FACTORS ANALYSIS OF CARDIOPULMONARY RESUSCITATION OUTCOMES IN THE ELDERLY IN TAIWAN

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SUMMARY

Performing cardiopulmonary resuscitation (CPR) can save countless lives, but its use is rather controversial in elderly patients. Some researchers believe that there is an inverse ratio between the success of CPR and the age of the patient, while others believe that the uniqueness of each case and existing comorbidities are more important factors. CPR can result in severe injury for patients. Therefore, physicians often face a dilemma between rational and moral decisions when dealing with older patients suffering from cardiac arrest. The solution to this problem rests on the determination of whether CPR will benefit the patient. This analysis, supported by a literature review and a review of the outcomes of CPR, considered different factors in elderly patients, including age, sex, prehospital emergency medical service, preexisting disease, witnessed cardiac arrest, initial arrest electrocardiogram rhythm, CPR locations, and ethics. Quality of life and the cost of medical care for the elderly affect the benefit analysis of CPR. Indeed, a large amount of money is spent on elderly CPR patients who remain in critical condition before finally dying in the hospital. Factors contributing to decisions to resuscitate also include post-resuscitation quality of life, and the will of patients, families and doctors. In short, patient age is not a barrier to performing CPR. However, to achieve the best outcome of CPR, one must consider the disease diagnosis of elderly patients as a useful reference to help improve medical care for this group.


Key Words: cardiopulmonary resuscitation, elderly patients, ethics, medical futility, survival to discharge

Background and Purpose

Cardiopulmonary resuscitation (CPR) was developed in 1960 by Kouwenhoven and colleagues1. Closed-chest cardiac massage, as CPR was originally known, was used to resolve complications because of anesthesia and cardiac arrest resulting from acute coronary syndrome. Later, the procedure became commonly used to treat cardiac arrest as a result of drowning, electric shock, drug poisoning, acute myocardial infarction, and sudden cardiac arrest during surgery. Kouwenhoven et al. showed that of 20 patients who received CPR, 14 survived, giving a survival rate of 70%. However, considering all modern medical advances, this figure is not so inspiring. The survival to discharge rate for patients receiving CPR in emergency units is 15–20%2, and for those not in medical facilities, it is lower than 5%3. Despite this, CPR is still a standard procedure used on patients suffering from cardiac arrest. In one study, the overall survival rate of cardiac arrest to hospital
discharge was only 7.25%, with patients aged between 40–49 years and 50–59 years experiencing the best rate of successful resuscitation (10%)\(^4\). CPR is a very important technique in helping physicians save lives, which is why anyone can perform CPR without a doctor's permission. However, CPR can result in serious physical damage, such as rib or sternum fracture, cardiac muscle contusions, pericardial stuffing, tearing of the oral cavity, teeth being knocked out, bleeding or vomiting.

Research has indicated that, since 1980, the survival rate for elderly patients receiving CPR has been lower than for younger patients\(^5\)–\(^9\). However, research has also shown that if preexisting diseases and organ function are taken into account, age does not necessarily affect the survival rate\(^10\)–\(^12\). Thus, the effectiveness of CPR for elderly patients remains unclear. Diseases of the elderly are multiple and complex, and this age group is delicate and more susceptible to adverse reactions to both invasive and noninvasive medical treatments\(^13\). Consequently, the decision as to whether or not to proceed with a medical treatment that has a low success rate and can cause significant damage, such as CPR\(^3\), can be a difficult one for physicians interested only in their patients' wellbeing\(^14\). Determining the patient's suitability to receive CPR could result in guidelines for physicians and, ultimately, better care for elderly patients.

Kvale and D'Elia\(^15\) were also concerned about quality of life, the cost of elderly medical care and the effectiveness of (CPR) efforts. A large amount of money is used in the treatment and care of elderly patients who have received CPR and remain in critical condition before finally dying in the hospital\(^15\). Factors guiding decisions to resuscitate and to resolve this dilemma include quality of life (medical condition, physical incapacity, age and ageing, and burden), the ethical issue of the autonomy of will to receive CPR, and the involvement of elderly patient’s relatives and doctors in the decision-making process\(^15\). The purpose of this paper is to analyze the effectiveness of CPR for elderly patients and to try to determine which category of elderly patients would benefit most from CPR based on a literature review regarding age, sex, prehospital emergency medical service (EMS), preexisting disease, witnessed cardiac arrest, initial arrest electrocardiogram rhythm, CPR locations, and ethical considerations. We conclude that patients who receive CPR inappropriately could be spared the procedure.

