Commentary

The Pan-Asian Resuscitation Outcomes Study (PAROS) clinical research network: what, where, why and how

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ABSTRACT Out-of-hospital cardiac arrest (OHCA) is a global health concern with an incidence rate of 50–60 per 100,000 person-years. To improve OHCA survival rates, several cardiac arrest registries have been set up in North America and Europe, such as the Resuscitation Outcomes Consortium, Cardiac Arrest Registry to Enhance Survival, Ontario Prehospital Advanced Life Support and European Registry of Cardiac Arrest. In Asia, however, there was previously no concerted effort in prehospital emergency care research owing to differences in prehospital emergency medical services systems, data collection methods and outcome reporting between countries. Recognising the need for a collaborative prehospital emergency care research group in Asia, researchers from seven countries in the Asia-Pacific region (including Japan, South Korea, Taiwan, Thailand, United Arab Emirates-Dubai, Singapore and Malaysia) established the Pan-Asian Resuscitation Outcomes Study (PAROS) clinical research network in 2010. This paper gives the overview, methodology and research accomplishments of the PAROS network.

Keywords: dispatcher-assisted CPR, out-of-hospital cardiac arrest, research network, resuscitation, survival

OHCA SURVIVAL RATES

Out-of-hospital cardiac arrest (OHCA) is a global health concern with an incidence rate of 50–60 per 100,000 person-years.[1] This number is expected to rise over the years owing to increasing population ageing. Chances of survival from OHCA have been pessimistically low, especially in Singapore, where the survival rate is around 3%.[2] Although this is an improvement from a decade ago (2%),[2] when benchmarked against sites in North America such as Seattle (16.3%),[1] there is still much room for improvement in the OHCA survival rate in Singapore.

To improve OHCA survival rates, several cardiac arrest registries have been set up in North America and Europe, such as the Resuscitation Outcomes Consortium (ROC),[3] Cardiac Arrest Registry to Enhance Survival (CARES),[4] Ontario Prehospital Advanced Life Support[5] and European Registry of Cardiac Arrest.[6] These registries have conducted research involving several cities, in interventions such as airway management and drugs administration, in their quest to improve OHCA survival. Prior to the establishment of the Pan-Asian Resuscitation Outcomes Study (PAROS), there had been no concerted effort in prehospital emergency care research in the Asia-Pacific region, owing to differences in emergency medical services (EMS) systems, data collection methods and outcome reporting between countries.

THE PAROS NETWORK

Recognising the need for a collaborative prehospital emergency care research group in Asia, researchers from seven countries in the Asia-Pacific region (including Japan, South Korea, Taiwan, Thailand, United Arab Emirates (UAE)-Dubai, Singapore and

Malaysia) established the PAROS clinical research network in 2010. The mission of the PAROS network is to "*improve outcomes from Prehospital and Emergency Care across the Asia-Pacific region by promoting high quality research into resuscitation*".[7] The network has a trial coordinating centre in Singapore and is chaired by a local emergency physician and co-chaired by emergency physicians and university professors from Japan, South Korea and Taiwan. The network subsequently grew to include the Philippines, China, Pakistan, Vietnam, India and UAE-Abu Dhabi in 2016. The diverse nature of the participating countries (developed vs. developing, rural vs. urban) offers insights into the variations among prehospital emergency care systems in Asia and allows identification of strategies (e.g. saturation of cardiopulmonary resuscitation [CPR] skills in the community or availability of public access defibrillators) that can impact OHCA outcomes.

