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ORIGINAL ARTICLE

Variation of current protocols for managing out-of-hospital cardiac arrest in prehospital settings among Asian countries



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KEYWORDS

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Background/Purpose: Protocols for managing patients with out-of-hospital cardiac arrest (OHCA) may vary due to legal, cultural, or socioeconomic concerns. We sought to assess international variation in policies and protocols related to OHCA.

Methods: A brief survey was developed by consensus. Elicited information included protocols for managing patients with nontraumatic OHCA or traumatic OHCA, policies for using automated

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external defibrillators (AEDs) during transportation of patients with ongoing resuscitation, and application of terminations of resuscitation (TOR) rules in prehospital settings in the respondent's city or country. The populations of interest were emergency physicians, medical directors of emergency medical services (EMS), and policy makers.

Results: Responses were obtained from eight cities in six Asian countries. Only one (12.5%) city applied TOR rules for OHCA. Do-not-resuscitate (DNR) orders were valid in prehospital settings in five (62.5%) cities. All cities used AEDs for nontraumatic OHCA; seven (87.5%) cities did not routinely use AEDs for traumatic OHCA. For nontraumatic OHCA, four (50%) cities performed 2 minutes of on-scene cardiopulmonary resuscitation (CPR) and then transported the patients with ongoing resuscitation to hospitals; three (37.5%) cities performed 4 minutes of on-scene CPR; one (12.5%) city allowed variation in the duration of on-scene CPR.

Conclusion: International variation in practices and policies related to OHCA do exist. Concerns regarding prehospital TOR rules include medical evidence, legal considerations, EMS manpower, public perception, medical oversight, education, EMS characteristics, and cost-effectiveness analysis. Further research is needed to achieve consensus regarding management protocols, especially for EMS that perform resuscitation during transportation of OHCA patients.

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Introduction

Out-of-hospital cardiac arrest (OHCA) is a global concern.¹ OHCA is estimated to affect 0.1% of the general population, approximately 60% of which is assessed by emergency medical services (EMS).² Evidence indicates that early defibrillation and uninterrupted chest compression are associated with better outcome.^{3,4} Based on this concept, optimal delivery of resuscitation efforts on scene, rather than performing inadequate cardiopulmonary resuscitation (CPR) in a moving ambulance and rushing to the nearest emergency department (ED), is believed to improve outcomes for OHCA patients.⁵ In addition, it is recognized that CPR efforts are futile for certain subsets of OHCA patients, giving rise to the need for field termination of resuscitation (TOR) rules for EMS providers.^{6,7}

Field TOR reduces unnecessary transport to the hospital, thus decreasing the associated road hazards and improving availability of EMS and ED resources for patients with a higher chance of survival.^{8–11} The American Heart Association (AHA), the International Liaison Committee on Resuscitation (ILCOR), and the European Resuscitation Council have developed guidelines for ethical and evidence-based TOR rules in the prehospital setting.^{12,13} However, the adherence rate to AHA guidelines at the local EMS level in the United States is low.^{14,15}

Sasson et al¹⁶ conducted focus-group interviews to identify barriers to local implementation of national AHA guidelines for TOR. The adoption of TOR rules in the EMS system may be hindered by medical, socioeconomic, or legal concerns.^{17,18} Asia-Pacific countries have unique cultures, health care and EMS systems, which are different from European or Anglo-American models.¹⁹ Since EMS utilization is rapidly growing in Asia, we conducted this study to investigate current protocols of managing patients with OHCA and field TOR applications among Asian countries.

Methods

Study design and sample

We conducted a three-phase qualitative survey at the Pan Asian Resuscitation Outcomes Study (PAROS) meetings. PAROS represents a recently organized collaborative in the Asia–Pacific area to optimize outcomes of OHCA.²⁰ There were six countries and eight cities in the PAROS group during the survey period. All of the participating cities have city-based EMS systems. PAROS has academic meetings at least twice a year.

The first phase was implemented in May 2011 at the Seoul meeting. A group discussion was conducted to formalize the survey. The definition of terms used in this study was discussed and was standardized by consensus. A web-based questionnaire was distributed to each representative. The characteristics of each EMS site were obtained in this phase, which include urbanization, population, land area, population density, average EMS response time (defined as the time between the ambulance leaving the fire station and the ambulance arriving at the scene), average EMS transport time (defined as the time between the ambulance leaving the scene and the ambulance arriving at the hospital), number of patients assessed by EMS per year, number of OHCA assessed by EMS per year, highest service level, operation of ambulance, finance, and tiered response.

