Chest Compression–Only Cardiopulmonary Resuscitation for Out-of-Hospital Cardiac Arrest With Public-Access Defibrillation : A Nationwide Cohort Study

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for the Japanese Circulation Society Resuscitation Science Study (JCS-ReSS) Group

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Chest Compression–Only Cardiopulmonary Resuscitation for Out-of-Hospital Cardiac Arrest With Public-Access Defibrillation

A Nationwide Cohort Study

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Background—It remains unclear which is more effective to increase survival after out-of-hospital cardiac arrest in those with public-access defibrillation, bystander-initiated chest compression–only cardiopulmonary resuscitation (CPR) or conventional CPR with rescue breathing.

Methods and Results—A nationwide, prospective, population-based observational study covering the whole population of Japan and involving consecutive out-of-hospital cardiac arrest patients with resuscitation attempts has been conducted since 2005. We enrolled all out-of-hospital cardiac arrests of presumed cardiac origin that were witnessed and received shocks with public-access automated external defibrillation (AEDs) by bystanders from January 1, 2005, to December 31, 2009. The main outcome measure was neurologically favorable 1-month survival. We compared outcomes by type of bystander-initiated CPR (chest compression–only CPR and conventional CPR with compressions and rescue breathing). Multivariable logistic regression was used to assess the relationship between the type of CPR and a better neurological outcome. During the 5 years, 1376 bystander-witnessed out-of-hospital cardiac arrests of cardiac origin in individuals who received CPR and shocks with public-access AEDs by bystanders were registered. Among them, 506 (36.8%) received chest compression–only CPR and 870 (63.2%) received conventional CPR. The chest compression–only CPR group (40.7%, 206 of 506) had a significantly higher rate of 1-month survival with favorable neurological outcome than the conventional CPR group (32.9%, 286 of 870; adjusted odds ratio, 1.33; 95% confidence interval, 1.03–1.70).

Conclusions—Compression-only CPR is more effective than conventional CPR for patients in whom out-of-hospital cardiac arrest is witnessed and shocked with public-access defibrillation. Compression-only CPR is the most likely scenario in which lay rescuers can witness a sudden collapse and use public-access AEDs. **(*Circulation*. 2012;126:2844-2851.)**

Key Words: cardiopulmonary resuscitation ■ death, sudden ■ defibrillators ■ epidemiology ■ heart arrest

For >50 years, the combination of chest compressions and rescue breathings has been a standard for cardiopulmonary resuscitation (CPR),[1,2] and CPR can double survival after out-of-hospital cardiac arrests (OHCAs).[3–6] However, despite the proven effectiveness of CPR by bystanders, the proportion of CPR by bystanders is still low in most areas around the world.[7–9]

Clinical Perspective on p 2851

Recently, many experimental[10,11] and clinical studies[12–16] have shown the effectiveness of chest compression–only CPR (CCCPR). The 2010 CPR guidelines changed the order of CPR from ABC (airway-breathing-compressions) to CAB (compressions-airway-breathing) and recommended CCCPR

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for untrained lay rescuers and dispatcher-assisted CPR to increase chest compressions by bystanders.[3–6] However, in some types of cardiac arrests like pediatric cardiac arrests of noncardiac origin, conventional CPR with rescue breathing can be more effective than CCCPR,[17–19] and conventional CPR with rescue breathing is still the standard of care in most areas.

In addition to CPR, integration of automated external defibrillators (AEDs) into a system of care is critical in the chain of survival.[3–6] Recently, public-access defibrillation (PAD) programs have been developed successfully, and their effectiveness has been demonstrated in some areas, including Japan.[20–22]

To give the victims of OHCA the best chance of survival, initiation of CPR and cardiac defibrillation are needed within the first moments of a cardiac arrest.[23–25] Some animal and clinical reports have suggested that the effectiveness of each type of bystander CPR is time dependent and that CCCPR might be more effective than conventional CPR with rescue breathing in the early phase of cardiac arrest.[10,12,13,16,26] Among those with PAD for whom defibrillation would be delivered fast and CPR would be needed only in the early phase after collapse, CCCPR can be more beneficial than conventional CPR. Improvements in the education and implementation process to increase CPR and AED use by bystanders are needed in this era when PAD programs are available to save more lives from OHCAs.[3–6] Because it is easier to learn and perform,[27] CCCPR would lead to an increase in the number of individuals trained and would increase CPR and AED use by bystanders.

