamycin (Cleocin) 900 mg IV every 8 hours.** The most likely diagnosis given the patient's known history of otolaryngology surgery with likely retained packing is toxic shock Syndrome (strep/staph serving as the most likely organism). Beta lactams were historically used (PCNases); however, clindamycin is more in favor given increased coverage (Gram positive/aerobic). Levofloxacin is appropriate for CAP monotherapy. Flagyl and fluconazole are not indicated for sinusitis.
8. **a) Place the patient in droplet precautions with influenza testing.** Knowing elderly populations in long-term facilities (skilled nursing facility [SNF]/long term acute care hospital [LTAC]/nursing homes) are at an increased risk for exposure to communicable disease, the AG-ACNP chooses correctly to place the patient in droplet precautions to limit the risk of transmission of influenza and sends for a screening test. Bowel perforation is on the differential, but there is no described history to support this. While a central line and norepinephrine is the correct for use in the setting of septic shock, this question does not

indicate if the patient received sufficient fluids or if she responded to the fluids, thus this may be premature. Imodium is the correct dose for suspected gastroenteritis from an unknown etiology; however, acute gastroenteritis does not normally present with respiratory components.

9. **b) Adhere to evidence-based care bundles and are reviewed daily in multidisciplinary rounds.** Use of the A, B, C, D, E care bundles in an interdisciplinary manner has shown decreases in length of stay, complications, infections, and mortality. Daily cultures and escalation of antibiotics can have adverse outcomes. The goal is to deescalate antibiotics as soon as possible. Changing lines after an established time is not appropriate; lines do not need to be changed unless a cause is identified. Adapting a policy from a larger facility that has not been vetted appropriately through your institution can have adverse effects as different hospitals have differing populations and sizes.
10. **a) Order IV acetaminophen (Ofirmev) 1 g IV every 8 hours, orthopedic consult for reduction and splinting, and consult to pain specialist for further evaluation.** Given the patient's medical history use of IV Tylenol may offer reduction of immediate pain with consult to orthopedic specialist to reduce/repair fracture if needed and pain specialist to help with the plan moving forward. Patient will likely not tolerate IV ketorolac or hydromorphone given renal failure and already saturated opioid receptors. Consult to pain management is appropriate; however, anticipation of lower extremity block may be excessive and internal medicine/endocrine consult for neuropathy may be worked up as an outpatient.
11. **c) The patient likely has ischemic liver (shock liver) with gluconeogenesis failing to respond to the stressors on the body.** The identification of shock liver here is imperative as liver synthesis dysfunction is an ominous sign of liver failure. Supportive measures are needed to ensure fulminant liver failure is not allowed to occur. Antibiotics can be mixed in a dextrose solution, thus causing glucose levels to rise. Assuming a patient has diabetes is not accurate. Insulin does not accumulate in body tissues as other agents such as (i.e., benzodiazepines) and is cleared after the drip is discontinued.
12. **c) With leukocytosis, fever, and tachycardia with a known bloodstream infection.** It is important for an AG-ACNP to recognize that other etiologies can cause SIRS criteria; however, it is necessary to differentiate between patients with SIRS and sepsis.
13. **d) Two large bore IVs are placed and possible placement of a central catheter if vasoactive agents are required.** Per the surviving sepsis campaign directive: a patient should have two large bore IVs and placement of central catheter if vasoactive agents are required. Serum lactate should be drawn every 6 to 8 hours. There is a 50% risk of mortality associated with hypoglycemia in the setting of septic shock. Permissive hyperglycemia (140–180 mg/dl) is allowed. Blood cultures ideally should be drawn before antibiotics are started, not after.
14. **b) Increase oxygen to high flow/non-rebreather mask (NRB) 100% as this patient is likely suffering from CO toxicity.** All of the aforementioned answers can cause an altered mental status; however, given the fact that the patient was rescued from an apartment fire,

she is suspected to have CO poisoning. A head CT and blood glucose are appropriate in the right clinical scenario. CO has a higher affinity for binding to the blood, therefore, it will take 250 to 320 minutes to clear, thus making ventilating with 100% oxygen the best clinical choice for this patient.