The second phase was implemented in September 2012 at the Penang meeting and in November 2012 at the Tokyo meeting. Interviews were conducted over 30 minutes individually with each representative. The purpose of the interview was to obtain the detailed characteristics of each EMS system and to have an in-depth understanding of how each EMS system currently manages patients with OHCA. Standardized checklists were used to avoid misunderstandings. The management of OHCA in each EMS site was obtained in this phase, including the status of do-

not-resuscitate (DNR) orders in the hospital setting and in the prehospital setting, CPR exemption if obvious signs of death exist, EMS protocols for treating patients with OHCA, and EMS application of TOR rules. We focused on protocols of basic life support (BLS) management plus AED use for treating OHCA. In order to avoid complexity, we did not include advanced life support (ALS) management in this survey, such as advanced airway procedures or medication administration. The results of the second phase were then reviewed and were clarified by each representative.

The final phase was conducted using a web-based survey with open-ended questions. The representatives replied via e-mail to identify the major barriers to adopting TOR rules in their own EMS systems. The representatives were also asked to provide their opinions on how to improve the situation. In this phase, we preferred written feedback, instead of oral interviews, to allow the representatives more time to ruminate on their responses. The response from each representative was independent in order to avoid shared information bias.^{21,22} Responses were reviewed in April 2013 at the Singapore meeting. The characteristics of each EMS site were updated using the data from 2011.

Respondents

The populations of interest were emergency physicians or EMS medical directors of the region. We identified these individuals on the basis of scientific publications related to OHCA, service on local EMS, or personal expertise. The participating sites and the corresponding representatives were identified. All representatives were medical directors involved in the development and implementation of local EMS policies and protocols. We contacted the representatives identified by the research committee and all of them consented to this survey.

Cities and countries

In order to give a more diverse representation of medical practices, we sought participation from as many cities and Asian countries as possible. The primary focus was on cities with an EMS infrastructure of medical direction and regular updates of protocols.

Verbalism

The survey questions and responses were all in English. The survey conductors and respondents were familiar with medical terms and communications in English. The responses and interview contents were emailed back to the respondents individually for clarification and confirmation.

Data collection and analysis

Survey responses were collected and then analyzed using the software Microsoft Office Excel (version 2010; Microsoft Corp., Redmond WA, USA).

Ethics

The PAROS research committee approved the study. No financial incentives were offered to the participants. This study was reviewed with exemption and was approved by the Institutional Review Board of National Cheng Kung University Hospital, Tainan, Taiwan.

Results

Survey responses

Individuals from the PAROS group from eight cities in six countries participated in the survey. The eight participating cities included Bangkok (Thailand), Kuala Lumpur (Malaysia), Osaka (Japan), Tokyo (Japan), Seoul (Korea), Singapore (Singapore), Tainan (Taiwan), and Taipei (Taiwan). The representatives of the EMS sites are listed in the authorship of this manuscript.

The characteristics of EMS sites

The characteristics of each EMS unit are shown in [Table 1](#). Tokyo and Osaka have a combination of urban and suburban EMS, Tainan has a combination of urban and rural EMS; all other sites (Bangkok, Kuala Lumpur, Seoul, Singapore, and Taipei) are urban EMS systems. The EMS systems in Bangkok and Kuala Lumpur are hospital-based and the highest service levels in both sites are physicians. The average EMS response time varies from 5.7 ± 3.5 minutes (Seoul) to 13.5 ± 6.6 minutes (Bangkok); the average EMS transport time varies from 4.5 ± 2.8 minutes (Taipei) to 16.4 ± 24.0 minutes (Singapore). All the cities included in this survey do not charge the end-users any fee to utilize the EMS system.

Protocols for managing OHCA in the prehospital settings

[Table 2](#) summarizes protocols for managing OHCA in the prehospital settings of the survey cities. Most EMS providers deliver CPR on scene for 2 minutes or 4 minutes and then transport the patient with OHCA to a designated hospital. In Seoul, the protocols require EMTs to perform CPR on-scene for 8 minutes if the EMS response time is less than 4 minutes; perform CPR on-scene for 4 minutes if the EMS response time is 4–8 minutes; perform CPR on-scene for 2 minutes if the EMS response time is 8–12 minutes; and no CPR is performed on-scene if the EMS response time is > 12 minutes.