In this study, we compared neurological outcomes among 1376 OHCA patients with PAD based on a Japanese prospective, nationwide, population-based cohort study of OHCA victims. Our hypothesis is that CCCPR by bystanders is more effective than conventional CPR for survival after bystander-witnessed OHCA with PAD.

Methods

Study Design and Setting

The All-Japan Utstein Registry of the Fire and Disaster Management Agency is a prospective, nationwide, population-based OHCA registry system based on the Utstein style.[28,29] This observational study enrolled all patients with OHCA of presumed cardiac origin that was witnessed who were provided CPR and shocks by bystanders with public-access AEDs and then treated by emergency medical service (EMS) from January 1, 2005, through December 31, 2009. The study protocol for analyses was approved by the Ethics Committee of the National Cerebral and Cardiovascular Center of Japan.

Cardiac arrest was defined as the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation.[28,29] The arrest was presumed to be of cardiac origin unless it was caused by cerebrovascular diseases; respiratory diseases; malignant tumors; external causes, including trauma, hanging, drowning, drug overdose, and asphyxia; or any other noncardiac causes. These diagnoses of cardiac or noncardiac origin were clinically determined by the physicians in charge who collaborated with the EMS personnel.

EMS Systems in Japan

Japan has an area of ≈378 000 km^2, including both urban and rural communities, and its population was ≈127 million inhabitants in 2005. There were 803 fire stations with dispatch centers in 2009, and their EMS systems are almost uniform.[30] The free emergency telephone number 1-1-9 is used to call for an ambulance from anywhere in Japan. Emergency services are provided 24 hours every day. An ambulance is dispatched from the nearest fire station when called. Each ambulance has 3 emergency providers, including at least 1 emergency life-saving technician, a highly trained prehospital emergency care provider. Emergency life-saving technicians were allowed to insert an intravenous line and an adjunct airway and to use semiautomated external defibrillators for OHCA patients. Specially trained emergency life-saving technicians have been permitted to insert tracheal tubes since July 2004 and to administer intravenous epinephrine since April 2006. Cardiac arrest treatment guidelines were based on the American Heart Association, the European Resuscitation Council, and the International Liaison Committee on Resuscitation guidelines 2000 until September 2006 and the 2005 guidelines thereafter.[31] EMS providers were not permitted to terminate resuscitation in the field. Therefore, most patients with OHCA who were treated by EMS personnel were transported to a hospital and registered in this All-Japan Utstein Registry except those with decapitation, incineration, decomposition, rigor mortis, or dependent cyanosis. Details of the EMS system in Japan were given previously.[20]

Systemic CPR Training for the General Public and Dissemination of Public-Access AEDs

All EMS providers have been performing and teaching CPR according to the Japanese CPR guidelines.[5,31] In Japan, ≈1.6 million citizens per year participated in the conventional CPR training programs consisting of chest compressions, mouth-to-mouth ventilation, and AED use offered mainly by local fire departments.[30] CCCPR was not taught as the recommended technique in any resuscitation training program during the study period, but it was first recommended as "acceptable" for those who were not able to or did not wish to perform rescue breathing according to the 2005 CPR guidelines.[31] The emergency telephone dispatchers in Japan are basically trained and ordered to give CPR instructions with conventional CPR before EMS arrival. However, it is permitted to encourage bystanders to provide CCCPR if it is difficult for them to administer rescue breathing.