**Introduction**

CPR is a procedure intended to maintain life, rebuild health, reduce pain, and prevent disability\(^16\). Of all out-of-hospital cardiac arrests (OHCAs), 27% of patients aged 70 years or older versus 29% of younger patients were resuscitated and admitted to hospital. Ten percent of elderly patients were discharged alive compared with 14% of younger patients\(^17\). The length of hospitalization and intensive care stay for CPR patients were not significantly different between the age groups. Furthermore, the number of neurologic deaths was similar in both age groups, as were residual neurologic impairments\(^18\). However, there was increased morbidity and mortality in elderly patients compared with their younger counterparts\(^5\). Cardiopulmonary resuscitation is rarely effective for elderly patients with cardiopulmonary arrests that occur outside hospital, that are unwitnessed, or are associated with asystole or electromechanical dissociation\(^5\).

Calculated long-term survival curves have demonstrated similar survival in both age groups; 65% of hospital survivors are alive 24 months after hospital discharge\(^18\). Elderly patients are more likely than younger patients to die during hospitalization. However, the hospitalization period of the elderly is not longer; the elderly do not have more residual neurologic impairments, and survival after hospital discharge is similar to that of younger patients\(^18\). Morse\(^19\) pointed out that CPR was rarely effective for those with cardiopulmonary arrests that had occurred outside of a hospital, were unwitnessed or were associated with asystole or electromechanical dissociation.

In 1976, Rabkin et al.\(^20\) suggested that CPR was not appropriate for all patients. Peatfield et al.\(^21\) collected data on 1,063 patients over a decade and calculated a survival to discharge rate of 8.7%. Of those patients, all who had cancer or gastrointestinal hemorrhages died, but acute myocardial infarction patients had a survival to discharge rate as high as 15%. Hershey and Fisher\(^22\) found that CPR conducted in medical facilities resulted in a survival to discharge rate of 14%, but none of the patients who suffered from cancer or acute stroke survived to discharge. In 1989, Murphy et al.\(^5\) gathered data on 503 elderly patients aged 70 and older who received CPR in two acute hospitals, two chronic hospitals and one long-term care facility, all of which were in Boston. Of those patients, 259 received CPR and the survival to discharge rate was 6.6% (17/259).
Age and CPR Outcome

Advanced age is a well recognized risk factor for negative CPR outcomes. Patients whose initial rhythms were ventricular fibrillation had the highest rate of successful resuscitation and discharge from hospital. Hospital deaths were more common in the elderly than in the middle-aged (71% vs. 53%).

Each subsequent age decade showed a steady decline in successful outcome: 8.1% for ages 60–69, 7.1% for ages 70–79, and 3.3% for ages over 80 years. In a post hoc analysis, further separation of the older age group revealed a successful outcome in 3.9% of patients aged 80–89 and 1% in patients 90 and older. Patients aged 80 years or more were more likely to arrest at home and were more likely to have an initial brady-asystolic rhythm, yet they had a similar rate of resuscitation and hospital admission.

In 2000, Kim et al. gathered statistics on 5,882 patients who had suffered cardiac arrest and received CPR in King County, Washington State. The survival to discharge rate of patients aged below 80 (n=4,572), above 80 (n=1,084) and above 90 (n=226) decreased as age increased (19.4%, 9.4% and 4.4%, respectively; p<0.01). Multiple logistic regression analysis determined that age played a minimal role in survival (odds ratio, OR, 0.92). Abnormal heart rhythms that encourage the use of CPR, such as ventricular fibrillation or ventricular tachycardia (VF/VT), took place less often in people aged older than 80 and 90 (34% vs. 24%) than those aged younger than 80 (53%), which is an important factor for CPR success (OR, 5.30; 95% confidence interval, CI, 4.00–7.00). Even so, at the age of 90, if the heart rhythm is VF/VT, the success rate of CPR can be as high as 17%.

