CME

Ali A. Sovari, MD, Ivan Zama, MD, John F. Hill, MD, Michael Freeland, MD

Who Should Be Admitted to the Intensive Care Unit?

Introduction

The way in which an Intensive Care Unit's (ICU) resources are utilized can have a major impact on total healthcare outcomes. Therefore, criteria for ICU admission, triage and discharge should be considered carefully, keeping in mind the general guidelines and the scope of services provided by each ICU and the patient population they serve. Hospital policies for ICU admission, triage and discharge should also be reviewed and revised on a regular basis, and compliance with the policies should be monitored in an appropriate forum. In most institutions this would be reviewed by the ICU committee.

These committees help regulate admissions when the unit is full, including the limiting of elective surgeries and the re-routing of critical care admissions from the Emergency Department to other units. Hospital staff, specifically non-intensivist physicians, should be fully informed of the ICU policies. This article will discuss the appropriate considerations and criteria for ICU admission for both intensivists and non-intensivist physicians.

Discussion

The Society of Critical Care Medicine (SCCM) provides guidelines for ICU admission in three different models: the Diagnosis Model, the Objective Parameters Model, and the Prioritization Model.[1]

The **Diagnosis Model** guidelines list a number of diseases in each specialty or organ system usually requiring management in an ICU.

CARDIAC SYSTEM

- Acute myocardial infarction (MI) with complications
- Cardiogenic shock
- Complex arrhythmias requiring close monitoring and intervention
- Acute congestive heart failure (CHF) with respiratory failure and/or requiring hemodynamic support
- Hypertensive emergencies
- Unstable angina particularly with dysrhythmias, hemodynamic instability or persistent chest pain
- Status post cardiac arrest
- Cardiac tamponade or constriction with hemodynamic instability
- Dissecting aortic aneurysm
- Complete heart block

The authors would add to this list patients with second degree atrioventricular block Mobitz 2 and patients with cardiogenic pulmonary edema who need to be closely monitored.

PULMONARY SYSTEM

- Acute respiratory failure requiring ventilatory support
- Pulmonary emboli with hemodynamic instability
- Patients in an intermediate care unit (IMCU) who are demonstrating respiratory deterioration
- Need for nursing/respiratory care not available in the less acute care areas
- Massive hemoptysis
- Respiratory insufficiency with possible intubation (authors: or risk of deterioration)

In addition to these diagnoses suggested in the SCCM guidelines, the authors would also include a patient with a persistent, severe asthmatic attack as one who should be considered for admission to ICU.

NEUROLOGIC DISORDERS

- Acute stroke with altered mental status (AMS)
- Coma: metabolic, toxic, or anoxic
- Intracranial hemorrhage with potential for herniation
- Acute subarachnoid hemorrhage
- Meningitis with AMS or respiratory compromise
- Central nervous system (CNS) or neuromuscular disorders with deteriorating neurologicor respiratory function
- Status epilepticus
- Brain-dead or potentially brain-dead patients who are being aggressively managed for the purpose of organ donation
- Vasospasm
- Severe head-injured patients

The authors add acute delirium as another condition that may warrant ICU admission.

DRUG INGESTION AND DRUG OVERDOSE

- Hemodynamically unstable drug ingestion
- Drug ingestion with significant AMS with inadequate airway protection
- Seizures following drug ingestion

The authors suggest considering ICU admission for patients with severe drug withdrawal syndrome.

GASTROINTESTINAL DISORDERS

- Fulminant hepatic failure
- Severe pancreatitis
- Esophageal perforation with or without mediastinitis
- Life threatening gastrointestinal bleeding, including that associated with hypotension, angina, continued bleeding or risk of rebleeding, or with comorbid conditions

SURGICAL

- Post-operative patients requiring hemodynamic monitoring/ventilatory support or intensive nursing care

ENDOCRINE

- Diabetes ketoacidosis (DKA) complicated by hemodynamic instability, AMS, respiratory insufficiency, or severe acidosis
- Thyroid storm or myxedema coma with hemodynamic instability
- Hyperosmolar state with coma and/or hemodynamic instability
- Adrenal crisis with hemodynamic instability
- Severe hypercalcemia with AMS, requiring hemodynamic monitoring
- Hypo- or hypernatremia with seizures, AMS
- Hypo- or hypermagnesemia with hemodynamic compromise or dysrhythmias
- Hypo- or hyperkalemia with dysrhythmias or muscular weakness
- Hypophosphatemia with muscular weakness

MISCELLANEOUS

- Septic shock with hemodynamic instability
- Hemodynamic monitoring
- Clinical conditions requiring ICU-level nursing care
- Environmental injuries (lightning, near drowning, hypo- or hyperthermia)
- New/experimental therapies with potential for complications

Environmental injuries that require intensive care are not limited to the SCCM guidelines and may include other conditions such as smoke inhalation. Additionally, patients with systemic inflammatory response syndrome may need intensive care.