- 15. c) Discontinue the medication ondansetron (Zofran) as a known side effect of the medication can lead to a fatal arrhythmia.** SSRIs cause QTc prolongation, a common side effect in Zofran (a commonly prescribed medication in ICU settings). Recognition of this early on is an important finding that needs to be immediately addressed. Continuing this medication in any dose can cause harm and is not the safest action. Serotonin syndrome may present with nausea.
- 16. c) Pericardiocentesis.** JVD, narrowing pulse pressure, and distant heart tones are signs of pericardial tamponade, a complication of blunt trauma and a true cardiac emergency. The immediate intervention is pericardiocentesis. The patient may need surgical intervention. Needle decompression or chest tube would treat a pneumothorax. A chest tube can also treat a hemothorax. Intubation may be needed later but the immediate life-saving intervention is a pericardiocentesis.
- 17. b) Thoracic 4.** Sensation at the level of the nipple line is indicative of Thoracic 4 or above injury. The middle finger is Cervical 7, the level of the umbilicus is Thoracic 10, and sensation at the back of the leg is indicative of Sacral 1 or above spinal trauma lesion.
- 18. d) Flail chest.** A flail chest occurs with two or more ribs fractured in two places and results in a floating rib section that moves paradoxically to normal inspiration and expiration. Tension pneumothorax is life threatening and occurs when air enters but does not exit the pleural space and puts pressure on the mediastinal structures. A hemothorax is a collection of blood in the pleural space, and with an open pneumothorax air enters and exits the chest cavity through the chest wound.
- 19. a) Widened mediastinum.** A widened mediastinum is a hallmark of aortic injury. Obliteration of the aortic knob, fracture of the first or second rib and/or scapula as well as circulatory collapse are all findings associated with aortic injury. Transverse process fractures are too far away to cause injury to the aorta.
- 20. b) Kehr's sign.** Cullen sign is periumbilical ecchymosis indicative of retroperitoneal bleeding. Palpation of the left lower quadrant causing increased pain in the right lower quadrant is Rovsing's sign and may indicate appendicitis. Psoas sign, also called ilio-psoas sign, occurs when passive extension of the right hip causes pain in the right iliac fossa.
- 21. d) 10 to 20 mmHg.** Normal intraocular pressure in penetrating ocular injury is 10–20 mmHg.
- 22. c) 54%.** In the rule of nines calculation, a leg is 18%, anterior thorax is 18%, and each arm is 9%, for a total of 54% TBSA burn.

- 23. b) Airway assessment.** The primary survey focuses on airway, breathing, circulation, disability (neurologic exam), and exposure and environmental control. The head to toe exam, laboratory data, and gastrointestinal assessment are part of the secondary survey.
- 24. c) Hemothorax.** A hemothorax, tension pneumothorax, and pneumothorax of 40% or more require a chest tube. A flail chest may require internal stabilization with intubation and positive pressure ventilation. Cardiac tamponade requires a pericardiocentesis or pericardial window.
- 25. b) Aortic rupture.** All of these signs on chest x-ray are suggestive of aortic rupture. A tension pneumothorax, hemothorax, and flail chest would not have a widened mediastinum.
- 26. a) Kidney.** Bruising of the flank is referred to as Grey Turner's sign and is indicative of a potential kidney injury.
- 27. d) 25-year-old with 30% first-degree burns.** The patient with first-degree burns can be managed and discharged from a nonburn center. The American Burn Association criteria for transfer to a burn center includes 10% partial thickness burns; any full thickness burn; electrical, chemical, or inhalation injuries; burn of the hands, feet, perineum, face, or major joints; and when there is increased risk for mortality including preexisting medical conditions. Patients with diabetes, inhalation injury, and third-degree burns would require transport to a burn center.
- 28. d) Positive focused assessment with sonography.** A positive focused assessment with sonography for trauma exam will be positive when the splenic capsule is disrupted. An elevated, not decreased, WBC count is associated with splenic injury. A decrease in hemoglobin and hematocrit are expected findings from blood loss associated with splenic injury. Kehr's sign is considered a classic sign of ruptured spleen; pain in the shoulder from irritation of the diaphragm. Kernig's sign is seen in meningitis.
- 29. b) Source control.** This is an example of source control, which is one of the tenets in the treatment of sepsis. Will resuscitation therapy, early goal directed therapy, and inotrope therapy are part of the bundle for sepsis, it is important to look at source control, which is the removal of the catheter.
- 30. b) Lactate less than 2.** The endpoints of resuscitation include lactate clearance, CVP 8 to 12, urine output (UOP) greater than 0.5 mL/kg/hr, mixed venous oxygenation 70% to 85%.
- 31. a) Aggressive volume resuscitation.** Volume expansion regardless of the type of agent is the most important treatment modality. Hemodialysis is not indicated yet. Diuretics and hemodialysis may be of help once the patient has been adequately fluid resuscitated. Alkalinization of urine has not proven to be beneficial.
- 32. a) Initiate the massive transfusion protocol and consult surgery.** Although it is important to recognize that the patient likely has a metabolic acidosis (likely secondary to lactic acidosis resulting from hypoperfusion) and the patient has mild hypokalemia, this is not the