The DNR orders are valid in both hospital and prehospital settings in five (62.5%) cities: Kuala Lumpur, Seoul, Singapore, Tainan, and Taipei; in Bangkok, Osaka, and Tokyo, the DNR orders are only valid in the hospital settings, but not in the prehospital settings. CPR is exempted in all participating sites if obvious signs of death are presented in the prehospital settings. The definition of obvious signs of death—which includes decapitation, rigor mortis, livor mortis, trunk dissection, burn with carbonized

Table 1 Characteristics of emergency medical services systems in the year 2011.

EMS unit (city-based)	Bangkok	Kuala Lumpur	Osaka	Tokyo	Seoul	Singapore	Tainan	Taipei
Country	Thailand	Malaysia	Japan	Japan	Korea	Singapore	Taiwan	Taiwan
Urbanization	Urban	Urban	Urban plus suburban	Urban plus suburban	Urban	Urban	Urban plus rural	Urban
Population (millions)	10.1	1.6	2.7	13	10.4	5.3	1.9	2.7
Territory (km ²)	1568	243	223	2187	605	710	2191	272
Population density (1000/km ²)	6.4	6.7	12	5.9	17.3	7.5	0.9	9.8
EMS response time, min (mean ± SD)	13.5 ± 6.6	24.0 ± 11.0	7.4 ^a	7.2 ± 3.2	5.7 ± 3.5	8.2 ± 3.7	6.0 ± 7.7	6.4 ± 3.3
EMS transport time min (mean ± SD)	12.5 ± 8.3	NA	28.6 ^a	20.4 ± 7.8	7.4 ± 4.8	16.4 ± 24.0	9.0 ± 6.8	4.5 ± 2.8
No. of patients assessed by EMS per y	36,362	17,581	214,953	640,193	295,699	142,549	72,010	98,300
No. of OHCA assessed by EMS per y	NA	1084	1600 ^b	12,851	4179	1761	1468	3072
Highest service level	Physician	Physician assistant or nurse	EMT-intermediate	EMT-intermediate	EMT-intermediate	EMT-intermediate	EMT-paramedic	EMT-paramedic
Operation of ambulance	Hospital	Mixture of hospital-based, civil defense, & nonprofit organizations	Fire department	Fire department	Fire department	Fire department	Fire department	Fire department
Finance	Free, & reimbursed by public insurance	Free & tax based	Free & tax based	Free & tax based	Free & tax based	Free & tax based	Free & tax based	Free & tax based
Tiered response	BLS plus ALS	BLS or ALS single	BLS single	BLS single	BLS single	BLS single	BLS plus ALS	BLS plus ALS

ALS = advanced life support; BLS = basic life support; EMS = emergency medical service; EMT = emergency medical technician; NA = not available; No. = number; OHCA = out-of-hospital cardiac arrest; SD = standard deviation.

^a SD is not available.

^b Only witnessed-OHCA.

Table 2 Protocols for managing patients with out-of hospital cardiac arrest in the prehospital settings.

EMS unit (city-based)	Bangkok	Kuala Lumpur	Osaka	Tokyo	Seoul	Singapore	Tainan	Taipei
Valid DNR order in the hospital setting	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Valid DNR order in the prehospital setting	No	Yes	No	No	Yes	Yes	Yes	Yes
CPR is exempted if obvious signs of death are presented ^a	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Protocols for nontraumatic OHCA	Performing CPR on scene for 2 min along with AED use & then transport to the hospital with ongoing CPR in the ambulance	Performing CPR on scene for 15 min along with AED use & then transport to the hospitals if ROSC or defibrillation	Performing CPR on scene for 4 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 4 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for varying duration ^b along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 2 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 4 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 2 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance
Protocols for traumatic OHCA	Performing CPR on scene for 2 min without AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	No CPR	Performing CPR on scene for 4 min without AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 4 min without AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 4 min without AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 2 min without AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 4 min along with optional AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance	Performing CPR on scene for 2 min along with AED use & then transport to the nearest hospitals with ongoing CPR in the ambulance
Application of TOR rules in nontraumatic OHCA	No ^c	Yes ^d	No	No	No	No	No	No