In Japan, citizen use of an AED has been legally permitted since July 2004. Public-access AED placement at public spaces, including schools, medical/nursing facilities, workplaces, sports/cultural facilities, and transportation facilities, depends on both public and private initiatives.[32] The cumulative number of public-access AEDs, excluding those in medical facilities and EMS institutions, estimated from AED sales increased from 9906 to 203 924 during this 5-year study period.[32]

Data Collection and Quality Control

Data were prospectively collected with a form based on the Utstein-style reporting guidelines for OHCA that included sex, age, type of bystander witness status, first recorded cardiac rhythm, time course of resuscitation, type of bystander-initiated CPR, type of advanced airway management, intravenous fluids, and epinephrine, as well as prehospital return of spontaneous circulation, 1-month survival, and neurological status 1 month after the event using the Cerebral Performance Category Scale. A series of EMS times of call receipt, vehicle arrival at the scene, contact with patients, initiation of CPR, defibrillation by EMS, and hospital arrival were recorded with the clock of each EMS system. When bystanders delivered shocks using public-access AEDs, the patient's first recorded rhythm was regarded as ventricular fibrillation or pulseless ventricular tachycardia. The estimated times of collapse, initiation of public-access AED shocks, and initiation of bystander CPR were obtained by EMS interview with the bystander. Type of bystander CPR was obtained by EMS observation and interview with the bystander before leaving the scene through the use of specific questions on the presence or absence of chest compressions and rescue breathing. The time interval from collapse to shocks by public-access AEDs was replaced with time to bystander CPR unless the time of shocks by public-access AEDs was obtained.