initial area of concern. Ordering 2 units of PRBC and 1 FFP may help initially to control bleeding, but the exact degree of resuscitation cannot be predicted and it is imperative to order more products for the patient as she is likely going to need a surgical intervention with more anticipated blood loss. It is extremely important to attain the code status of the patient; however, the initial action of the NP is to ensure an appropriate resuscitation is transpiring.

- 33. c) Prepare for rapid sequence intubation.** Immediate placement of a definitive airway is required in this patient given his declining respiratory status and changes to phonation after witnessed inhalation of an open flame. Consulting pulmonary medicine and chest radiography are likely secondary medical treatments; however, the initial treatment is to secure his airway. Nebulized albuterol is the treatment of choice for wheezing associated with asthma but should not be initially considered for this patient.
- 34. a) Assessment based on appearance rather than mechanism of injury.** This patient was assessed based on appearance rather than mechanism of injury. The patient appeared to be a young healthy adult and requesting him to walk up the hill, rather than perform a primary survey of the patient, indicated mechanism of injury was not considered.
- 35. c) Pneumothorax.** Blunt chest trauma can cause severe injuries. Rib fractures are the most common injury sustained following blunt chest trauma and the significance of rib injuries should never be underestimated. Upper ribs (1–3) may indicate a high magnitude of injury, placing the head, spine, and great vessels at risk. The majority of blunt trauma tend to affect the middle ribs (4–9) forcing the ends of the bones into the thorax, which may cause a pneumothorax. Splenic injury may occur with blunt trauma to the left side of the chest wall. A cardiac contusion and aortic injury are possible, they are not the most likely injuries given the mechanism and hemodynamic stability.
- 36. b) Admit to ICU for monitoring and consider invasive pain management.** A common pitfall with rib fractures is underestimating the severe pathophysiology that can occur, especially in older adults and the elderly. Rib fractures are common and fractures can be significant in a patient with trauma to the thoracic cage. Rib fractures are painful and for those individuals who have suffered blunt trauma to the chest wall with several rib fractures, pain control is essential in order to prevent splinting that can lead to atelectasis and pneumonia. Continuous epidural infusion has been found to be helpful with these patients. Pulmonary contusions following rib fractures can be lethal. Patients need to be observed closely for 24 to 48 hours as respiratory failure can occur.

## Bibliography

- Agnihotri, N., & Agnihotri, A. (2014). Transfusion associated circulatory overload. *Indian Journal of Critical Care Medicine*, 18(6), 396–398. doi:10.4103/0972-5229.133938
- American College of Surgeons Committee on Trauma. (2012). *Advanced trauma life support* (9th ed.). Chicago, IL: American College of Surgeons.
- ARDS Network. (2017). *Mechanical ventilation protocol summary*. Retrieved from [http://www.ardsnet.org/files/ventilator\\_protocol\\_2008-07.pdf](http://www.ardsnet.org/files/ventilator_protocol_2008-07.pdf)