To standardise outcome reporting, a common data collection form and data dictionary was developed and used across all PAROS-participating countries. Variables in the data collection form were classified into core and non-core, with non-core variables being optional. Data collected included information from dispatch centres, ambulances and hospitals. Data was entered into an electronic data capture platform (ePAROS), which was developed in collaboration with the CARES group. The ePAROS is offered to participating PAROS countries at no cost, with training provided by the trial coordinating centre; this is particularly helpful to members with limited resources (e.g. lack of research funding). Countries that had existing national registries contributed data via an export field entry process, which matched the standardised PAROS format. More details

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regarding the PAROS methodology can be found in a previously published paper.[8]

In 2015, the PAROS group published its main findings. The network had collected more than 66,000 OHCA cases over a period of 2.5 years. The group found that most OHCA cases occurred in the home and that bystander CPR (BCPR) rates ranged from 10.5% to 40.9%, with only a very small proportion receiving defibrillation (< 1%). The BCPR rate in Singapore was relatively low at 24.3% as compared to the over 40% seen in Japan and South Korea. Survival to discharge rates in the participating countries ranged from 0.5% to 8.5%; Singapore's survival to discharge rate was 2.5%. The findings of this paper suggest that the variations in OHCA survival rates seen in the PAROS participating countries were likely due to patient and system differences. This indicates that it may be possible to increase survival through interventions at both the prehospital (e.g. BCPR, public access defibrillation, ambulance response time) and hospital (e.g. targeted temperature management) levels.[9] The findings also give an indication of where Singapore stands, benchmarked against other developed nations in Asia, and offer insights into strategies that could help to improve OHCA survival in Singapore. Such information will be useful to policymakers and healthcare providers in prioritising cost-effective interventions targeted at increasing, for instance, BCPR rates, which would in turn impact OHCA survival. Since its inception, the PAROS group has generated over 20 publications, covering various topics such as termination of resuscitation rules and dispatcher-assisted CPR (DACPR) in peer-reviewed journals.

OHCA trends in Singapore

To gain a better understanding of the current state of affairs of OHCA in Singapore, the local PAROS group analysed OHCA survival trends over the last ten years. The study showed that survival rates had improved in 2001–2004 (2,428 cases), compared with ten years later in 2010–2012 (3,025 cases).[2] Overall survival to discharge improved from 1.6% in 2001–2004 to 3.2% in 2010–2012 (adjusted odds ratio [OR] 2.2, 95% confidence interval [CI] 1.5–3.3). Utstein (witnessed arrest with shockable rhythms) survival to discharge improved from 2.5% to 11.0% (adjusted OR 9.6, 95% CI 2.2–41.9). BCPR rates increased from 19.7% to 22.4% (p = 0.02). The group also analysed the effect of various interventional strategies over the past ten years and found that ambulance response time < 8 minutes (OR 1.5, 95% CI 1.0–2.3), bystander automated external defibrillator (OR 5.8, 95% CI 2.0–16.2), and post-resuscitation hypothermia (OR 30.0, 95% CI 11.5–78.0) were significantly associated with survival to hospital discharge. Prehospital epinephrine (OR 0.6, 95% CI 0.4–0.9) had a negative association with survival.

Both OHCA with an initial shockable rhythm (OR 6.10) and subsequent conversion to a shockable rhythm (OR 2.00) independently predicted survival to hospital discharge. This data was featured in Cardiology News Digital Network in January 2016 and was also presented at conferences locally and internationally.[9]

PAROS Phase 2

Survival of OHCA patients requires a set of actions termed the 'chain of survival'. The chain of survival includes recognition of cardiac arrest and activation of the emergency response system, early CPR, rapid defibrillation, effective advanced life support and integrated post-resuscitation care.[10] Previous research has similarly confirmed that the earlier CPR is started, the greater the chances of survival from OHCA.[5,11,12] With this in mind, the focus of the PAROS network since 2013 has been to develop and implement a cost-effective strategy that can improve the BCPR rate. One of the solutions is to implement a DACPR programme. With the help of Save Hearts in Arizona Registry and Education and the CARES group, an implementation package consisting of a DACPR protocol, training programme and quality improvement toolkit was developed.

In early 2016, the PAROS group published the results of the implementation of the DACPR training programme on BCPR rate and cardiac arrest outcomes in Singapore. It showed that out of 2,968 OHCA cases, the overall survival rate was 3.9% with good functional recovery in 2.2% of the patients and a trend suggesting improved survival outcomes with the programme.[13] BCPR rate increased from 22.4% to 42.1% (OR 2.52, 95% CI 2.09–3.04; p < 0.001) and return of spontaneous circulation rate increased significantly from 26.5% to 31.2% (OR 1.26, 95% CI 1.04–1.53; p = 0.02).

