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Original Article

National Data of CPR Procedures Performed on Hospitalized Thai Older Population Patients☆

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SUMMARY

Background: Little is known about the epidemiology of the elderly who receive cardiopulmonary resuscitation (CPR) and the subsequent survival factors in Thailand and other developing countries. The objective of this study was to determine the rate of CPR and the survival rate among hospitalized Thai elderly patients, and also factors predicting survival at discharge.

Methods: National databases from three sources were searched. These three systems accounted for 96% of the Thai population. All inpatients in the fiscal year 2010 (from October 1, 2009 to September 31, 2010) aged 60 years or over who received CPR procedure were included. Baseline characteristics were studied. The study outcomes were CPR rate, mortality rate, and survival factors.

Results: In total, 17,813 elderly patients who were hospitalized during the 2010 fiscal year received CPR (997.2/100,000 older adults). Of those, 5125 patients (28.77%) survived at discharge. Pre-existing co-morbidity, asystole, time on a mechanical ventilator > 96 hours, and being admitted to a private hospital were associated with poorer outcomes ($p < 0.05$).

Conclusion: The rate of CPR in hospitalized elderly patients was 997.2 events/100,000 older adults with a survival rate of 28.77%. Factors predicting death at discharge are pre-existing comorbidities, cardiac arrhythmia type, intervention/procedure, and type of hospital.

1. Introduction

Cardiopulmonary resuscitation (CPR) is defined as an attempt to restore spontaneous circulation by performing chest compressions with or without ventilations[1]. The survival rate of out-of-hospital CPR appeared to be less than in-hospital CPR[2]. The overall incidence of CPR in the elderly (≥ 65 years) from the largest study to date which included 433,985 patients who underwent in-hospital CPR was 2.73 events per 1000 admissions. The rates were higher in black and nonwhite patients[3]. The incidence of CPR in the elderly among developing countries is currently limited.

The outcome of CPR is diverse due to the differences in age and pre-existing conditions[4]. Nearly half of older people have a history of heart failure compared with one-fifth of younger people[4]. Prolonged hypoxemia in survivors worsens functional and cognitive status, which consequently leads to caregiver burden and poor quality of life. Therefore, it is a common dilemma of physicians to weigh up between rational and moral decisions dealing with older persons with cardiac arrest[4].

There are several predictors of CPR outcomes such as age, sex, ethnic, pre-existing conditions, time to perform CPR, or type of arrhythmia. Aged over 70 years, male African Americans were shown to be associated with poor survival rate and functional status[2,3,5–8]. Older adults often have multiple comorbidities, and are at risk of death during hospitalization. Advance directive plans

☆ Conflicts of interest: All contributing authors declare that they have no conflicts of interest.

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for these patients in the event of a cardiac arrest are challenging for physicians, patients, and their families to prevent unnecessary CPR and improve satisfaction of patient care[9]. Unfortunately, the data regarding the epidemiology and prognostic factors for survival at discharge in an Asian context are limited. This study aims to determine the rate of CPR, its outcome, and survival factors in Thai elderly patients using a national database.

2. Materials and methods

2.1. Patient population

This study was a national survey over three Thailand databases including the National Health Security Office (NHSO), the Civil Servants Benefit System from the Comptroller General's Department, and the Social Security Office. These three systems accounted for 96% of the Thai population. All inpatients in the fiscal year 2010 (from October 1, 2009 to September 31, 2010) aged 60 years or over who received CPR procedure (the International Classifications of Diseases or ICD-9-99.6: cardioversion of cardiac rhythm) were included. Data were checked for accuracy by looking for: (1) overlapping information; (2) visit dates; (3) missing items; (4) incorrect coding; and (5) dating with the correct fiscal year by our analyst team. Data collection of all eligible patients was performed by using their summary discharge forms.

2.2. Patient demographics and clinical characteristics

Baseline characteristics of the patients including age, sex, primary admitting diagnosis, presence of cardiovascular bypass, duration of mechanical ventilator use, levels of hospital, regions of hospital, admission rate, prevalence rate, and mortality rate were studied. For admitting diagnosis, the principal diagnosis of participants was obtained from the ICD-10 codes; severe infection (J09-J22, A49.9, N39), stroke (I61-I67), cirrhosis with complication (K74, I85), renal failure (N17-N19), poisoning (T36-T50), drowning (W65-W74), and pulmonary embolism (I26).

2.3. Outcome measures

The study outcomes were admission rate, prevalence rate, and mortality rate per 100,000 populations in three age groups; 61–70 years, 71–80 years, and over 80 years. Survival to discharge post CPR, length of stay in days, and predictors of discharge status were analyzed.