Application of TOR rules in traumatic OHCA	No ^c	Yes ^d	No	No	No	No	No
<p>AED = automated external defibrillators; ALS = advanced life support; BLS = basic life support; CPR = cardiopulmonary resuscitation; DNR = do-not-resuscitate; EMS = emergency medical service; EMT = emergency medical technician; OHCA = out-of-hospital cardiac arrest; ROSC = return of spontaneous circulation; TOR = termination of resuscitation.</p> <p>^a The obvious signs of death include decapitation, rigor mortis, livor mortis, trunk dissection, burn with carbonized appearance, and decomposition.</p> <p>^b Performing CPR on scene for 8 minutes if EMS response time is < 4 minutes; performing CPR on scene for 4 minutes if EMS response time is 4–8 minutes; performing CPR on scene for 2 minutes if EMS response time is 8–12 minutes; no CPR on scene if EMS response time is > 12 minutes.</p> <p>^c Ambulance physicians may terminate on-scene resuscitation efforts according to clinical judgments; however, no documented rule of TOR exists.</p> <p>^d ALS providers may terminate on-scene resuscitation efforts if the patient with OHCA neither achieves ROSC nor has a shockable rhythm after 15 minutes of CPR, but there is no protocol of TOR for BLS providers.</p>							

appearance, and decomposition—is consistent in all participating sites.

All participating sites provide CPR and apply AEDs for patients with nontraumatic OHCA and then transport the patients to the designated hospitals with ongoing CPR in the ambulance during transportation. However, the on-scene CPR protocols vary in different sites. For nontraumatic OHCA, four (50.0%) cities perform 2 minutes of CPR on-scene before transporting the patients to hospitals, and three (37.5%) cities perform 4 minutes of CPR. Duration of on-scene CPR efforts provided by EMTs in Seoul is determined by EMS response time.

For patients with traumatic OHCA, the EMS protocol in Kuala Lumpur does not initiate on-scene CPR; the EMS systems of the remaining seven (87.5%) cities provide some on-scene CPR efforts. Seven (87.5%) cities, which include Bangkok, Kuala Lumpur, Osaka, Tokyo, Tainan, Seoul, and Singapore, do not routinely use AEDs for patients with traumatic OHCA. The AED use for traumatic OHCA is mandatory in Taipei.

Prehospital TOR rules are applicable for patients with OHCA in only one (12.5%) city. In Kuala Lumpur, ALS providers may terminate on-scene resuscitation efforts if the patient with OHCA neither achieves return of spontaneous circulation (ROSC) nor has a shockable rhythm after 15 minutes of CPR, but there is no protocol of TOR for BLS providers. While in Bangkok, ambulance physicians may terminate on-scene resuscitation efforts according to clinical judgment; however, no documented rule of TOR exists.

Adopting prehospital TOR rules

The obstacles of adopting field TOR rules in the EMS sites are summarized in Table 3. The major concerns and possible strategies for applying prehospital TOR rules in each city were coded as medical evidence, legal consideration, EMS manpower, public perception, medical oversight, EMT education, EMS characteristics, and cost-effectiveness analysis.

Discussion

There are wide variations in local regulations and practices regarding management of patients with OHCA in the pre-hospital setting among Asian countries. Though differences were observed between the EMS agencies in Western communities,²³ the unique characteristics of Asian societies deserve elaborating upon.

Almost all EMS systems in this survey use a policy of “resuscitation during transportation” since TOR rules are rarely practiced among Asian societies. The protocols in most survey cities request EMS providers to deliver CPR on-scene for a certain duration before transporting the patients with OHCA to hospitals. In Seoul, the duration of on-scene CPR provided by EMTs was dependent on the length of the EMS response time. However, the protocol in Seoul was amended in 2014 so that EMTs perform on-scene CPR for at least 5 minutes for patients with either traumatic or nontraumatic OHCA, regardless of the length of EMS

Table 3 Considerations regarding field termination of resuscitation.