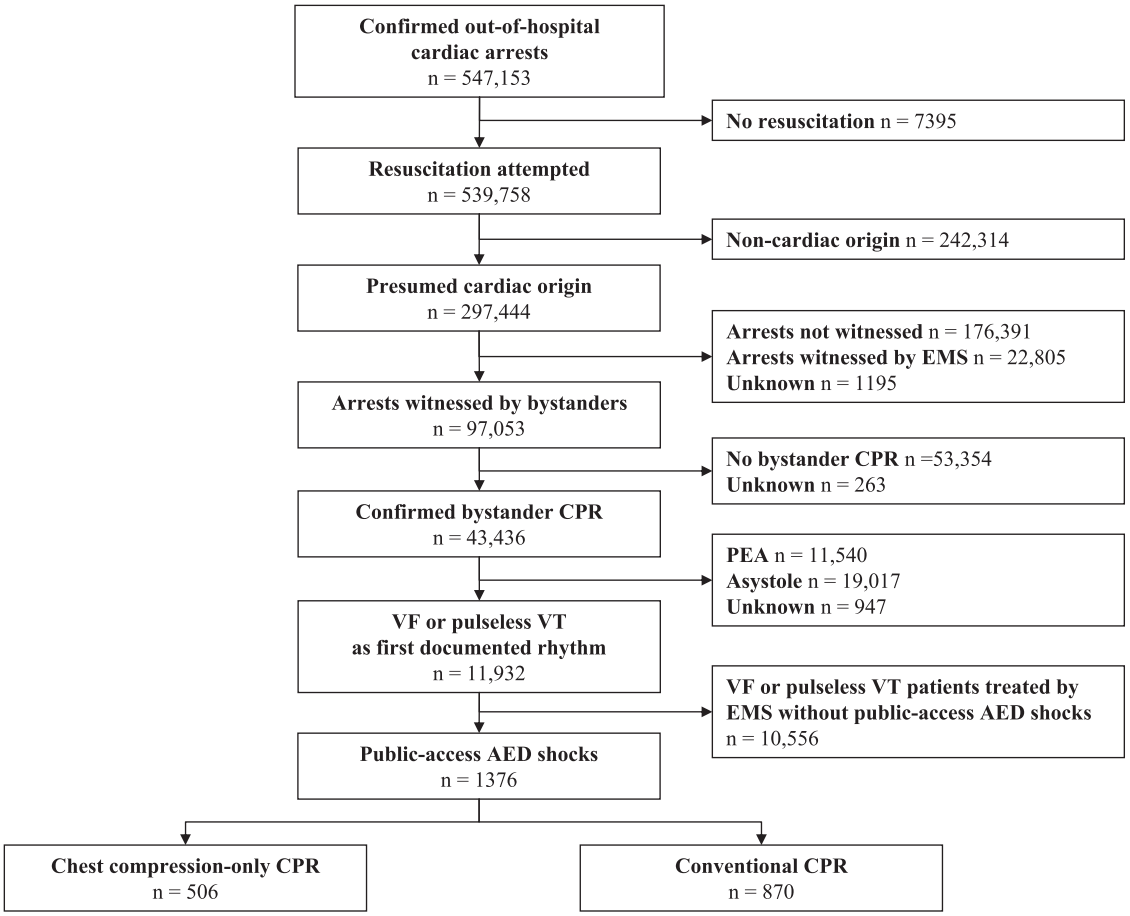

Figure. Study flow of out-of-hospital cardiac arrest patients using an abridged Utstein template from January 1, 2005, to December 31, 2009. EMS indicates emergency medical service; CPR, cardiopulmonary resuscitation; PEA, pulseless electric activity; VF, ventricular fibrillation; VT, ventricular tachycardia; and AED, automated external defibrillator.

All of those who survived OHCA were followed up for up to 1 month after the event by the EMS personnel in charge. The neurological status after 1 month was determined by the physician caring for the patients using the Cerebral Performance Category Scale: category 1, good cerebral performance; category 2, moderate cerebral disability; category 3, severe cerebral disability; category 4, coma or vegetative state; and category 5, death.[28,29] Neurologically favorable survival was defined as a Cerebral Performance Category Scale score of 1 or 2.[28,29]

The data form was filled out by the EMS personnel in cooperation with the physicians in charge of the patients, and the data were integrated into the registry system on the Fire and Disaster Management Agency database server and then logically checked by the computer system. If the data form was incomplete, the Fire and Disaster Management Agency returned it to the respective fire station for data completion.

Statistical Analysis

Outcomes after bystander-witnessed OHCA of cardiac origin with PAD were compared by type of bystander-initiated CPR. Both bystander-initiated CCCPR and conventional CPR with rescue breathing were included as bystander CPR. Patient characteristics and outcomes by type of bystander-initiated CPR were evaluated with the use of the t test for numeric variables and the χ^2 test or Fisher exact test for categorical variables. Trends were tested with univariate regression models. Multivariable analysis was used to assess the contribution of bystander-initiated CPR to 1-month survival with favorable neurological outcome; odds ratios and their 95% confidence intervals were calculated. Potential confounding factors based on biological plausibility and previous studies were included in the multivariable analysis. These variables included age ($<$17, 18–74, $\geq$75 years), sex (male, female), bystander witness status (family member, other), time interval from collapse to the public-access AED shock or the initiation of CPR by bystanders (for 1-minute increment), and year of arrest (for 1-year increment). All statistical analyses were performed with SPSS statistical package version 16.0J (SPSS, Inc, Chicago, IL). All tests were 2 tailed, and values of $P<0.05$ were considered statistically significant.

The authors had full access to and take full responsibility for the integrity of the data. All authors have read and agree to the manuscript as written.

Results

A total of 547 153 confirmed OHCAs were documented during these 5 years (the Figure). Of 539 758 OHCA patients with resuscitation attempts, 297 444 were presumed to be of cardiac origin. Of them, OHCA was witnessed in 97 053 patients (32.6%) by bystanders, 43 436 (14.6%) received bystander-initiated CPR, and 11 932 (4.0%) had ventricular fibrillation or pulseless ventricular tachycardia as the first documented rhythm. Among the bystander-witnessed OHCA with bystander CPR, 1376 patients (3.2%) who received their first shock by public-access AEDs before EMS arrival were eligible for our analyses. Among them, 506 (36.8%) received CCCPR and 870 (63.2%) received conventional CPR with rescue breathing.