The real advantage of this model is its simplicity. However, it does not prioritize among the above-mentioned diagnoses and also does not consider objective data such as vital signs. For example, it is not clear whether the guidelines recommend ICU admission for a patient with mild epigastric pain and mild elevation of amylase and lipase but compromised vital signs. Therefore, this easy-to-use model is best used as a screening tool; it is not comprehensive and specific enough to recommend a final decision about admission to the ICU. It is also beneficial if the patient's comorbidities are considered as well. For example, severe pneumonia in a patient with no comorbidities carries less risk than in a patient with several cardiovascular problems or who is immunosuppressed.

The **Objective Parameters Model** uses objective findings such as vital signs, laboratory values, radiographic findings, electrocardiographic findings and physical findings.

VITAL SIGNS

- Pulse <40 or >150 beats per minutes
- Systolic blood pressure <80mm Hg, or 20mm Hg below the patient's usual pressure
- Mean arterial pressure <60mm Hg
- Diastolic arterial pressure >120mm Hg
- Respiratory rate >35 breaths/minute

The authors suggest considering the patient's usual blood pressure as the background level when making a

decision for ICU admission. For example, a patient with a systolic blood pressure of usually 90mm Hg who now has a systolic blood pressure of 80mm Hg; although this patient may need careful observation and intervention, he or she may not need to be admitted to the ICU.

LABORATORY VALUES

- Serum sodium <110 mEq/L or >170 mEq/L
- Serum potassium <2 mEq/L or >7 mEq/L
- PaO_2 <50 mm Hg
- pH <7.1 or > 7.7
- Serum glucose >800 mg/dL
- Serum calcium >15 mg/dL
- A toxic level of a drug or other chemical substance in a hemodynamically or neurologically compromised patient

RADIOGRAPHY/ULTRASONOGRAPHY/ TOMOGRAPHY

- Cerebral vascular hemorrhage, contusion or subarachnoid hemorrhage with AMS or focal neurologic signs
- Ruptured viscera, bladder, liver, esophagus, or uterus with hemodynamic instability
- Dissecting aortic aneurysm

ELECTROCARDIOGRAM

- Myocardial infarction (MI) with complex arrhythmias, hemodynamic instability or CHF
- Sustained ventricular tachycardia (VT) or ventricular fibrillation (VF)
- Complete heart block with hemodynamic instability

PHYSICAL FINDINGS (acute onset)

- Unequal pupils in an unconscious patient.
- Burns covering >10% body surface area
- Anuria
- Airway obstruction
- Coma
- Status epilepticus
- Cyanosis
- Cardiac tamponade

Among the above-mentioned conditions from SCCM guidelines, anuria should be assessed carefully before considering the patient for an ICU admission since it may have an easily correctable cause such as dehydration.

This model does not take into account the underlying medical conditions that a patient may have or the context in which the abnormalities are seen. Clearly a young healthy asymptomatic athlete with a heart rate of 40 does not have equal priority as the 85-year-old patient with multiple comorbidities and the same heart rate. Indeed, an important parameter that is not included in the guidelines is the patient's age, which affects the outcome in the majority of the medical conditions; for example, very young and elderly patients are at higher risk for hemodynamic instability.

The Objective Parameters Model may give better insight into the current physiologic status of the patient but it does not consider current medical diagnosis, while the opposite is true of the Diagnosis Model. However, neither considers the associated comorbidities. In addition, the Objective Parameters Model does not look at the improvements that may occur as a result of resuscitative efforts. However, by combining the two models the accuracy of the guidelines increases significantly and the simplicity is preserved. A combined model of Diagnosis and Objective Parameters would seem to be ideal for non-intensivist physicians to determine whether their patients in the emergency department or medical or surgical floor should be considered for transfer to an ICU.

