Case Studies in Critical Care of the Surgical Patient

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In the United States, 20% of all hospital stays require an intensive care unit admission (ICU). There are nearly 6000 ICUs in the United States with nearly 60,000 ICU beds. Dedicated surgical ICUs represent 12% of all total ICUs, while 65% of U.S. ICUs are mixed medical-surgical units. The most common reason patients require ICU care is organ failure. For surgical patients not suffering organ failure, ICU admission for close monitoring commonly follows operations that are high risk or are performed in high-risk patients. Slightly less than 5% of all ICU admissions are trauma patients.

ICU care is expensive and complicated, and strategies are being developed to reduce the morbidity and mortality of patients requiring intensive care. For surgical patients, goal-directed care and rapid recognition and treatment of potential complications have resulted in increased long-term survival benefits. ICU care in surgical patients has also led to increases in survival by avoidance of postoperative complications. This manual uses case presentations to highlight and review major concepts in intensive care of the surgical patient, including acute kidney injury, acute respiratory failure, and nutrition.

### CASE 1 PRESENTATION

**PRESENTATION**

A 42-year-old man was involved in a high-speed motor vehicle collision 48 hours prior. He underwent an emergent exploratory laparotomy with splenectomy and colon resection at the time of initial presentation. He remains critically ill, requiring mechanical ventilation. He initially received several units of blood products and has received maintenance intravenous fluids in the last 24 hours. His urine output has been 0.2 mL/kg/hour for the last 12 hours.

- What are the potential causes for low urine output?

### ACUTE KIDNEY INJURY

Renal dysfunction is common in ICU patients, occurring in about 5% to 20% of all patients, and is termed acute kidney injury (AKI). AKI is defined as an abrupt decline in the ability of the kidney to filtrate waste products (glomerular filtration rate, GFR) in the blood, resulting in acute azotemia. The etiology of AKI in the critically ill patient includes prerenal azotemia, intrinsic renal parenchymal disease, or postrenal azotemia. The common pathway of prerenal azotemia is decreased renal perfusion resulting from a decrease in the extracellular volume from excessive volume losses (hemorrhage), decreased effective circulating volume (heart failure), or excessive third-spacing in the interstitial spaces from conditions such as pancreatitis or intra-abdominal sepsis. Prerenal azotemia is generally considered reversible if the causative etiology is addressed in a timely manner. If not addressed, it can progress to a type of intrinsic renal disease that affects the tubules known as acute tubular necrosis (ATN), which is the most common type of AKI occurring in hospital settings. Intrinsic renal parenchymal disease can be preexisting in surgical ICU patients or develop as a result of profound volume depletion leading to ATN. The etiology of postrenal azotemia is generally an obstructive process, and in patients who have recently undergone intra-abdominal operation this should be excluded as a cause of postoperative renal dysfunction. Obstructive causes can include ureteral injury or urethral/prostate obstruction. Hemorrhage in the bladder can lead to clot formation in a trauma patient, causing secondary obstruction of the urethra.

- What is the workup for suspected AKI in a critically ill surgical patient?

All patients should have a Foley catheter placed to monitor hourly urine output and relieve any urethral or prostate obstruction. If concern exists for postrenal azotemia causes, a renal ultrasound should be performed to rule out hydronephrosis. If a Foley