Table 1. Characteristics of Out-of-Hospital Cardiac Arrest Patients With Public-Access Automated External Defibrillation Shocks by Type of Bystander-Initiated Cardiopulmonary Resuscitation

	Compression-Only CPR (n=506)	Conventional CPR (n=870)	*P*
Age, mean (SD), y	61.3 (16.2)	61.3 (19.1)	0.986
Age group, n (%)			0.003
<17 y	8 (1.6)	36 (4.1)	
18–74 y	397 (78.5)	621 (71.4)	
≥75 y	101 (20.0)	213 (24.5)	
Sex, n (%)			<0.001
Male	430 (85.0)	659 (75.7)	
Female	76 (15.0)	211 (24.3)	
Type of bystander witness status, n (%)			0.389
Family member	50 (9.9)	99 (11.4)	
Other	456 (90.1)	771 (88.6)	
Collapse to public-access AED shock or initiation of CPR by bystanders, mean (SD), min	2.9 (4.8)	2.6 (5.1)	0.256

CPR indicates cardiopulmonary resuscitation; AED, automated external defibrillator.

Characteristics of OHCA patients with PAD by type of bystander CPR are noted in Table 1. Mean age and bystander witness status were similar between the groups. The proportions of children (<17 years) and elderly (≥75 years) were lower in the CCCPR group than in the conventional CPR group, and the male/female ratio was higher in the CCCPR group than in the conventional CPR group. Mean time intervals from collapse to the public-access AED shock or the initiation of CPR by bystanders were also similar. The proportion of patients receiving CCCPR among eligible patients significantly increased from 5.1% (2 of 37) in 2005 to 44.4% (246 of 554) in 2009 (*P* for trend <0.001; Table 2).

Table 3 shows the outcomes of OHCA patients with PAD by type of bystander-initiated CPR. The CCCPR group had significantly better outcomes after OHCA than the conventional CPR group (prehospital return of spontaneous circulation, 50.2% [254 of 506] versus 40.5% [352 of 506], *P*<0.001; 1-month survival, 46.4% [235 of 506] versus 39.9% [347 of 870], *P*=0.018; neurologically favorable 1-month survival, 40.7% [206 of 506] versus 32.9% [286 of 870], *P*=0.003, respectively).

Table 4 shows the factors associated with neurologically favorable 1-month survival after OHCA with PAD.

Table 3. Outcomes of Out-of-Hospital Cardiac Arrest Patients With Public-Access Automated External Defibrillation Shocks by Type of Bystander-Initiated Cardiopulmonary Resuscitation

	Compression-Only CPR (n=506)	Conventional CPR (n=870)	*P*
Prehospital ROSC, n (%)	254 (50.2)	352 (40.5)	<0.001
1-mo survival, n (%)	235 (46.4)	347 (39.9)	0.018
Neurologically favorable 1-mo survival, n (%)	206 (40.7)	286 (32.9)	0.003

CPR indicates cardiopulmonary resuscitation; ROSC, return of spontaneous circulation.

Bystander-initiated CCCPR produced more neurologically favorable 1-month survival than conventional CPR (adjusted odds ratio, 1.33; 95% confidence interval, 1.03–1.70). Compared with the elderly, adults 18 to 74 years of age (adjusted odds ratio, 4.76; 95% confidence interval, 3.27–6.92) and children (adjusted odds ratio, 9.46; 95% confidence interval, 4.69–19.08) had significantly higher rates of neurologically favorable 1-month survival after OHCA. Earlier shocks (adjusted odds ratio for 1-minute increment, 0.93; 95% confidence interval, 0.89–0.96) were also associated with favorable neurological outcome.

