



Clinical paper

Associations between gender and cardiac arrest outcomes in Pan-Asian out-of-hospital cardiac arrest patients[☆]

Yih Yng Ng^{a,c,1}, Win Wah^{b,1}, Nan Liu^{c,d,*,1}, Sheng Ang Zhou^e, Andrew Fu Wah Ho^f, Pin Pin Pek^c, Sang Do Shin^g, Hideharu Tanaka^h, Nalinas Khunkhlaiⁱ, Chih-Hao Lin^j, Kwanhathai Darin Wong^k, Wen Wei Cai^e, Marcus Eng Hock Ong^{c,1}, for the PAROS Clinical Research Network²

^a Medical Department, Singapore Civil Defence Force, Singapore

^b Centre for Infectious Disease Epidemiology and Research, Saw Swee Hock School of Public Health, National University of Singapore, Singapore

^c Department of Emergency Medicine, Singapore General Hospital, Singapore

^d Centre for Quantitative Medicine, Duke-NUS Medical School, Singapore

^e Department of Emergency Medicine, Zhejiang Provincial People's Hospital, Hangzhou, Zhejiang, China

^f SingHealth Emergency Medicine Residency Program, Singapore

^g Department of Emergency Medicine, College of Medicine, Seoul National University, Seoul, Republic of Korea

^h Department of EMS System, Graduate School, Kokushikan University, Tokyo, Japan

ⁱ Department of Emergency Medicine, Rajavithi Hospital, Bangkok, Thailand

^j Department of Emergency Medicine, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan

^k Emergency Department, Hospital Pulau Pinang, Penang, Malaysia

¹ Health Services and Systems Research, Duke-NUS Medical School, Singapore

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ABSTRACT

Background: The incidence of out-of-hospital cardiac arrest (OHCA) in women is thought to be lower than that of men, with better outcomes in some Western studies.

Objectives: This study aimed to investigate the effect of gender on OHCA outcomes in the Pan-Asian population.

Methodology: This was a retrospective, secondary analysis of the Pan Asian Resuscitation Outcomes Study (PAROS) data between 2009 and 2012. We included OHCA cases which were presumed cardiac etiology, aged 18 years and above and resuscitation attempted by emergency medical services (EMS) systems. We used multi-level mixed-effects logistic regression models to account for the clustering effect of individuals within the country. Primary outcome was survival to hospital discharge.

Results: We included a total of 40,159 OHCA cases, 40% of which were women. We found that women were more likely to be older and have an initial non-shockable arrest rhythm; they were more likely to receive bystander cardio-pulmonary resuscitation (CPR). The univariate analysis showed that women were significantly less likely to have return of spontaneous circulation (ROSC) at scene or in the emergency department (ED), and had lower rates of survival-to-admission and discharge, and poorer overall and cerebral performance outcomes. There was however, no significant gender difference on outcomes after adjustment of other confounders. Women in the reproductive age group (age 18–44 years) were significantly more likely to have ROSC at scene or in the ED, higher rates of survival-to-admission and discharge, and have better overall and cerebral performance outcomes after adjustment for differences in baseline and pre-hospital factors. Menopausal women (age 55 years and above) were less likely to survive to admission after adjusting for other pre-hospital characteristics but not after age adjustment.

Conclusion: Differences in survival outcomes between reproductive and menopausal women highlight a need for further investigations into the plausible social, pathologic or hormonal basis.

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* Corresponding author at: Department of Emergency Medicine, Singapore General Hospital, Outram Road, Singapore 169608, Singapore.

E-mail address: liu.nan@sgh.com.sg (N. Liu).

¹ These authors contributed equally to this work.

² Investigators listed in Appendix A.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a major cause of mortality around the world. Approximately around 359,400 Americans suffered OHCA every year with an overall survival rate of 9.5% in the United States in 2013.¹ Overall survival-to-hospital-discharge rates were lower in the Pan-Asian population with rates ranging from 0.5% to 8.5%.²

The incidence of OHCA in women is thought to be lower than that of men.³ Several published studies have suggested the favorable effect of female gender on chances of survival to hospital admission, one month survival and good neurological outcomes, due to the possible neuro-protective effect of female endogenous estrogen and progesterone hormones.^{3,4} Most studies have been conducted in the US and Europe with a few studies done in Japan and Korea.^{3,4} Although a larger number of these studies have shown the positive impact of female gender on OHCA outcomes, a few of these studies contradicted the finding.^{3,4} This calls for further studies to elucidate the conflicting results found. To date, no study has been conducted in a multi-ethnic Asian population on the effects of gender on survival and neurological outcomes after OHCA.

This study aimed to investigate the effect of gender on OHCA outcomes in a Pan-Asian population. The study findings will give insight into the effect of gender and its possible underlying mechanisms.