2.4. Statistical analysis

After the primary analysis, results were sent to 10 medical specialists to check the validity of the information. Upon confirmation of validity, the data were compared to the Ministry of Public Health's Statistics Report 2010 for trend congruence as well as the hospital's mortality reporting for each age and disease group, and to the National Death Registration of the Registry Administration, Ministry of Interior Affairs[10]. Data were shown as descriptive statistics. CPR rate was calculated from the number of older adults divided by the total population of older adults who received CPR procedure, and survival rate at discharge was calculated from the number of population in each age group divided by the total number of population in the same age group who received CPR procedure. Predictors of CPR outcomes were analyzed using multiple logistic regressions. For univariate analysis, the Chi-square test or Fisher's exact test was used to examine all categorically associated factors. Factors with a $p < 0.20$ were then entered into a multiple logistic regression model. A p value < 0.05 was considered to indicate statistically significant differences and their 95% confidence intervals (CI) were reported to consider the strength of association between factors and death at discharge.

Ethics approval was provided from the Ethics Committee of Medicine Faculty, Khon Kaen University, Khon Kaen, Thailand under guidelines of the Helsinki Declaration.

3. Results

In total, 17,813 elderly patients who were hospitalized during the 2010 fiscal year received CPR (997.2/100000 older adults). Of those, 5125 patients (28.77%) survived at discharge. Age group of 70–79 years had the highest CPR rate at 41.11%, while the survival rates were not different among the three different age groups. Renal failure and severe sepsis were the two most common pre-existing conditions (Table 1). The most common established

Table 1
Percentage of patients who received CPR and survived to hospital discharge, according to patient and hospital characteristics.

	CPR (N = 17,813 patients)	Survival at discharge (N = 5125 patients)
Patient characteristics		
Prevalence rate/100,000 older adults (≥ 60 y)	997.2	286.9
Male (%)	52.8	29.4
Female (%)	47.2	28.1
Age (y)		
• 60–69	6314 (35.4)	1734 (27.5)
• 70–79	7320 (41.1)	2145 (29.3)
• 80+	4179 (23.5)	1246 (28.8)
Primary admitting diagnoses		
• MI	2922	690 (23.6)
• CHF	2811	784 (27.89)
• Severe infection	5477	1375 (25.1)
• Stroke	1271	279 (22)
• Cirrhosis with complication	382	107 (28)
• Renal failure	6482	1548 (23.9)
• Poisoning	94	30 (31.9)
• Drowning	6	0 (0)
• Pulmonary embolism	77	12 (15.6)
Established cardiac arrhythmia		
• AVB	5	4 (80)
• CHB	98	71 (72.4)
• Asystole	422	112 (26.5)
• SVT	132	107 (81.1)
• AF	139	94 (67.6)
• VT ± VF	106	68 (64.2)
Intervention/procedure		
• CABG	150	87 (58.0)
• Bypass anastomosis	88	47 (53.4)
• Mechanical ventilator > 96 h	13,024	3350 (25.7)
LOS (d)		
• 0–6	12,740	3319 (26.1)
• 7–13	2576	934 (36.3)
• 14–20	1015	371 (36.6)
• 21–27	500	162 (32.4)
• 28+	981	338 (34.5)
Hospital characteristics		
Type of hospital		
• Primary	2160	1120 (51.9)
• Secondary	5298	1270 (24)
• Tertiary	9671	2619 (27.1)
• Private	684	116 (17)
Region		
• Central	6613	1504 (22.7)
• North	3861	1080 (28)
• Northeast	5491	1955 (35.6)
• South	1848	586 (31.7)

Data are presented as n (%) unless otherwise indicated.
AF = atrial fibrillation; AVB = atrioventricular block; CABG = coronary artery bypass graft; CHB = complete heart block; CHF = congestive heart failure; CPR = cardiopulmonary resuscitation; LOS = length of stay; MI = myocardial infarction; SVT = supraventricular tachycardia; VF = ventricular fibrillation; VT = ventricular tachycardia.

Table 2
Multivariable analyses for factors associated with death at discharge.

Predictors	Adjusted odds ratio (95% CI)	SE	*p*	95% CI
Age group (y)				
• 60–69	Ref			
• 70–79	0.93	0.04	0.05	0.86, 1.00
• 80–89	0.92	0.04	0.06	0.84, 1.00
Sex				
• Female	Ref			
• Male	0.92	0.03	0.01	0.85, 0.98
Significant primary admitting diagnoses				
• MI	1.33	0.06	0.00	1.20, 1.45
• Severe infection	1.18	0.05	0.00	1.09, 1.27
• Stroke	1.36	0.10	0.00	1.19, 1.58
• Renal failure	1.33	0.05	0.00	1.23, 1.42
• Pulmonary embolism	2.10	0.66	0.02	1.11, 3.86
Established cardiac arrhythmia				
• Normal sinus rhythm at admission	Ref			
• AVB	0.11	0.12	0.05	0.01, 1.00
• CHB	0.15	0.04	0.00	0.10, 0.24
• Asystole	1.38	0.16	0.01	1.10, 1.74
• SVT	0.15	0.04	0.00	0.10, 0.24
• AF	0.25	0.05	0.00	0.17, 0.36
• VT ± VF	0.23	0.05	0.00	0.15, 0.34
Intervention/procedure				
• CABG	0.29	0.07	0.00	0.18, 0.47
• Bypass anastomosis	0.87	0.27	0.65	0.47, 1.59
• Mechanical ventilator > 96 h	1.18	0.05	0.00	1.10, 1.28
Type of hospital				
• Primary	Ref			
• Secondary	2.92	0.17	0.00	2.61, 3.27
• Tertiary	2.53	0.13	0.00	2.29, 2.80
• Private	4.96	0.57	0.00	3.97, 6.21