Discussion

From this nationwide registry of OHCA, we demonstrated that CCCPR was more effective than conventional CPR with rescue breathing for individuals with witnessed OHCA who are shocked with public-access AEDs. This is the first study to investigate the effectiveness of CCCPR compared with conventional CPR in the present era when there is an increasing chance of receiving shocks with public-access AEDs. Such a large, prospective, population-based study covering all of Japan, at a time when the PAD program has developed nearly worldwide, makes it possible to evaluate the effectiveness of each type of bystander CPR for those treated with PAD.

The present study suggests that the combination of early defibrillation with public-access AEDs and CCCPR by bystanders is the best way to save lives after sudden cardiac arrests. Neurologically favorable survival after witnessed ventricular fibrillation was >40% among those who received CCCPR and defibrillation with public-access AEDs. This is one of the highest survival rates with neurologically favorable outcome reported[20] and should be the target survival after OHCA. Many reports have shown the extreme effectiveness of early defibrillation with public-access AEDs,[20–22] which

Table 2. Proportion of Type of Bystander-Initiated Cardiopulmonary Resuscitation Among Out-of-Hospital Cardiac Arrest Patients With Public-Access Automated External Defibrillation Shocks by Year

	2005 (n=39)	2006 (n=125)	2007 (n=262)	2008 (n=396)	2009 (n=554)	*P* for Trend
Conventional CPR with rescue breathing, n (%)	37 (94.9)	101 (80.8)	175 (66.8)	249 (62.9)	308 (55.6)	<0.001
Chest compression–only CPR, n (%)	2 (5.1)	24 (19.2)	87 (33.2)	147 (37.1)	246 (44.4)	

CPR indicates cardiopulmonary resuscitation.

Table 4. Factors Contributing to Neurologically Favorable Outcome After Out-of-Hospital Cardiac Arrest With Public-Access Automated External Defibrillation Shocks

	Survival		OR			
	%	n/N	Crude	95% CI	Adjusted	95% CI
Age group, y						
<17	56.8	25/44	9.01	4.56–17.84	9.46	4.69–19.08
18–74	41.9	427/1018	4.95	3.47–7.05	4.76	3.27–6.92
≥75	12.7	40/314	Reference		Reference	
Sex						
Male	38.9	424/1089	Reference		Reference	
Female	23.7	68/287	0.49	0.36–0.66	0.75	0.53–1.04
Bystander-initiated CPR						
Conventional CPR with rescue breathing	32.9	286/870	Reference		Reference	
Chest compression–only CPR	40.7	206/506	1.40	1.12–1.76	1.33	1.03–1.70
Type of bystander witness status						
Family member	30.2	45/149	Reference		Reference	
Other	36.4	447/1227	1.32	0.92–1.92	1.20	0.82–1.77
Collapse to public-access AED shock time or initiation of CPR by bystanders (for 1-min increment)			0.94	0.91–0.97	0.93	0.89–0.96
Year (for 1-y increment)			1.09	0.96–1.21	1.07	0.96–1.20

OR indicates odds ratio; CI, confidence interval; CPR, cardiopulmonary resuscitation; and AED, automated external defibrillator. ORs were adjusted for age, sex, type of bystander-initiated CPR, collapse to public-access AED shock time or initiation of CPR by bystanders, and year.

have been widely developed.[3–6] However, even in an interventional trial, lay rescuers attempted resuscitation before EMS arrival for only half of the victims of witnessed sudden cardiac arrests, and the onsite AED was used for only one third of the victims who experienced an arrest at locations with PAD programs.[33] Strategies and more efforts to increase the number of lay rescuers who can perform CPR and use an AED are needed.[3–6] This study showing the superiority of the combination of CCCPR and early defibrillation with public-access AEDs strongly suggests the need for implementation of PAD programs with attempts to increase the number of lay rescuers who can at least perform CCCPR and use an AED.