EMS unit (city-based)	Bangkok	Kuala Lumpur	Osaka	Tokyo	Seoul	Singapore	Tainan	Taipei
Medical evidence	Lack of validation of TOR rules in Asian EMS systems	Medical evidence is not strong enough	Unmentioned	Unmentioned	Using shortterm outcomes like survival to discharge may overestimate TOR adequateness; longer follow up for neurologic performance may be needed to generate proper TOR guidelines	Unmentioned	Unmentioned	Lack of validation of TOR in Asia EMS system. New interventions (such as ECMO, hypothermia therapy, or mechanical CPR devices) may improve outcome.
Medical oversight	Unmentioned	Absence of national consensus on TOR for BLS providers	Unmentioned	Lack of medical direction committee	Ambiguousness of EMS protocols for patients with OHCA	Unmentioned	Unmentioned	Unmentioned
EMS characteristics	Unmentioned	System is maintained by hospital-based providers with proper organizational structure, oversight & protocol. System also has another nonhospital based provider that is mainly focused on providing first responder service with minimal organizational medical oversight	Unmentioned	Unmentioned	Advanced medical care in hospitals at the early postarrest phase may be beneficial for patients with OHCA because the EMS transport time is relatively short	Unmentioned	Unmentioned	EMS transport time in Asia EMS system is relatively short
EMS manpower	Unmentioned	Lack of ambulance & manpower, may delay response time	Unmentioned	Unmentioned	Not enough EMT to perform ALS- TOR	Not enough EMT to perform ALS- TOR	Unmentioned	Unmentioned
EMT education	Unmentioned	Absence of standardization on	Unmentioned	Unmentioned	Unmentioned	EMT education consistency in	Unmentioned	Unmentioned

		the education requirements for EMS providers				applying protocols by EMTs		
Legal consideration	Authorities unaware of the importance of TOR	Unmentioned	Lack of national consensus & legislation for TOR rules	Lack of legislation for TOR rules	Unmentioned	Unmentioned	Unmentioned	Unmentioned
Public perception	Unmentioned	Local social norms are acceptable; should be adhered to local practice	Public unawareness of pre-existing DNR orders	Public concerns of making rules for terminal care is generally high	Unmentioned	Family acceptance of field TOR is generally low	Public perception is overoptimistic for outcomes of patients with OHCA; lack of confidence in EMT expertise. Family may overrule existing DNR orders	Unmentioned
Cost-effectiveness analysis	Lack of cost-effectiveness analysis	Unmentioned	Unmentioned	Unmentioned	Unmentioned	Unmentioned	EMS is free of charge & financial burden of post-resuscitation care is relatively low	Unmentioned

ALS = advanced life support; BLS = basic life support; DNR = do-not-resuscitate; ECMO = extracorporeal membrane oxygenation; EMS = emergency medical service; EMT = emergency medical technician; OHCA = out-of-hospital cardiac arrest; TOR = termination of resuscitation.

response time, unless there were obvious signs of death. The optimal duration of on-scene CPR is still unknown.²⁴

All survey cities use AEDs for nontraumatic OHCA. However, for traumatic OHCA, most cities do not routinely use AEDs. The survey finding is congruent with the current opinion that use of AED is not associated with better outcomes for traumatic OHCA.²⁵

CPR is exempted in all survey sites when there are obvious signs of death. Kuala Lumpur is the only city with an adapted TOR rule for OHCA in this survey. The representative mentioned that TOR is a relatively acceptable social norm in Kuala Lumpur. The presence of hospital personnel at the scene may strengthen public trust since the highest service level of EMS provider in Bangkok and Kuala Lumpur is a physician. By comparison, public concern regarding TOR is higher in all the other survey cities without physicians. The association between public acceptance of TOR and religion or socioeconomic status remains unclear.

The quality of CPR in a moving ambulance is generally considered inadequate.^{26–29} In a video recording and time-motion analysis, frequent interruptions of CPR as well as poor CPR quality were observed during ambulance transportation.²⁸ Current prehospital TOR rules are not widely validated for the practice of ongoing CPR in an ambulance. Recent studies also suggested that the misclassification rates of TOR rules were more than 1% in all provider combinations in Tokyo and Taipei.^{30,31} None of them achieved the expected standards for medical futility, that is, <1% chance of survival of a given treatment. The results were inconsistent with studies carried out in North American and European sites, where the misclassified rates for TOR rules ranged from 0% to 0.5%.^{30,31}

