Clinical Paper

The impact of prolonged boarding of successfully resuscitated out-of-hospital cardiac arrest patients on survival-to-discharge rates

CrossMark

Won Chul Cha [a,d], Jin Seong Cho [b,d,*], Sang Do Shin [c,d], Eui Jung Lee [c,d], Young Sun Ro [e,d]

[a] Samsung Medical Center, Department of Emergency Medicine, Seoul, Republic of Korea
[b] Gachon University Gil Medical Center, Department of Emergency Medicine, Incheon, Republic of Korea
[c] Seoul National University Hospital, Department of Emergency Medicine, Seoul, Republic of Korea
[d] Seoul National University Hospital Biomedical Research Institute, Laboratory of Emergency Medical Services, Seoul, Republic of Korea
[e] Seoul National University College of Medicine, JW LEE Center for Global Medicine, Seoul, Republic of Korea

A R T I C L E   I N F O

A B S T R A C T

Aim: To evaluate the effect of prolonged ED boarding of successfully resuscitated out-of-hospital cardiac arrest (OHCA) patients on their survival-to-discharge rate.

Methods: This is a retrospective nationwide cohort study of OHCA patients from 2006 to 2010. OHCA patients are classified as having those with presumed cardiac aetiology but who gained a sustained return of spontaneous circulation (ROSC). Patients who were transferred to in-hospital units within 6 h after ROSC were classified in the not-delayed group (the ND group), and the remaining patients were classified as the delayed group (the D group). The survival rate between the two groups using univariate and multivariate analyses with Utstein variables was compared. We also performed a sensitivity analysis using a different time standard.

Results: During the study period, 101,463 OHCA patients were assessed by Emergency Medical Services in Korea. Of these patients, 13,330 presented with ROSC at admission, 4686 patients were selected for final analysis, 3419 were categorised in the ND group, and 1267 in the D group. After adjusting confounders with a multivariate regression model, the D group showed a significantly lower rate of survival than the ND group (OR: 0.73 [0.62–0.86]). Sensitivity analysis using different time cut-offs showed a consistently lower rate of survival in the D group, from 1 to 36 h.

Conclusion: OHCA patients who were delayed in their transfer to in-patient units had a significantly lower survival-to-discharge rate.

© 2015 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

A new chain of survival with integrated post-cardiac arrest care was added to the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. When these bundled and integrated programmes are properly applied, these therapies can improve patient survival.[1–3]

As in other industrial services, case volume contributes greatly to the quality of care in the healthcare industry.[4–6] In order to increase volume and to focus resources, regionalisation of OHCA patient care has been considered as an acceptable strategy. [7–9]

However, academic emergency departments (EDs) that have high annual visits are already experiencing significant overcrowding.[10–12] Overcrowded EDs may adversely affect the outcome of patients who require critical care.[13–15] This harmful effect is due to the compromised quality of care owing to factors such as increased error and delayed time-sensitive treatments that would influence the quality of care following post-resuscitation of patients. No studies have examined the effect of prolonged ED boarding on the outcome of OHCA patients.

The goal of this study was to prove that prolonged ED boarding decreases the survival rate of resuscitated OHCA patients.

2. Methods

2.1. The study design and setting

This was a population-based retrospective analysis using data from the Cardiovascular Disease Surveillance (CAVAS) project and

* Corresponding author at: Department of Emergency Medicine, Gachon University Gil Medical Center, 21, Namdong-daero 774 beon-gil, Namdong-Gu, Incheon 405-760, Republic of Korea.
 E-mail address: truecho@hanmail.net (J.S. Cho).

a nationwide project to build a cohort for EMS-assessed OHCA. The registry was constructed on the basis of ambulance run sheets, and further information was collected from medical records of destination institutes. The project was initiated in 2007 by the Korean Center for Disease Control and Prevention (CDC).

Data from January 2006 to December 2010 were collected. OHCA patients were defined as patients presenting with symptoms classified as cardiac or respiratory arrest that was confirmed using a hospital medical review. Chart reviews were carried out by designated medical recorders who had undergone standardised training. A structured review form was designed for the chart review. It was based on the Utstein style customised for local circumstances. For quality assurance of investigations, monthly meetings were held with field investigators and the CDC Data Quality Control (DQC) team. The team consisted of physicians, statistical experts, experienced medical reviewers, officers from the NEMA, and an epidemiologist.

