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Sex-Based Disparities in Cardiac Arrest Care: Time to Do Better!

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Out-of-hospital cardiac arrest (OHCA) remains a major public health problem, with 1000 adults suffering OHCA each day in the United States alone.[1] Only 1 in every 9 OHCA victims survives to hospital discharge nationally.[1] Sudden cardiac death, including OHCA, accounts for nearly half of all years of life lost due to cardiac disease, and is the leading cause of death among men.[1] Early application of basic life support, including cardiopulmonary resuscitation (CPR) and defibrillation, remains the cornerstone of optimal OHCA care.[2] Only half of OHCA cases are witnessed by a layperson or medical provider, a situation associated with substantially better outcomes.[1] Administration of CPR by bystanders is associated with lower mortality among OHCA victims, yet few Americans have had recent CPR training.[1,3]

Men are disproportionately affected by OHCA, with a greater representation in OHCA studies.[1,4-10] Men have a higher prevalence of coronary artery disease and cardiomyopathy, which are the primary causes of OHCA in adults.[1] Baseline characteristics of male and female OHCA victims differ, with women typically being older and displaying a lower prevalence of favorable arrest circumstances such as witnessed arrest, shockable arrest rhythm, and cardiac etiology.[4-10] The results of recent studies conflict regarding the association between the sex of OHCA victims and OHCA outcomes, particularly after adjustment for baseline differences.[4-10] A 2015 meta-analysis of older studies demonstrated higher survival among female OHCA victims (adjusted odds ratio [OR]=1.1) after adjusting for their higher age and lower rates of shockable rhythms and witnessed arrest. Women with cardiac arrest etiology similarly had better outcomes, raising the question of a protective effect in women.[4] By contrast, more recent studies have shown lower adjusted[5-7] or unadjusted[8-10] survival among women after OHCA. These divergent findings regarding the association between the sex of OHCA victims and OHCA mortality as delineated in older and newer studies may relate to the different study populations, temporal changes in patient characteristics, or covariates used for statistical adjustment. The finding of higher unadjusted mortality among women with OHCA that was no longer present after adjustment for baseline variables and therapeutic interventions may imply that sex-based differences in outcomes may be mitigated by ensuring equal quality of care for women.[8-10]

The paradoxically higher mortality in women after OHCA may be due to the lower prevalence of cardiac disease and shockable rhythms as the etiology of OHCA among women, but important sex-based disparities in initial resuscitation and postarrest care have been reported.[5-8] Several studies have emphasized the lower utilization of coronary angiography among women after OHCA, despite the association between early coronary angiography and favorable outcomes in OHCA populations.[5-8] In the Nationwide Inpatient Sample, in-hospital mortality was higher in women with cardiac arrest, who had

a lower prevalence of shockable arrest rhythms and less frequent utilization of coronary angiography, percutaneous coronary intervention, and therapeutic hypothermia; although overall rates of coronary angiography utilization increased over time, this effect was diminished among women.[5] Data from the International Cardiac Arrest Registry similarly demonstrate higher adjusted in-hospital mortality among female OHCA victims associated with a lower prevalence of shockable arrest rhythm, presumed cardiac etiology of arrest, bystander CPR, and lower utilization of coronary angiography.[6] Recent studies from Denmark and California have also reported higher in-hospital mortality and a lower utilization of coronary angiography among women after OHCA.[7,8] In the Korean Hypothermia Network database, women had a lower prevalence of cardiac etiology and shockable arrest rhythm, associated with worse unadjusted survival and neurologic outcomes among women, particularly younger women.[9]

In the current issue of the *Mayo Clinic Proceedings*, Matsuyama et al[11] report on a large nationally-representative cohort of almost 85,000 patients with a witnessed OHCA from the All-Japan Utstein Registry from 2013 to 2015, examining the rates and outcomes associated with bystander CPR as a function of the sex of the patient. As in prior studies, women had lower rates of shockable arrest rhythms and were less likely to receive advanced life support interventions. Unadjusted rates of bystander CPR were lower in women overall, a difference that was no longer present after multivariate adjustment. Further analysis showed that younger women (aged 18 to 64 years) were less likely to receive bystander CPR, and women were less likely to receive bystander CPR in a public location overall. After multivariate adjustment, women had lower rates of survival with good neurological outcome at 30 days (adjusted OR=.8), and bystander CPR was associated with higher rates of survival with good neurological outcome at 30 days (adjusted OR 2.1).[11] This study further supports the presence of clinically-relevant differences between male and female OHCA victims, not only in the initial circumstances of the arrest, but also in the provision of basic and advanced life support interventions that may influence outcomes.

The finding of lower rates of bystander CPR among women, especially younger women and those with OHCA in public locations, is particularly concerning given the good outcomes seen among young OHCA victims with a witnessed OHCA in a public place who receive bystander CPR.[1] The reasons for lower rates of bystander CPR among certain subgroups of women in this study remain uncertain, but similar findings were reported in the International Cardiac Arrest Registry and may relate to inherent biases and differences in social norms.[6] By contrast, the 2015 meta-analysis demonstrated higher rates of bystander CPR among women, suggesting that bystanders in Japan may have different attitudes toward bystander CPR among women leading to lower rates of bystander CPR in public locations.[4] Matsuyama, et al hypothesize that bystanders in Japan may be concerned about performing CPR being misinterpreted as assault, an interesting cultural insight that may or may not be observed in other countries. Few studies have examined the influence of rescuer bias on provision of CPR to OHCA victims, and further research should explore the ways in which rescuer characteristics and attitudes could influence willingness to perform bystander CPR as a function of the sex of the victim.

This study highlights the importance of bystander CPR as a key component of the "chain of survival" for OHCA victims, emphasizing the need for public heath interventions to ensure adequate CPR training among laypeople.[2] Additional studies are needed to determine why there are sex-based differences in the provision of bystander CPR for OHCA victims, to ensure that all patients with a witnessed OHCA can receive this crucial therapy, which can increase the likelihood of neurologically-intact survival.

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