Methodology

Study design

The Pan-Asian Resuscitation Outcomes Study (PAROS) registry, established as a resuscitation clinical research network, is a prospectively collected Asia-Pacific, multinational registry to provide baseline information about OHCA prevalence, management and outcomes, describe variations among emergency medical systems (EMS) in region and compare systemic and structural interventions to address OHCA.⁵ The network aims to improve survival from sudden cardiac arrest and other prehospital emergency conditions by supporting research on cost-effective strategies to improve outcomes.⁵

This study involved 12 sites in seven countries – Singapore, Japan, South Korea, Malaysia, Thailand, Taiwan and United Arab Emirates.⁵ The demographic, socioeconomic characteristics and EMS systems of PAROS countries vary across the region.⁶ Each participating country is responsible for its own data collection through a standardized process. All data are inputted through a secured shared internet electronic data capture system hosted by the Study Coordination Centre (SCC) in Singapore.⁵ Institutional review board approval was granted to each center and country according to the regulations of each participating country.

The PAROS registry includes OHCA of both presumed cardiac and non-cardiac etiology brought in by EMS or presenting at emergency departments (EDs), as confirmed by the absence of pulse, unresponsiveness and apnea. The registry excludes patients who were immediately pronounced dead and for whom resuscitation was not attempted, including those with decapitation, rigor mortis, and dependent lividity and “do not attempt resuscitation” orders.

Data collection and outcomes

This retrospective observational study included OHCA collected by the PAROS registry from seven countries in Asia between 2009 and 2012. For this analysis, we included OHCA cases which were presumed cardiac etiology, aged 18 years and above and had resuscitation attempted by EMS.

Survival-to-hospital discharge (discharged alive/remained in hospital at 30th day post-arrest) was the primary outcome. Secondary outcomes were return of spontaneous circulation (ROSC) at scene or in the ED, survival-to-hospital admission and survival with good neurological status with post-arrest overall and cerebral performance scales of 1 or 2. Variables included in this study were age, gender, location type, medical comorbidity, arrest witnessed status, bystander cardio-pulmonary resuscitation (CPR), initial arrest rhythm, prehospital defibrillation, prehospital airway, prehospital drug administration and EMS response time.

Data analysis

The analyses were conducted using STATA software (College Station, Texas, StataCorp LP). The association between gender and outcomes were assessed using chi-squared tests and independent samples *t*-test or Mann–Whitney–*U* test as appropriate. We used multi-level mixed-effects logistic regression models to account for the clustering effect of individuals within the country. Univariate analyses were done to select variables for an adjusted multivariate analysis. Statistical significance was set at $p < 0.05$ criteria. In Asia (Singapore as the reference), the mean age for natural menopause in women is around 49 years.⁷ Though there are other age group definitions defined for reproductive age, studies have consistently used the age range of 18–44 years as measurements for reproductive age.⁸ Subgroup analyses were done in younger and older OHCA cases aged 18–44 years and ≥ 55 years (excluding the perimenopausal groups age 45–54) to assess the association between estrogen exposure and survival.^{9,10}

Results

The selection process for the included cases is shown in Fig. 1. Of 66,780 OHCA cases collected between 2009 and 2012, we included 40,159 OHCA cases aged 18 years old and above, of presumed cardiac etiology and with resuscitation attempted by EMS/private ambulance. Of the 40,159 cases, 24,267 cases were men (60%) and 15,892 cases were women (40%). We found women were older and more likely to have an initial non-shockable arrest rhythm; they were more likely to receive bystander CPR (Table 1). Men were younger, more likely to have witnessed arrests in public areas, have medical comorbidities and receive prehospital defibrillation, airway and drug administration.

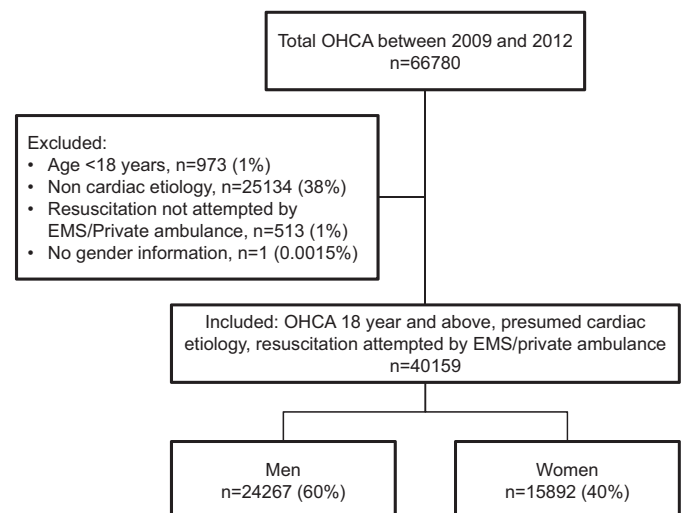


Fig. 1. Flow diagram of included cases.

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