In Sweden, Herlitz et al. examined the statistics of patients aged 18 and above who suffered cardiac arrest and received CPR outside a hospital setting between 1990 and 1999. Those patients were divided into three age groups: below 65 years (n=7,810), 65–75 years (n=7,261) and above 75 years (n=8,390). The results showed that as age increased, cardiac etiology also increased. However, the rate of cardiac arrest caused by ventricular fibrillation decreased (p<0.0001), and the percentage of those who survived 1 month after receiving CPR was 4.5%, 3.2% and 2.5%, respectively (p<0.0001).

The survival rate after ventricular fibrillation was 10.7%, 7.6% and 6.6% (p<0.0001) for patients below 65 years of age, 65–75 years of age and above 75 years of age, respectively. After a multiple logistic regression analysis, age was still a factor (OR, 0.85; 95% CI, 0.80–0.91).

Sex and CPR Outcome

In 2005, a report by the Council for Economic Planning and Development, Executive Yuan in Taiwan showed no significant differences in sex between elderly survivors and non-survivors, although women have a longer life expectancy than men.

Physical Reserve and CPR Outcome

The outcome difference of CPR is because of the decreased physiologic reserve that accompanies aging and preexisting medical conditions in the elderly patient. Prior to cardiac arrest, 42% of elderly patients had a history of heart failure, compared with 18% of younger patients.

The instances of end-stage heart disease increase in those aged 75 and above, which led to the category of patients who do not react positively to CPR. Considering human physiology, middle-aged adults have more physical reserves than the elderly to tolerate longer resuscitation and post-resuscitation complications, allowing them to survive longer resuscitations.

Electrocardiogram Rhythm and CPR Outcome

Only 3.8% of patients with electrocardiogram rhythms survived to hospital discharge, and most survivors had ventricular arrhythmias. Moreover, in patients whose initial rhythms were ventricular fibrillation, the percentage of patients discharged alive was substantially higher, i.e., 24% for elderly patients and 30% for younger patients. At the time of cardiac arrest, 83% of younger patients demonstrated ventricular fibrillation compared...
with 71% of the elderly, and electromechanical dissociation was five times more common in the elderly patients. Survival rates for younger and older VF/VT patients were not significantly different. Of the elderly cardiac arrest victims, 22% of patients were successfully resuscitated and 7% of patients survived. In the case of younger patients, 26% were successfully resuscitated and 12% survived. Thirty-two percent of all elderly patients presented with VF/VT. Forty percent of patients were resuscitated and 7% of patients survived. In the case of younger patients, 26% were successfully resuscitated and 12% survived. Thirty-two percent of all elderly patients presented with VF/VT. Forty percent of patients were resuscitated and 20% survived.

From a total of 200 patients who presented with ventricular fibrillation in OHCAs, 69% survived to hospital admission, seven (4%) died in the emergency department, and 79 (39%) were discharged neurologically intact. The survival rate for ventricular fibrillation OHCA is significantly improved by the presence of a rapid defibrillation program.

Rogove et al. studied 774 patients who all survived initial resuscitation. They reported that increasing age was an independent factor of post-resuscitation mortality. In the subgroup of all patients who had return of spontaneous circulation (ROSC) in their study, we also found that the adult group had a significantly greater survival rate than the elderly. However, a multivariate analysis from Rogove et al. revealed that only patients with VF/VT had an increased chance of survival. Gulati et al. reported that VF/VT was a strong predictor of elderly survival, which is supported by many other studies. However, in this study, the initial cardiac rhythm of the elderly did not affect the survival rate. Gulati et al. indicated that the initial rhythm recorded at the emergency department (ED) arrival could not represent the real initial arrest rhythm, and possibly, the case numbers were insufficient to obtain this result. The ratio of VF/VT occurring in elderly patients is lower than in younger patients. However, for elderly patients who suffer from VF/VT, the success rate of CPR can be as good as that of younger patients. Of the 259 patients, if the heart rhythm at the time of cardiac arrest was VF/VT, the survival rate was higher than for asystole patients or those with pulseless electrical activity (20.8% vs. 2.6%; p < 0.01). For those who suffered ventricular fibrillation or supraventricular tachycardia at the time of cardiac arrest, the survival rate was much higher than for asystole patients or for those with heart blockages or pulseless electrical activity.