There are multiple possible explanations for the better outcomes in OHCA patients with CCCPR over conventional CPR shown in this study. Rescue breathing is so difficult to perform that it can interrupt chest compressions.[27] Minimizing interruptions in chest compressions during resuscitation attempts by bystanders might be associated with significant increases in survival compared with conventional CPR, as many animal and clinical studies have suggested.[10,15,34–36] The time dependency of the effectiveness of each type of bystander CPR can be another explanation. Among those with PAD, the time period for CPR by bystanders would be the time for defibrillation by use of public-access AEDs and should be the early phase after cardiac arrest. In this phase, CCCPR can be better than conventional CPR, as some animal and clinical reports have suggested.[10,12,13,16,26] The reduction of cardiac venous return during positive pressure ventilation also can be associated with a worse outcome in those receiving conventional CPR.[37]

The advantage of CCCPR for survival after OHCA with PAD over conventional CPR raises a question about the CPR program for lay rescuers. Many reports show the effectiveness of CCCPR, and there is no doubt that either CCCPR or conventional CPR is better than no CPR.[12,13,15–17,27] As for the dispatcher-assisted CPR, a meta-analysis showed that CCCPR was associated with improved survival after adult OHCAs,[38] and there is consensus that CCCPR is better than conventional CPR.[39] However, the best CPR technique for survival is a controversial issue that has been discussed extensively over the past few years.[3–6,10–20,27,40] An Arizona group launched a statewide effort to encourage bystanders to use CCCPR and showed a significant increase in the proportion of bystander CPR and the superiority of CCCPR compared with conventional CPR for survival.[15] The AHA is now leading the Hands-Only CPR campaign across the United States to increase CPR by bystanders.[41] The Japanese CPR guidelines have started to recommend CCCPR training for lay rescuers to increase CPR and AED use, but conventional CPR with rescue breathing is still the standard, and CCCPR training is limited to people who cannot receive the conventional CPR training.[5] This is a balance issue. CCCPR is easy to teach, learn, remember, and perform.[3–6,27] Considering recent data showing the superiority of CCCPR over conventional CPR for adult OHCAs of cardiac origin (which are the majority of OHCAs and have the best chance of survival with widespread AEDs), difficulties in performing CPR in real settings, and the low proportion of bystander CPR,[3–6,27] we think CCCPR should be the standard for the lay rescuer CPR program.

This study showed that children ≤17 years of age had a better chance of survival than adults with public-access AEDs, consistent with previous studies. Although outcomes and characteristics of OHCA differ between children and adults,[42,43] adolescents with OHCA had characteristics similar to those of adults: The cardiac arrests were more likely to be of cardiac origin, to be ventricular fibrillation/ventricular tachycardia, and to have better outcomes.[42] However, for some types of cardiac arrests like those of noncardiac origin or those of long duration, conventional CPR with rescue breathing can be more beneficial than CCCPR.[16–19] The addition of rescue breathing may be especially important for pediatric cardiac arrests of noncardiac origin.[17] An important unresolved issue for future studies is how to determine in the field which subjects are experiencing cardiac and which are experiencing noncardiac origin of arrest so that resources can be focused on those most able to be helped. However, in adults, survival rates after OHCA of noncardiac origin and long-duration cardiac arrests are similarly low regardless of the type of CPR.[16,18,19] In addition, the incidence of pediatric cardiac arrests is relatively small compared with the incidence of adult OHCAs,[17,42,44] and individuals who are more likely to witness pediatric cardiac arrests of noncardiac origin can be targeted more easily. The public endorsement of CCCPR in the State of Arizona has consistently and carefully advocated conventional CPR for suspected noncardiac and pediatric arrests and successfully demonstrated that most pediatric OHCA patients had received conventional CPR.[15] On the basis of such data showing the superiority of CCCPR for OHCA with PAD, we propose a double CPR training strategy: CCCPR training as standard for most people and conventional CPR training as an option for individuals who are more likely to witness pediatric cardiac arrests of noncardiac origin such as medical professionals, lifeguards, school teachers, and members of families with children.