CABG = coronary artery bypass graft; LOS = length of stay; MI = myocardial infarction; SE = standard error.

cardiac arrhythmia was asystole. Most patients (12,740 patients or 71.52%) had a length of stay < 6 days. CPR was commonly performed in the secondary or tertiary hospital in the region of central and Northeastern Thailand. The survival rate was highest at the primary care hospital (51.9%).

The factors associated with death at discharge using univariate analysis models were evaluated. Six factors including age group, sex, pre-existing comorbidity, cardiac arrhythmia, intervention/procedure, and type of hospital were included in the model to find predictors of death ($p < 0.20$). The last four factors were significantly associated with death using multiple logistic regressions ($p < 0.05$). Pre-existing comorbidities namely myocardial infarction, sepsis, stroke, renal failure, or pulmonary embolism were associated with death significantly (Table 2). In terms of cardiac arrhythmia, asystole was significantly associated with death, while ventricular tachycardia/fibrillation was significantly associated with survival. Receiving mechanical ventilation for > 96 hours was related to death but coronary artery bypass graft procedure was negatively associated with death. Compared with primary care hospital, the adjusted odds ratio for death was highest if CPR was performed at a private hospital (4.96 with 95% CI of 3.96, 6.20).

4. Discussion

These are the national data of Thailand regarding CPR procedures in hospitalized elderly patients based on three database systems. The rate of CPR in hospitalized elderly patients was 997.2 events/100,000 older adults. The survival rate from resuscitation attempts in older people was approximately one-third. The survival rate was higher than a previous report from Thailand (28.77% vs. 6.90%)[11]. The success rate of CPR from the previous study was based on all age groups at only one tertiary care hospital while this study was based on all hospitals over Thailand and enrolled only elderly patients. One similar finding of both studies was that the common pre-existing comorbidity was noncardiac causes, not cardiac-related diseases. The strength of this study is that it is generalized to Thai patients and may be similar to other developing countries such as Asian countries.

This study also showed that increasing age was not a predictor of death, thus age alone is not a barrier to perform CPR[10]. Factors predictive of death in hospitalized elderly patients were having pre-existing comorbidity, procedure/intervention, particular cardiac arrhythmia type, and hospital type. Pre-existing conditions with complications have been shown to relate with poor outcomes[2,3,6,8], and similarly to prolong mechanical ventilator use > 96 hours in this study.

Improving outcomes of older persons with cardiac arrest focuses on pre-, intra-, and post- cardiac arrest factors[6]. Pre-arrest factors include early recognition of critically ill patients and prevention of cardiac arrest as about two-thirds of causes of cardiac arrest are potentially avoidable, and availability of medical emergency teams appears to reduce incidence and mortality of unexpected cardiac arrest. Better resuscitation, early defibrillation, and ongoing training of health care workers to perform CPR are essential keys for improved survival in the area of intracardiac arrest factors. The high success CPR rate in this study may be explained by the fact that CPR was done immediately after event detection[6]. For the postcardiac arrest factors, the data are inconclusive. Furthermore, identification of “do not resuscitate” (DNR) orders in appropriate patients to prevent unnecessary suffering to the patients complicates the issue. In Thailand; however, a DNR order in clinical practice is uncommon due to our culture, ethical, and religious beliefs. The goal in CPR success is not only making patients survive but also making them survive with good quality of life afterwards.

Medical information from this study, which was obtained from discharge summaries based on ICD-9 and ICD-10 had limitations in the collection of information but indicated that quality of CPR and the cost of elderly medical care during and especially after CPR efforts were factors. Generally, the Utstein template has been used to record CPR data. The template comprises four major categories of variables, namely, hospital, patient, arrest, and outcome variables for documenting in-hospital resuscitation. The Utstein style assessment methods for CPR outcomes contribute to standardization at an international level[12]. Encouraging use of this template as a national registry may lead to more scientifically rigorous data which are comparable across different countries.

There are several limitations in the study. Data may be incomplete or lost from incomplete chart or CPR records. Using ICD-10 coding search may lose some patients due to physician misclassification. Outcome data were limited on actual functional status such as neurological outcome, functional capacity in activities of daily living, quality of life postcardiac arrest, and long-term outcomes.

5. Conclusion

The rate of CPR in hospitalized elderly patients was 997.2 events/100,000 older adults with a survival rate of 28.77%. Factors predicting death at discharge are pre-existing comorbidities, cardiac arrhythmia type, intervention/procedure, and type of hospital.

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