Preexisting Medical Factors and CPR Outcome

The health of elderly patients is influenced by increased instances of comorbidity. Johnson et al. studied 552 patients who received CPR and found the survival to discharge rate to be 14.9%. However, patients diagnosed with sepsis, cancer or gastrointestinal tract bleeding had a survival to discharge rate of zero. Bedell et al. gathered data on 294 patients who had metastatic cancer, acute stroke, septicemia, pneumonia or dialysis, all of whom died after receiving CPR. There are enough published case studies to prove that patients with certain diseases, such as terminal cancer, septicemia, gastrointestinal hemorrhages and acute stroke, who suffer cardiac arrest have minimal chances of survival. In fact, the survival rate is next to zero.

A possible reason for the decline in the survival rate of elderly patients might be the existence of diseases that make CPR ineffective, such as cancer, stroke, septicemia, pneumonia, heart failure, kidney failure or gastrointestinal hemorrhage. It is essential to consider such diseases, instead of merely reporting the survival rate for each age group.

Prehospital EMS and CPR Outcome

A recent study showed that EMS availability is not a significant factor in increasing the survival rate of elderly patients. When comparing elderly survivors with non-survivors, there are only two predictive factors. Witnessed arrest and the duration of resuscitation significantly affect the outcome of cardiac arrest in the ED. The arrest being witnessed was a significant independent factor in the outcome of an OHCA. Earlier studies showed that patients who had shorter durations of resuscitation have a better chance of survival. However, two Taiwan-based studies on patients over 18 reported no patients resuscitated for longer than 20 minutes in the ED surviving to hospital discharge. Another study confirmed this and found that the elderly survivors’ resuscitation took less than 20 minutes, but that some adults survived resuscitation of more than 20 minutes. If the cardiac arrest lasted longer than 5 minutes with no CPR, the survival rate was lower than for cardiac arrest lasting less than 5 minutes with no CPR (2.6% vs. 22.5%; p < 0.01).
Cause of Cardiac Arrest and CPR Outcome

Chien et al. found that in the elderly, a presumption of a cardiac cause of arrest decreased the ROSC rate, but not the survival rate. This result differed from that reported by Chang and Lin, who studied patients over 18 and suggested that those with a presumed cardiac cause of arrest had a better outcome. Chien et al. revealed that a cardiac cause of arrest in the elderly did not have a better outcome than other causes. Recent contributors to the Canadian Medical Association Journal have concluded that CPR is rarely effective for the terminally ill or for residents of long-term care institutions. Younger patients, however, more often had an acute myocardial infarction at the time of the cardiac arrest (33% vs. 16%) Multivariate analysis from Kim et al. indicated that lung cancer, low blood pressure, renal failure, and a home-bound lifestyle can obviously influence the death rate (p < 0.05). The cause of cardiac arrest is important, because elderly patients with ventricular fibrillation or supraventricular tachycardia could have a survival to discharge rate as high as 20%, which is as good as that for young patients.

Location and CPR Outcome

Outcome of in-hospital CPR for elderly patients

According to the research of Bedell et al. in 1983, the survival to discharge rate after receiving CPR for in-hospital cardiac arrest patients at an average age of 70 is 14%. The results of CPR are in no way related to a patient’s age, but rather to disease diagnosis and a patient’s level of activity. The study by Sandroni et al. showed that CPR achieves minimal results for in-hospital patients aged 70 or above. In comparison with other in-hospital patients who could have a survival to discharge rate of 15% after receiving CPR, elderly patients in this study had a survival rate of only 6.5%.

In Italy, Di Bari et al. studied 245 patients in 2000 who had received CPR in a hospital setting and divided them into two age groups, aged above 70 years and below 70. The immediate, short- and long-term survival to discharge rates did not differ significantly. Di Bari et al. believed that age is not a factor for performing in-hospital CPR, but that the survival rate for cardiac arrest patients are determined by the rhythm of the heart, low blood pressure and heart failure (systolic pressure lower than 100 mmHg) in in-hospital cardiac arrest patients.

