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Impact and treatment success of new-onset atrial fibrillation with rapid ventricular rate development in the surgical intensive care unit



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ABSTRACT

Background: Atrial fibrillation (AF) with rapid ventricular rate (RVR; heart rate >100) in noncardiac postoperative surgical patients is associated with poor outcomes. The objective of this study was to evaluate the practice patterns of AF management in a surgical intensive care unit to determine practices associated with rate and rhythm control and additional outcomes.

Materials and methods: Adult patients (≥ 18 y) admitted to the surgical intensive care unit (SICU) from June 2014 to June 2015 were retrospectively screened for the development of new-onset AF with RVR. Demographics, hospital course, evaluation and treatment of AF with RVR, and outcome were evaluated and analyzed.

Results: Thousand seventy patients were admitted to the SICU during the study period; 33 met inclusion criteria (3.1%). Twenty-six patients (79%) had rate and rhythm control within 48 h of AF with RVR onset. β -Blockers were the most commonly used initial medication (67%) but were successful at rate and rhythm control in only 27% of patients (6/22). Amiodarone had the highest rate of success if used initially (5/6, 83%) and secondarily (11/13, 85%). Failure to control rate and rhythm was associated with a greater likelihood of comorbidities (100% versus 57%; $P = 0.06$).

Conclusions: New-onset AF with RVR in the noncardiac postoperative patient is associated with a high mortality (21%). Amiodarone is the most effective treatment for rate and rhythm control. Failure to establish rate and rhythm control was associated with cardiac comorbidities. These results will help to form future algorithms for the treatment of AF with RVR in the SICU.

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Introduction

Postoperative atrial fibrillation (POAF) with rapid ventricular rate (RVR) in noncardiac surgical, trauma,¹ and intensive care unit (ICU) patients² is of significant clinical concern. Mortality is twice as great in critically ill surgical patients who develop atrial fibrillation (AF) when compared to those patients who do not.³ Furthermore, new-onset POAF may be a marker for future stroke or myocardial infarction (MI).⁴

Advanced cardiac life support guidelines provide recommendations for the treatment of acute tachyarrhythmias, including AF. For postoperative cardiac patients, there have been numerous investigations into the optimal treatment of AF,⁵ but beyond advanced cardiac life support recommendations, there are no evidence-based guidelines for the treatment for postoperative noncardiac surgical patients who develop AF.^{6,7} Because postoperative patients develop AF for a variety of reasons, management can be complex and often involves a variety of measures of evaluation and treatment.⁸

The objective of this study was to evaluate the practice patterns of POAF management in a surgical ICU without a protocol for management of AF with RVR and to then assess associated outcomes specifically looking at rate and rhythm control and mortality. The practice patterns of treatment for these patients and those associated with the best outcomes will help to better frame future treatment algorithms.

Methods and material

This is a retrospective study of critically ill noncardiac and nonthoracic postoperative, adult patients (≥ 18 y old) admitted to the surgical intensive care unit (SICU) at Loyola University Medical Center between June 1, 2014 and June 1, 2015. The study protocol was approved by the Institutional Review Board of Loyola University Medical Center. Consent was waived because of the observational nature of the study. The primary outcome of this study was to determine the treatment strategies associated with (1) rate and rhythm control within 48 h of POAF with RVR onset and (2) correlation of treatments with mortality. Both rate and rhythm control were measured as our patient population had no history of AF before surgery, developed both POAF and RVR, and were not postcardiac surgery patients. Secondary outcomes included rate and rhythm medication used at 7 d following diagnosis or at time of discharge if before 7 d, anticoagulation used at 7 d following diagnosis or discharge, in-hospital morbidity (MI, stroke, deep venous thrombosis, or pulmonary emboli), readmission to the SICU for treatment of AF, readmission to SICU for recurrent AF, 30 d readmission to SICU for recurrent AF, 30 d readmission after discharge, 30 d emergency department visit, discharge disposition (home, dead, skilled nursing facility or inpatient rehabilitation, long-term acute care, transfer to other hospital), and scheduled follow-up with either primary care or cardiology.

Development of POAF was determined by documentation of electrocardiogram interpretation by a cardiologist. New-onset POAF was defined as development of AF in any patient with no prior history of AF as documented in the

patient history or review of available medical records. AF with RVR was defined as a heart rate >100 beats per minute based on the highest recorded rate during the period of AF.⁹ Patients without RVR were excluded from the study. Patients who had recent cardiac surgery within 30 d were also excluded from the study. In summary, patients included were noncardiac postoperative patients aged ≥ 18 y with development of new-onset POAF with RVR as documented by a cardiologist-interpreted electrocardiogram.

Once patients were identified, the electronic medical record was reviewed for demographics (age, sex, race, and body mass index), home medications, and comorbidities (hypertension, diabetes mellitus type II, coronary artery disease, asthma/chronic obstructive pulmonary disease (COPD), stroke, and peripheral vascular disease). Other data collected were postoperative day at which AF occurred, hemodynamics during AF, fluid balance and electrolytes, development of hypotension (systolic blood pressure <90) within 2 h of AF onset, requirement of vasopressors within 24 h of AF onset, incidence of surgical complications (surgical site infection, anastomotic leak, reoperation), and laboratory values. Medication management (β -blocker, calcium channel blocker, amiodarone) was recorded as first, second, or third agent used and the success of these medications. Finally, we recorded ICU and hospital length of stay, discharge location, death, and medical follow-up.

Statistical analysis

All data were analyzed using SPSS (version 22.0, SPSS Inc, Chicago, IL). For continuous variables, the median (interquartile range) are reported, whereas for categorical variables, the frequency and the corresponding percentage are given. When appropriate for bivariate categorical data, statistical analysis was performed by the chi-square or Fisher's exact test. Markov chain analysis was used to determine the treatment success of each medication over time.¹⁰ Markov chain analysis can reliably compare a desired outcome (rate and rhythm control) over a desired time frame (48 h) while accounting for those patients who have already achieved the desired outcome. In addition, by assessing the desired outcome overtime, Markov chain analysis allows for recognition that the desired outcome was already achieved with a different medication. For all analyses, a P value of <0.05 was considered to be significant.

Results

Overall SICU patient population

During the 13-mo study period, 1070 adult patients were admitted to the SICU (Fig. 1). Seventy-two patients (6.7%) developed POAF. Fifty-seven of these 72 patients had RVR (79%), while the remainder ($n = 14$; 21%) did not. Of the patients with POAF with RVR, 24 (42%) had chronic AF while 33 (57.9%) had new-onset POAF with RVR, our target population. Overall, 3.1% of patients admitted to the SICU had new-onset POAF with RVR. All 33 patients underwent surgery with the

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