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Original Article

# Emergency department critical care unit for critically ill cardiovascular patients: An observation study

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**Abstract**

*Background*: We investigated an intensive care model for acute critically cardiovascular emergency patients in the emergency department (ED) as compared with those in the coronary care unit (CCU) after ED visits.
*Methods*: We performed a retrospective cohort analysis of patients with acute cardiovascular emergency admitted to the intensive care unit in the ED (EICU) or CCU from January 1, 2010 to March 31, 2011 in an university-affiliated medical center. All clinical characteristics or predictors possibly related to in-hospital mortality were documented, completed, and measured via electronic medical records review. The clinical independent variables with $p < 0.1$ in univariate analysis were further analyzed by using multiple logistic regression. Survival analysis of the predictors for hospital mortality was assessed by Kaplan−Meier survival curves.
*Results*: A total of 964 patients were recruited in this study. Of all patients, 328 were enrolled in the EICU group, whereas 636 were enrolled in the CCU group. Multiple regression analysis of both EICU and CCU mortality demonstrated that Acute Physiology and Chronic Health Evaluation II scores were common predictors of mortality in both groups of patients. Based on these scores, Kaplan−Meier survival curves showed no statistically significant differences of cumulative survival rates in both the 7-day and in-hospital survival between both groups.
*Conclusion*: Our study demonstrated a feasible and qualified model of intensive care delivery accomplished by collaboration of emergency physicians and cardiologists for acute critically ill cardiovascular emergency patients after initial ED management. Our results suggest that an expanded multicenter study should be conducted to further test and confirm this intriguing model.


*Keywords:* coronary care unit; emergency department; intensive care unit

## 1. Introduction

For acute critically ill patients visiting the emergency department (ED), initial resuscitation and stabilization, followed by continuously provided specific critical care treatment are mandatory in modern medical systems. ED visits increasing,[1−3] and the challenges of ED care are numerous, including overcrowding, increased length of stay (LOS) and boarding time, even leading to some critically ill patients receiving delayed admission to the intensive care unit (ICU).[4,5] Increased hospital LOS and higher ICU and hospital mortality are associated with delayed transfer of critically ill patients from the ED to the ICU.[6,7] Therefore, providing a continuously high quality of critical care to manage acute

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critically ill patients from ED visits through ICU care is one of the core contents of emergency medicine practice.

The care or intervention provided during the ED stay for critically ill patients significantly impacts the progression of hospital outcomes.[8] Svenson and colleagues[9] reported that critically ill patients received critical care procedures commonly performed in the ED while waiting for ICU admission. A significant proportion of critical care[10] and typical ICU procedures[11] were performed in the ED for critically ill patients. For patients with acute cardiogenic pulmonary edema, hypoxia, and severe respiratory distress or failure, noninvasive positive pressure ventilation may not only improve outcomes[12,13] but also help to avoid intubation and ICU admission.[14] However, there still remains a high risk of clinical deterioration in patients with acute cardiovascular emergency, with few if any signs of improvement during their short stay in the ED. Having a continuously monitoring system and interventions for acute critically ill patients has become imperative, especially for patients with acute cardiovascular emergency.

The main purpose for establishing an ICU in the ED (EICU) was to meet the need of quality care for critically ill patients, who might deteriorate rapidly or progressively in an overcrowded ED with prolonged boarding time. In addition, a lack of specialty ICU beds for acute critically ill patients, either from inpatient units or ED, would be associated with increased ED LOS and a delay of quality care.[15–17] Thirdly, to improve acute critically ill patient outcome by reconstructing an observation unit into an EICU setting that were equipped by a monitoring and intervention system, and intensivists, including reasonable collaboration with other specialists to be responsible for the care of all critically ill patients while waiting admission.

In a previous report on patients with cardiovascular diseases, the leading diagnoses of patients staying at an observation unit are described.[18] Early implementation of intensive monitoring and therapies, such as short-term noninvasive positive pressure ventilation for ED patients with acute cardiogenic pulmonary edema may improve outcome.[12–14,19] Our previous article demonstrated that cardiovascular emergency patients occupied approximately 13.3% of EICU admissions in a 1-year study period.[20] However, the detailed clinical characteristics and outcomes of patients admission to the EICU as compared to those admissions to the coronary care unit (CCU) still require elucidation. Few articles have aimed to investigate the care model of ICU settings in ED, especially focusing on cardiovascular emergency patients. The hypothesis addressed by this study was that providing continuous EICU for patients with acute critical cardiovascular emergencies had a similar quality of care compared with those patients admitted to the CCU.

## 2. Methods

### 2.1. Study design

This study was a retrospective analysis of prospectively registered patients aged $\geq 18$ years, with cardiovascular emergency admissions to either the EICU or CCU by way of an ED visit. The Taipei Veterans General Hospital, a 3000-bed, university-affiliated medical center had an annual ED mean $\pm$ standard deviation census of 85,500 $\pm$ 4520 during the past 10 years. The hospital's institutional review board approved this study with a waiver of patient's consent (VGHIRB Number: 2012-02-024AC).

### 2.2. Study setting and population

Our study recruited patients with acute cardiovascular emergencies who visited the ED, and thereafter needed continuous ICU admission between January 1, 2010 and March 31, 2011. To verify and avoid missing potential participants, charts were cross-checked for coding with the International Classification of Diseases, 9$^{th}$ Revision, clinical modification coding numbers: 398 (rheumatic heart disease); 401–405 (hypertension); 410–413 (myocardial infarction); 414 (coronary artery disease); 415–417 (acute pulmonary heart disease); 421 (acute and subacute endocarditis); 421 (valvular heart disease); 425 (cardiomyopathy); 426 (conduction disorders); 427 (cardiac arrhythmia); 428 (heart failure); 429 (cardiovascular disease); 441 (aortic aneurysm); 458.9 (hypotension); 785 (symptoms involving cardiovascular system); and 972 (poisoning by cardiotonic glycosides and drugs of similar action). Medical charts of the patients were comprehensively and extensively reviewed. Exclusion criteria included the following: age $<$ 18 years; those who died in ED before hospital admission; those with do-not-attempt-resuscitation orders; and charts lacking certain important information (e.g., 7-day and hospital discharge status). Patients with acute cardiovascular emergencies were initially resuscitated, diagnosed, and treated by emergency physicians (EPs) in the ED and were simultaneously consulted with cardiovascular physicians, who collaborated with the on-duty EP to conduct emergency cardiovascular interventions and hospital admissions based on individual patient clinical necessities and hospital admission resources.

### 2.3. Both EICU and CCU settings

The primary goal of the EICU setting was to implement continuous emergency and critical quality of care for critically ill patients who cannot be admitted to a specialized CCU immediately after initial ED resuscitation and stabilization. The EICU contained 13 beds, was located within the ED, and had been operated since 1994, complying with the regulations for an ICU setting issued from the Ministry of Health and Welfare. All EICU patients are limited to ED patient admissions only. The EICU was staffed by EPs, collaborating with other specialty physicians who thereafter will be in charge of subsequent patient care. All the staffed EPs are board-certificated intensivists accredited by the Joint Committee of Intensive Care Medicine in Taiwan. The staffed EP performed a clinical round every day for all the patients in the morning. At night, the on-duty EP also performed rounds for all patients at the beginning of their shift and then worked in an adjacent