Outcome of out-of-hospital CPR for elderly patients

In a report by Murphy et al. in 1989, 503 elderly patients (aged 70 years and above) who suffered cardiac arrest outside hospitals (n=244) and inside hospitals (n=259) and who had received CPR were studied. Only two out of 244 were discharged from the hospital and 91.8% died at the scene. The OHCA survival to discharge rate was 0.8% vs. 6.5% in in-hospital cardiac arrest. Both of the survivors’ cardiac arrests were witnessed. In other words, when the hearts of these elderly patients stopped outside the hospital, their survival rate was near to zero if they received any help at all. The survival rate decreased as age increased for those who received CPR outside hospitals. Herlitz et al. found that among patients suffering from OHCA, factors at resuscitation are strongly related to age. The chance of survival diminishes with increasing age. Other factors including initial rhythm, etiology and bystander CPR also affect the outcome of elderly CPR. When correcting for the dissimilarities in terms of factors at resuscitation, age is still significantly associated with survival, and lower
survival among the elderly was evident\(^8\). Elderly patients can benefit from attempted resuscitation from OHCA\(^22\).

**CPR outcome in nursing homes for elderly residents**

In 1990, Applebaum et al.\(^6\) conducted a study of 117 residents aged 65 and above in nursing homes in the Baltimore area. They compared the results of CPR in this group to those of 580 elderly people aged 65 and above living in the community. Of the 117 nursing home patients, only two survived to discharge (2%). This was compared with 61 survivors from the community group (11%), which is a remarkable difference \((p < 0.01)\). Of the 117 nursing home patients, 102 (87%) were pronounced dead in emergency rooms, two died within 24 hours, and 11 died within 5 days. One survivor, a female aged 87 years, died after suffering cachexia, dementia and bedsores 8 months after discharge. Another survivor died in a nursing home 14 days after discharge. The authors, therefore, believed that weaker old people in nursing homes who suffer cardiac arrest derive minimal benefit from CPR.

In 1993, Tresch et al.\(^37\) analyzed data from 196 patients living in nursing homes in the Milwaukee area during a period of 4 years (no specific age groups, but only 11 patients were below 60 years old). They recorded the ages, diagnoses, medical history before and after the cardiac arrest, basic functioning condition, laboratory data, instances of ventricular fibrillation, and number of witness at the scene. The survival to discharge rate was only 5%. For residents suffering from ventricular fibrillation, the number could be as high as 15%. The survival to discharge rate for ventricular fibrillation patients who had witnesses at the scene was 27%, which is no less than for the average patient. For patients other than those who had ventricular fibrillation, the survival to discharge rate decreased to 2.3%, and the difference between the two groups was significant \((p < 0.002)\). Factors such as age, disease and functioning condition were not influential. CPR could be given to residents in nursing homes if there were any witnesses and should be continued when ventricular fibrillation is verified.

In 1995, Ghusn et al.\(^38\) collected data from the emergency medical network in the Houston area. Of 229 emergency calls, 114 were made for nursing home residents who were aged 70 years or older. Matching these patients’ sexes and ages at the time cardiac arrest occurred with elderly residents in the community, they found that 228 elderly people in the community formed the community group. The results showed that after CPR, residents in nursing homes had a survival to discharge rate of 10.5%, and the community group had a survival to discharge rate of 9.2%. The difference was trivial. Of the 114 nursing home residents, 35 had no witnesses to their cardiac arrest and none of the 35 survived. The survival to discharge rate in this study was higher compared with previous studies, suggesting that there might have been a selection bias. This might be because the cases collected for this study were based on emergency calls, and the chance of having a witness was, by default, higher than other studies. In addition, the authors excluded the number of patients who died at the scene. Therefore, the survival rate was rather high.

In Germany in 2001, Mohr et al.\(^39\) studied 46 patients with an average age of 81.8 years who received CPR in nursing homes in an area with local EMSs. Only two survived to discharge (survival to discharge rate, 4.3%). One was a female aged 79 years who died in the nursing home 3 weeks later. The other was an 83-year-old male who returned to the nursing home in a coma and died 10 months later. Factors that increased the survival rate included having witnesses, immediate CPR, ventricular fibrillation, and having an etiology of cardiac arrest.