The likelihood of requiring intensive care increases significantly if the patient has multiple criteria of both the Diagnosis and Objective Parameters models.
Some examples:

- A patient with acute MI and hypotension and bradycardia may need intensive care more so than a patient with acute MI but normal blood pressure and heart rate.
- A patient with sepsis and acute MI may need more intensive care than a patient with sepsis but no acute MI.
- An alcoholic patient in delirium tremens with acute esophageal variceal bleeding and hypotension needs more intensive care than an alcoholic patient in withdrawal.

However, such a model does not have enough accuracy and depth to be used by intensivists to determine which patients would truly benefit from ICU-level care. More importantly, it does not prioritize patients. For example, the guidelines do not give guidance on how to choose between a patient with severe pancreatitis and another with fulminant hepatic failure in situations where beds are not available for both.

The **Prioritization Model** is a more comprehensive model that divides patients into four levels of priorities:

1: Patients are critically ill, unstable and in need of intensive treatment and monitoring.
2: Patients require close monitoring as they may need urgent intervention based on their clinical conditions.
3: Patients are critically ill or could require urgent intervention, but with multiple underlying medical problems they have a low likelihood of recovery.
4: Patients represent the two extremes: not ill enough or with terminal or irreversible illness or disease that they would not benefit from ICU care.

This Prioritization Model is not based solely on diagnosis, laboratory values or vital signs but rather on a bigger clinical picture. In other words, in the Diagnosis Model the decision-making is based on medical diagnoses; in the Objective Parameters Model it is based on current objective clinical information of the patient; but in the Prioritization Model the decision is based on predicting the course of the disease. This characteristic makes the Prioritization Model superior to the other two and requires that the physician who uses it has expertise and experience in the field of critical care medicine.

The authors believe that combining the Prioritization Model with the other two models is not practical since the Prioritization Model uses a completely different scale to prioritize ICU admissions. The authors recommend that non-intensivists use the Diagnosis and Objective Parameters Models in deciding whether to consult an intensivist about the possible ICU admission of a patient. Table 1 below provides a summary of all models. The likelihood of necessity of intensive care is increased significantly when there are multiple criteria from these two models. The intensivists may use the Priority Model to make the final admission or non-admission decision based on his/her clinical experience and available resources. Appropriate ICU utilization has great impact on patient outcome and the healthcare economy.

Table 1. Summary of the characteristics of each model of Society of Critical Care Medicine guidelines for Critical Care Unit admissions

Diagnosis Model	Based on certain diagnoses; easy to use; can be applied by non-intensivists.
Objective Parameters Model	Based on certain objective clinical and laboratory or radiographic data; easy to use; can be applied by non-intensivists
Combined Diagnosis and Objective Parameters Model	Presence of several criteria from each of these two models increases the likelihood of necessity of ICU admission; consider the patient's age and underlying co-morbidities as well.
Prioritization Model	Based on predicting the course of the disease; takes into consideration whether the patient will benefit from an ICU admission; gives least priority to patients who are not critically ill or who have terminal or irreversible diseases; considers available resources and requires greater experience and expertise in the field of critical care medicine.

Ali Sovari, MD, is an Internal Medicine Resident at the University of Illinois College of Medicine at Urbana-Champaign.

Ivan Zama, MD, is an Internal Medicine Resident at the University of Illinois College of Medicine at Urbana-Champaign.

John Hill, MD, is a full-time intensivist at Carle Foundation Hospital and a Clinical Associate Professor of Medicine at the University of Illinois College of Medicine at Urbana-Champaign.

Michael Freeland, MD, is board certified in Internal Medicine, Nephrology, and Critical Care Medicine. He is a full-time intensivist and the current co-director of the Surgical ICU at Carle Foundation Hospital.

Reference

1. Guidelines for intensive care unit admission, discharge and triage. Task Force of the American College of Critical Care Medicine, The Society of Critical Care Medicine. Crit Care Med 1999;27(3):633–638

CME Questions 5a-c

Please select the best answer for the following:

5a. Which of the following is important and relevant in considering a patient for intensive care unit admission?
   a. The main working diagnosis
   b. Vital signs, physical findings, laboratory and imaging findings
   c. The patient's age and comorbidities
   d. Experience and available resources of the ICU
   e. All of the above

5b. All patients with mean arterial pressure of less than 60mm Hg should be transferred to the intensive care unit.
   a. True
   b. False

5c. Non-intensivists may refer to the list of diagnoses and objective parameters suggested by Society of Critical Care Medicine to consider their patients for referral to an intensivist for an ICU admission. Intensivists may make the final decision based on the prioritization model criteria and available expertise and resources in the ICU.
   a. True
   b. False