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Clinical paper

Recruitments of trained citizen volunteering for conventional cardiopulmonary resuscitation are necessary to improve the outcome after out-of-hospital cardiac arrests in remote time-distance area: A nationwide population-based study

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ABSTRACT

Aims: To compare the factors associated with survival after out-of-hospital cardiac arrests (OHCAs) among three time-distance areas (defined as interquartile range of time for emergency medical services response to patient's side).
Methods: From a nationwide, prospectively collected data on 716,608 OHCAs between 2007 and 2012, this study analyzed 193,914 bystander-witnessed OHCAs without pre-hospital physician involvement.
Results: Overall neurologically favourable 1-month survival rates were 7.4%, 4.1% and 1.7% for close, intermediate and remote areas, respectively. We classified BCPR by type (compression-only vs. conventional) and by dispatcher-assisted CPR (DA-CPR) (with vs. without); the effects on time-distance area survival were analyzed by BCPR classification. Association of each BCPR classification with survival was affected by time-distance area and arrest aetiology ($p < 0.05$). The survival rates in the remote area were much higher with conventional BCPR than with compression-only BCPR (odds ratio; 95% confidence interval, 1.26; 1.05–1.51) and with BCPR without DA-CPR than with BCPR with DA-CPR (1.54; 1.29–1.82). Accordingly, we classified BCPR into five groups (no BCPR, compression-only with DA-CPR, conventional with DA-CPR, compression-only without DA-CPR, and conventional without DA-CPR) and analyzed for associations with survival, both cardiac and non-cardiac related, in each time-distance area by multivariate logistic regression analysis. In the remote area, conventional BCPR without DA-CPR significantly improved survival after OHCAs of cardiac aetiology, compared with all the other BCPR groups. Other correctable factors associated with survival were short collapse-to-call and call-to-first CPR intervals.
Conclusion: Every effort to recruit trained citizens initiating conventional BCPR should be made in remote time-distance areas.

Introduction

The response time of an emergency medical service (EMS) is a major determinant of survival after out-of-hospital cardiac arrest (OHCA).[1–3] However, the major factors associated with survival after OHCAs in remote time-distance areas with delayed EMS response have not been elucidated. High-quality bystander cardiopulmonary resuscitation (BCPR) that is started early after patient collapse and is continued until the EMS arrival may have a major impact on survival[4] in remote time-distance areas than in other areas.

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Two types of BCPR, the compression-only or conventional, are currently provided for OHCA patients in compliance with dispatcher-assisted CPR (DA-CPR) or on bystander's own initiative. Although ventilation in BCPR was reported to be valuable for presumed non-cardiac OHCA,[5,6] meta-analyses have reported that compression-only CPR may improve survival more than conventional CPR.[7,8] Another study reported that both BCPR types improved survival.[9] Because DA-CPR is commonly provided for suspected OHCA, BCPR can be classified into another category based on initiative (with DA-CPR vs. without DA-CPR).[3]

This study aimed to investigate whether the association between BCPR classification and survival after OHCA will differ among close, intermediate and remote time-distance areas. In addition, we searched other correctable factors associated with a neurologically favourable one-month (1-M) survival after OHCA in remote areas.

Methods

Study design and setting

We obtained consent from the Japanese Fire and Disaster Management Agency (FDMA) to analyze their OHCA data that were prospectively collected between 2007 and 2012. This study was approved by the review board of Ishikawa Medical Control Council.

The population of Japan is 128 million; in 2012, the aged (≥65 years) population comprised 30.79 million (24.1%). There were 770 fire departments with 5004 ambulance teams.[10] According to FDMA recommendation, the number of ambulances in one fire department was determined by regional population: 1 ambulances/50,000–70,000 population. Generally, ambulances are composed of three crews, including at least one paramedic. DA-CPR was commonly provided by EMS on the basis of the FDMA protocol.[11] According to this protocol, dispatchers are recommended to instruct compression-only CPR to bystanders who are untrained or unwilling to perform mouth-to-mouth ventilation. Emergency medical technicians (EMTs) must not terminate resuscitation in the field, unless an OHCA patient has post-mortem signs: Reportedly, the proportion of non-resuscitation-attempted cases in all OHCA activating EMS was 30–50% (Supplementary Table 1). All EMTs may use automated external defibrillators (AEDs). Paramedics are authorized to use airway adjuncts and peripheral venous infusion of lactated Ringer's solution for resuscitation. However, only authorized and specially trained paramedics are allowed to insert tracheal tubes and administer intravenous adrenaline. All EMTs resuscitated OHCA patients according to the Japan Resuscitation Council guidelines.[12,13]

Selection of participants

The FDMA database included the following data by the Utstein recommendations[14,15]: bystander-patient relationship, BCPR type, provision of DA-CPR, estimated time of arrest witness, BCPR initiation, recorded time of EMS vehicle arrival, EMS arrival at patient's

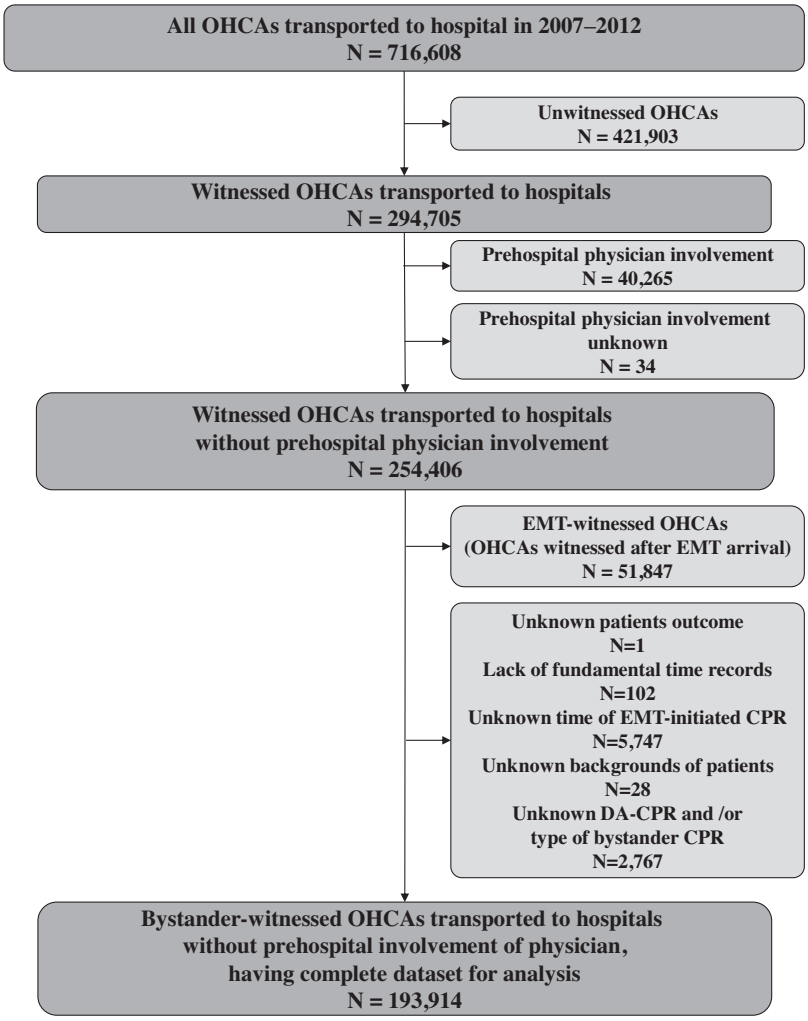

Fig. 1. Flow diagram of data selection.