Some Asian cities are highly populated and the medical resources are relatively concentrated. ALS techniques such as extracorporeal membrane oxygenation are generally available in the EDs of tertiary care hospitals in many Asian cities.³² The response time of EMS and the transport time from scene to hospitals in Asian cities are generally much shorter than in Western cities.¹⁹ The EMS characteristics may have significant impact on the predictability of TOR rules on OHCA's outcome. Local observation in Japan and Taiwan demonstrated an increase in neurologically favorable survival when patients without field ROSC were transported to tertiary care hospitals. Given similar overall survival and assumption of better survival for shockable rhythms versus nonshockable rhythms, the findings of current research may infer that patients with nonshockable rhythms who would have been predicted dead by current TOR rules derived from the Western community, survived in some Asian communities. This translates to lower accuracy of TOR rules in this subgroup of patients.^{30,31}

Asian societies have long debates on terminal and hospice care. When a patient approaches the end of life, physicians are more likely to follow the family members' decisions rather than the patient's as "the family settles the final things". Respondents urged the need to illustrate outcomes of OHCA in a simplistic manner, as public awareness of patient outcome is generally unrealistic. Most people are not aware that survival from OHCA with intact neurological function is the exception rather than the norm.

In some countries, such as Japan, physicians are not directly involved in medical direction in most EMS, which make it difficult to integrate latest medical evidence into EMS protocols. Some respondents also expressed the concerns of medical-legal issues. Authorities could be unaware of the importance of TOR. National consensus and legislation for TOR rules were lacking. National health authorities should be encouraged to explore this issue. Further research is also needed to validate TOR rules.

The majority of EMS manpower in most cities is EMT-intermediate, which is inadequate to run the entire Advanced Cardiac Life Support (ACLS) protocol in the field. In most of the survey cities, an ambulance team responding to an OHCA call consists of only one paramedic and one to two EMT-intermediates.^{19,32,33} The ability to provide adequate prehospital ALS level care is limited; for BLS care delivered by EMT-intermediates, there are also concerns about terminating resuscitation after attempting only BLS measures such as laryngeal mask airways and administering only adrenaline.^{30,31}

Transporting all patients with OHCA to hospitals could burden both EMS systems and hospitals. Patients with unfavorable neurological outcomes could devastate their families financially and emotionally. Since only a few patients with OHCA survive to hospital discharge with favorable neurological outcomes, cost-effectiveness analysis of current EMS protocols should be conducted.^{16,17,30,31}

Developing the paramedic system towards operationalization of full EMT-Paramedic (EMT-P) capability can be considered if the organization is keen to provide full-ALS level care in the prehospital setting, including applying TOR rules. However, the consistency in applying the proper standards by the paramedic teams should be monitored closely.^{18,30,31} The processes needed to manage the administration of a dead body should be incorporated in EMS protocols. If the paramedic team terminates the resuscitation in the field, the protocols should include the following: coordination with the doctors for death certification, coordination to transport the body, psychological surveillance of EMTs/bystanders/first responders, and other administrative considerations.

This study has several limitations. Firstly, it was a convenience sample of respondents selected on the basis of their knowledge and involvement in the practices in their cities. Secondly, the survey was conducted in English, which is not the native language used in most of the survey cities. However, the survey used English terms that are commonly seen in medical literature and the confirmation process was conducted to minimize misunderstanding. Thirdly, the survey data was collected from 2011 to 2013. However, we believe that the characteristics of EMS systems in each city remain similar across this period. The management protocols for patients with OHCA in the prehospital settings in the survey cities did not change much during the research years. Lastly, we did not discuss the use of ALS in this survey.

In conclusion, there are international variations in practices and policies regarding management of patients with OHCA. Most EMS systems in Asian cities do not apply rules of TOR for OHCAs in the prehospital settings. Most cities in this survey have a policy of transporting patients with ongoing CPR to hospitals if ROSC is not achieved after

resuscitation efforts on scene. There is an ongoing need to enhance protocols based on operational feasibility and improved specificity to identify futile resuscitation for wider adoption of TOR rules in Asian EMS systems. There are many concerns regarding prehospital TOR rules that need to be addressed with various stakeholders such as the public, EMS providers, and hospital clinicians in the areas of medical evidence, legal consideration, EMS manpower, public perception, medical oversight, EMT education, EMS characteristics, and cost-effectiveness analysis.

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