Managing Arrhythmias in the Intensive Care Unit

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Cynthia Tracy, MD[a,*], Ali Boushahri, MD[b]

KEY POINTS

- Patients admitted to the intensive care unit (ICU) are at increased risk for cardiac arrhythmias.
- Cardiac arrhythmias are common in the ICU, and can be either the initial reason for admission to the ICU or a consequence of the medical condition.
- Exacerbating and contributing factors are multiple, and management of the patient requires a careful determination of these factors and correction where possible.

INTRODUCTION

Patients admitted to the intensive care unit (ICU) are at increased risk for cardiac arrhythmias, which may be either the primary reason for ICU admission or a contingency in the critically ill patient. This article addresses the occurrence of arrhythmias in the critically ill patient, and their pathophysiology, implications, recognition, and management.

PATHOPHYSIOLOGY

Although patients can be admitted to the ICU with a variety of conditions, the critical nature of their underlying processes and the supportive measures used to treat them can contribute to an elevated catecholamine state. Coupled with fluctuations in intravascular volume, electrolyte disturbances, and other metabolic derangements, this places patients at risk for cardiac arrhythmias. The incidence of arrhythmia in the ICU patient can approach 40%, most typically associated with conditions such as septic shock and respiratory failure.[1] The most common arrhythmias in the ICU setting can be divided into 2 basic categories: (1) tachyarrhythmias (eg, atrial fibrillation [AF] and atrial flutter, ventricular arrhythmias, and other supraventricular tachycardias [SVTs]) and (2) bradyarrhythmias (eg, junctional rhythm, sinus bradycardia, and atrioventricular [AV] conduction block).

[a] Department of Medicine, George Washington University, 2150 Pennsylvania Avenue, Northwest, Washington, DC 20037, USA; [b] Cardiovascular Medicine, George Washington University, Medical Faculty Associates, 2150 Pennsylvania Avenue, Northwest, Washington, DC 20037, USA
* Corresponding author.
E-mail address: ctracy@mfa.gwu.edu

Predictors of tachyarrhythmia occurrence in ICU patients include the use of stimulant drugs such as norepinephrine, and a high APACHE II score ($\geq$25) (see the article on Cardiogenic Shock by Shah and colleagues elsewhere in this issue). For those with bradyarrhythmias, identified predictors include the use of norepinephrine (which is a predictor of both tachyarrhythmia and bradycardia), arterial pH less than 7.3, and HCO$_3$ level of 18 mEq/L or higher (see **Box 1** for common risk factors).[1]

CONSEQUENCES OF ARRHYTHMIAS IN THE INTENSIVE CARE UNIT

The presence of arrhythmia, especially ventricular fibrillation (VF), symptomatic sinus bradycardia, and junctional bradycardia, in the medical ICU has been associated with higher in-hospital mortality. Tongyoo and colleagues[1] reported on a single-center population of 247 ICU patients (mean age 58.5 years; mean APACHE II score 20.1). In this group of critically ill patients, arrhythmias were seen in 39.7%. The mortality among patients who developed arrhythmias was significantly higher than among those who did not. Among those who developed significant bradyarrhythmias (sinus or junctional) the mortality was 88.7%, and in those with tachyarrhythmias (particularly VF) the mortality was 66.7%, compared with 18.1% mortality ($P<.001$) in patients free of arrhythmias.

Similar results were seen by Annane and colleagues[2] among 1341 medical ICU patients, sustained arrhythmias being seen in 12% of patients. In this population, in-hospital death rates were 17% in patients without arrhythmia; 29% in patients with supraventricular arrhythmia (SVA); 73% in patients with ventricular arrhythmia (VA); and 60% in patients with conduction abnormalities.

The occurrence of arrhythmias in the ICU population can be associated with a prolonged stay in hospital.[3] Polanczyk and colleagues[3] reported on 4181 patients aged 50 years or older who presented in sinus rhythm and underwent nonemergency, noncardiac procedures. In this group of patients, perioperative SVAs were seen in in 317 patients (7.6%). Independent preoperative correlates for the occurrence of these arrhythmias included male sex, age 70 years or older, history of valvular heart disease or heart failure, and prior history of SVA or asthma. The occurrence of SVA was associated with a 33% increase in length of stay after adjustment for other clinical data ($P<.001$).

Goodman and colleagues[4] reported on both short-term and long-term consequences of arrhythmias in the ICU population. This study included 611 patients

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Box 1
Risk factors for arrhythmia in the intensive care unit

- Male gender
- Age greater than 70 years
- Cardiac disease (coronary artery disease, heart failure, valvular disease)
- Pulmonary disease (asthma)
- Thyroid disease
- Critically ill (APACHE score $\geq$25)
- Volume fluctuations
- Electrolyte disturbances
- Metabolic derangements
- Vasopressors