- Bauer, S. (2015). *Using teamwork to improve patient outcomes*. Society of Critical Care Medicine. Retrieved from <http://www.sccm.org/Communications/Critical-Connections/Archives/Pages/Using-Teamwork-to-Improve-Patient-Outcomes.aspx>
- Bickley, L., & Szilagy, P. (2013). *Bates' guide to physical examination and history taking*. Philadelphia, PA: Lippincott.
- Buckley, N. A., Dawson, A. H., & Isbister, G. K. (2014). Serotonin syndrome. *British Medical Journal*, *348*, g1626. doi:10.1136/bmj.g1626
- Centers for Disease Control and Prevention. (2018). *Influenza*. Retrieved from <https://www.cdc.gov/flu/index.htm>
- Dellinger, R. P., Levy, M. M., Rhodes, A., Annane, D., Gerlach, H., Opal, S. M., & Jaeschke, R. (2013). Surviving sepsis campaign: International guidelines for management of severe sepsis and septic shock, 2012. *Intensive Care Medicine*, *39*(2), 165–228. doi:10.1097/CCM.0b013e31827e83af
- Emergency Nursing Association. (2014). *TNCC: Trauma nursing core course provider* (7th ed.). Des Plaines, IL: Emergency Nurses Association.
- Ethgen, O., Schneider, A. G., Bagshaw, S. M., Bellomo, R., & Kellum, J. A. (2015). Economics of dialysis dependence following renal replacement therapy for critically ill acute kidney injury patients. *Nephrology, Dialysis, Transplantation*, *30*(1), 54–61. doi:10.1093/ndt/gfu314
- Gerlach, A. T., & Dasta, J. F. (2007). Dexmedetomidine: An updated review. *Annals of Pharmacotherapy*, *41*(2), 245–254. doi:10.1345/aph.1H314
- Holcomb, J. B., Wade, C. E., Michalek, J. E., Chisholm, G. B., Zarzabal, L. A., Schreiber, M. A., & Park, M. S. (2008). Increased plasma and platelet to red blood cell ratios improves outcome in 466 massively transfused civilian trauma patients. *Annals of Surgery*, *248*(3), 447–458. doi:10.1097/SLA.0b013e318185a9ad
- Kasper, D., Hauser, S., Jameson, J., Fauci, A., Longo, D., & Loscalzo, J. (2015). *Harrison's principles of internal medicine* (19th ed.). New York, NY: McGraw-Hill.
- Kunisawa, T. (2011). Dexmedetomidine hydrochloride as a long-term sedative. *Therapeutics and Clinical Risk Management*, *7*, 291. doi:10.2147/TCRM.S14581
- Madden, L. K., Hill, M., May, T. L., Human, T., Guanci, M. M., Jacobi, J., & Badjatia, N. (2017). The implementation of targeted temperature management: An evidence-based guideline from the neurocritical care society. *Neurocritical Care*, *27*(3), 468–487. doi:10.1007/s12028-017-0469-5
- Marx, J. A., Hocksberger, R. S., Walls, R. M., Biros, M. H., Ling, L. J., Danzl, D. F., & Jagoda, A. (2014). *Rosen's emergency medicine concepts and clinical practice* (8th ed.). Philadelphia, PA: Saunders.
- Office on Women's Health U.S. Department of Health and Human Services. (2015). *Sexually transmitted infections, pregnancy, and breastfeeding*. Retrieved from <https://www.womenshealth.gov/a-z-topics/stis-pregnancy-and-breastfeeding>

- Parrillo, J., & Dellinger, R. (2013). *Critical care medicine: Principles of diagnosis and management in the adult* (4<sup>th</sup> ed.). Philadelphia, PA: Elsevier.
- Singer, M., Deutschman, C. S., Seymour, C. W., Shankar-Hari, M., Annane, D., Bauer, M., & Angus, D. C. (2016). The third international consensus definitions for sepsis and septic shock (Sepsis-3). *JAMA*, *315*(8), 801–810. doi:10.1001/jama.2016.0287
- Walker, P. F., Buehner, M. F., Wood, L. A., Boyer, N. L., Driscoll, I. R., Lundy, J. B., & Chung, K. K. (2015). Diagnosis and management of inhalation injury: An updated review. *Critical Care (London, England)*, *19*(1), 351. doi:10.1186/s13054-015-1077-4
- Wyckoff, M., Houghton, D., & LePage, C. (2009). *Critical care concepts, role, and practice for the acute care nurse practitioner*. New York, NY: Springer Publishing Company.