Recognition for PAROS

The American Heart Association and Resuscitation Science Symposium have awarded the PAROS network the 2014 'Award for International Group Collaboration to Advance Resuscitation Science'. Previous winners include the Australian and New Zealand Intensive Care Society Clinical Trial Group (2011), ROC Investigators (2012) and International Liaison Committee on Resuscitation (2013). The network has also garnered awards such as those for best oral and poster presentations at conferences.

PAROS events

In the past years, the PAROS network has organised meetings in Japan, South Korea, UAE-Dubai, Singapore, Taiwan, Malaysia, India and Thailand. The network, in collaboration with local emergency medicine societies and the Asian Association for EMS (previously known as Asian EMS Council), organised EMS Asia conferences in some of its member countries: Penang, Malaysia (2012); Singapore (2013); Goa, India (2014); and Seoul, South Korea (2016), for EMS providers in the region.

REFERENCES

1. Nichol G, Thomas E, Callaway CW, et al; Resuscitation Outcomes Consortium Investigators. Regional variation in out-of-hospital cardiac arrest incidence and outcome. JAMA 2008; 300:1423-31.

2. Lai H, Choong CV, Fook-Chong S, et al; PAROS study group. Interventional strategies associated with improvements in survival for out-of-hospital cardiac arrests in Singapore over 10 years. Resuscitation 2015; 89:155-61.

3. Morrison LJ, Nichol G, Rea TD, et al; ROC Investigators. Rationale, development and implementation of the Resuscitation Outcomes Consortium Epistry-Cardiac Arrest. Resuscitation 2008; 78:161-9.

4. McNally B, Stokes A, Crouch A, Kellermann AL; CARES Surveillance Group. CARES: Cardiac Arrest Registry to Enhance Survival. Ann Emerg Med 2009; 54:674-83.e2.

5. Stiell IG, Wells GA, DeMaio VJ, et al. Modifiable factors associated with improved cardiac arrest survival in a multicenter basic life support/defibrillation system: OPALS Study Phase I results. Ontario Prehospital Advanced Life Support. Ann Emerg Med 1999; 33:44-50.

6. Grasner JT, Herlitz J, Koster RW, et al. Quality management in resuscitation – towards a European cardiac arrest registry (EuReCa). Resuscitation 2011; 82:989-94.

7. Singapore Clinical Research Institute. About PAROS [online]. Available at: http://www.scri.edu.sg/crn/pan-asian-resuscitation-outcomes-study-paros-clinical-research-network-crn/about-paros/. Accessed June 10, 2016.

8. Ong ME, Shin SD, Tanaka H, et al. Pan-Asian Resuscitation Outcomes Study (PAROS): rationale, methodology, and implementation. Acad Emerg Med 2011; 18:890-7.

9. Ong ME, Shin SD, De Souza NN, et al. Outcomes for out-of-hospital cardiac arrests across 7 countries in Asia: The Pan Asian Resuscitation Outcomes Study (PAROS). Resuscitation 2015; 96:100-8.

10. Cummins RO, Ornato JP, Thies WH, Pepe PE. Improving survival from sudden cardiac arrest: the "chain of survival" concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association. Circulation 1991; 83:1832-47.

11. Martens PR, Mullie A, Calle P, Van Hoeyweghen R. Influence on outcome after cardiac arrest of time elapsed between call for help and start of bystander basic CPR. The Belgian Cerebral Resuscitation Study Group. Resuscitation 1993; 25:227-34.

12. Cummins RO, Eisenberg MS, Hallstrom AP, Litwin PE. Survival of out-of-hospital cardiac arrest with early initiation of cardiopulmonary resuscitation. Am J Emerg Med 1985; 3:114-9.

13. Harjanto S, Na MX, Hao Y, et al. A before-after interventional trial of dispatcher-assisted cardio-pulmonary resuscitation for out-of-hospital cardiac arrests in Singapore. Resuscitation 2016; 102:85-93.