Study Limitations

The most important limitations of this study are the lack of data on the quality of bystander CPR and the potential biases involved in providing CCCPR or conventional CPR. Evaluating the quality of CPR before EMS arrival is not feasible. During the study period, no CCCPR but only conventional CPR with rescue breathing was taught in Japan. Rescuers who do not provide rescue breathing may be less well trained and may thus provide less effective chest compressions. Because people who learned CPR generally use an AED on the scene, the greater proportion of conventional CPR observed in this study population compared with previous reports from Japan, where the proportion of lay rescuers performing CCCPR has increased year by year,[16–18] might be due to this bias. This study demonstrates that CCCPR is more effective than conventional CPR even though such a potential bias would strengthen the superiority of CCCPR in this population. Nevertheless, our data cannot explicitly address these potential biases. Second, the present study includes only patients in whom OHCA was witnessed, who received CPR by bystanders, and who were delivered shocks with public-access AEDs. PAD occurred in only 3% of all bystander-witnessed OHCA with CPR by bystanders. We cannot evaluate the effectiveness of each type of CPR by bystanders when unwitnessed or for non–ventricular fibrillation cardiac arrests in which public-access AEDs cannot be used. Although the number of OHCA patients who received shocks with public-access AEDs has been increasing, the proportion of those with PAD among the total number of OHCAs is still low. Because penetration and more frequent use of PAD remain a challenge for many areas, translating the findings of this study showing the superiority of the combination of CCCPR and shocks with public-access AEDs into more widespread use remains a challenge. Third, we could not conduct long-term follow-ups after OHCA. Therefore, the effectiveness of the type of bystander CPR in terms of long-term outcome is uncertain. As with all multisite epidemiological studies, data integrity, validity, and ascertainment bias are potential limitations. The data collected by EMS providers included relatively few data points that were easy to attain accurately at the scene with the clear and concise Utstein-style guidelines for reporting cardiac arrest.[28,29] The uniform data collection, consistent definitions, time synchronization process, large sample size, and population-based study design covering the whole of Japan were intended to minimize these potential sources of bias.

Conclusions

CCCPR is more effective than conventional CPR for patients in whom OHCA is witnessed and shocked with PAD. Compression-only CPR is the most likely scenario in which lay rescuers who witness a sudden collapse can use public-access AEDs.

Acknowledgments

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Disclosures

None.

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CLINICAL PERSPECTIVE

Although early cardiopulmonary resuscitation (CPR) and shocks with public-access automated external defibrillators (AEDs) are the keys to saving lives after sudden cardiac arrests, the proportion of bystander CPR remains low. Because chest compression–only CPR (CCCPR) is easier to learn and perform than conventional CPR, CCCPR would lead to an increase in the number of individuals trained and increase CPR and AED use by bystanders. Recently, the effectiveness of CCCPR has become well accepted, but conventional CPR with rescue breathing is still the standard of CPR. However, some animal and clinical reports have suggested that the effectiveness of each type of bystander CPR is time dependent and that CCCPR may be more effective than conventional CPR in the early phase of sudden cardiac arrest. Among those with public-access defibrillation in whom defibrillation would be delivered fast and CPR would be needed only in the early phase after collapse, CCCPR can be more beneficial than conventional CPR. Based on this hypothesis, our study demonstrated that CCCPR is more effective than conventional CPR for individuals with witnessed OHCA who are shocked with public-access AEDs through a large, prospective, population-based registry covering all of Japan where the public-access defibrillation program is successfully developed. We believe that CCCPR could be a standard by which lay rescuers are likely to witness sudden collapse and use public-access AEDs. Because penetration and more frequent use of public-access defibrillation remain a challenge for many areas, strategies and efforts to increase the number of public-access AEDs and lay rescuers who can perform chest compressions and use an AED are needed.

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