2.2. The study population

The population of interest consisted of successfully resuscitated OHCA patients who were presumably presenting with cardiac distress and needed post-resuscitation care such as therapeutic hypothermia. To standardise the level of care that was received, we selected patients who had been transferred to designated level I of level II emergency centres. Patients who showed preadmission

ROSC and those who did not show any ROSC were excluded. Patients who were transferred to another facility from the initial ED were also excluded because of the lack of further information. Patients who died before the cut-off time of boarding were excluded from the final logistic analysis because this study's aim was to examine the effect of prolonged boarding on patients after the cut-off time.

2.3. Variables of interest

Variables of OHCA patients were selected based on the Utstein style. We also included the EMS response interval, transport interval, and the interval between ED arrival and ROSC, which are potential indicators of the final outcome of a patient.

2.4. Statistical analysis

Boarding of patients for $\geq 6\,h$ was considered as a crowding measure.[16–18] We divided patients into two groups based on the cut-off value of 6 h. The D group included patients who had not been admitted until 6 h. The ND group included patients who had been admitted before the 6 h. After describing baseline characteristics, we performed a multivariate analysis to compare the survival-to-discharge rates between the D and ND groups. Cluster-adjusted standard errors with each ED as a cluster were placed into the regression model.
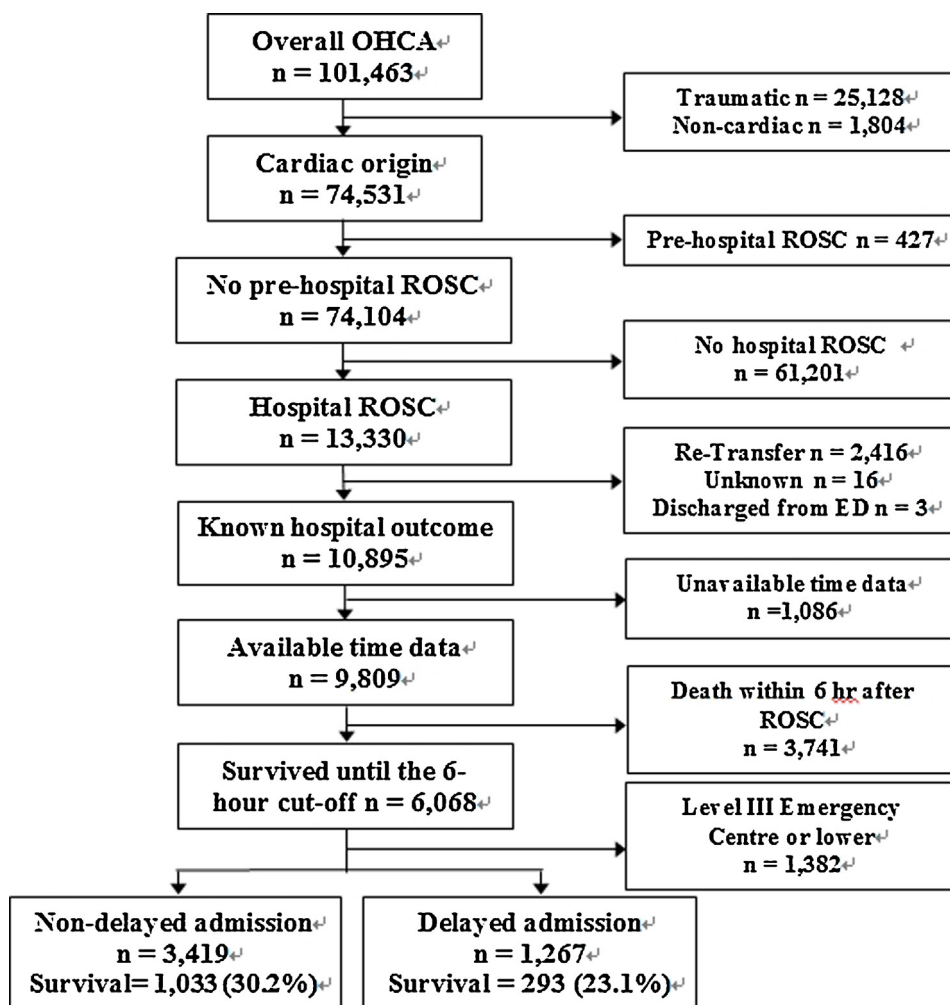

Fig. 1. Cardiac arrests from 1 January 2006 through 31 December 2010. Subject selection process. *OHCA*, out-of-hospital cardiac arrest; *ED*, emergency department; *ROSC*, return of spontaneous circulation.