In the emergency network in Rochester, New York, Shah et al.\(^40\) reported that the survival rate for 28 residents in nursing homes who received CPR and who lived up to a year after was 1 out of 28 (2%). The rate for those living in the community was 5%.

Based on the data above, elderly patients in nursing homes have a low survival rate after receiving CPR, usually between 2% to 5%\(^6,9,39,40\). Most survivors are left with functioning and cognitive disabilities and complications\(^6,39\). For those who suffered ventricular fibrillation and had witnesses to their cardiac arrest, age and other factors did not affect positive results\(^37\).

**Ethics and CPR Outcome**

In 1991, the Royal College of Physicians in England declared that diagnosis, severity of illness and comorbidities determine a patient’s reaction to treatment, not age\(^41\). A decade later, English researchers found that clinical practices did not follow this principle\(^42\). An important study identified that decisions of emergency physicians to withhold CPR were not affected by the patient’s age \((p = 0.105)^{28}\). However, it might be
presumed that physicians tended to give up on elderly OHCA cases more quickly if there was any evidence of irreversible death, or the family indicated the right to represent the patient’s will with a do-not-resuscitate request\(^2\). A previous study showed that 1 out of 20 patients aged 65 and above were denied medical treatment\(^4\). Another study indicated that CPR is sometimes medically contraindicated for the terminally ill and should not, in that situation, be offered during discussions of do-not-resuscitate orders with the elderly patient or their family. Unless there has been a previous conversation, a patient will automatically receive CPR at the time their heart stops, which is a blessing for a few but a curse for most patients and their families\(^1\). A further study indicated that most elderly patients would prefer CPR if they should have a cardiac arrest, but only when the expectation of success is higher than 50\(^\%\)\(^4\). Once the actual survival rate is explained in detail, this percentage decreases\(^4\). When an elderly patient with a chronic disease has a sudden cardiac arrest and is in need of CPR, it is the doctor’s responsibility to explain the low success rate and possible harmful effects to the patient and their family. Patients can be unconscious and family members may not know the patient’s wishes. In moments like this, families have no choice but to advocate for CPR to save the patient’s life.

Adams and Snedden\(^5\) conducted research using 100 patients aged over 70 years in clinic and hospital settings. Interestingly, of the 100 elderly patients, 44\% signed an agreement to not receive CPR even though 81\% believed the success rate to be more than 50\%. Diem et al.\(^6\) gathered statistics on the success rate of CPR, which they found to be as high as 75\%. In 1994, Murphy et al.\(^7\) interviewed elderly people in retirement communities and found that 41\% would choose to have CPR should they suffer a cardiac arrest. However, after being told the survival rate was between 10–17\%, only 22\% wanted CPR. Moreover, when they were told that the success rate was as low as 0–5\% when other chronic diseases were involved, only 5\% chose CPR. In 2003, one study indicated that 55\% of 1,266 hospitalized elderly patients aged 80 and above would prefer CPR.\(^8\) However, of the doctors caring for those elderly patients, only 36\% would choose CPR if they themselves suffered similar health conditions as their patients. The elderly group have the least positive results of CPR with a survival to discharge rate lower than 5\%.\(^5\,6\,10\,22\,33\,37\,39\,40\).

To better estimate the health condition of elderly cardiac patients, doctors must understand that different categories of elderly patients react differently to CPR. Based on the outcome principles of beneficence and non-malfeasance, doctors can provide patients with better suggestions and treatment.

**Post-resuscitation and CPR Outcome**

A recent study showed that elderly survivors had cerebral outcomes as good as those of the adult survivors\(^2\). As previous studies\(^18\,26\) concluded, the elderly do not necessarily have a poorer neurologic outcome than adult patients. However, studies have shown that many patients who survive CPR, especially the elderly, do suffer cognitive and functional disabilities. Some even fall into a permanent coma\(^6\,39\). CPR can be harmful to delicate elderly patients, causing them incredible pain late in their lives.

After CPR, post-cardiac arrest syndrome is identified as: (1) post-cardiac arrest brain injury, (2) post-cardiac arrest myocardial dysfunction, (3) systemic ischemia/reperfusion response, and (4) persistent precipitating pathology\(^7\). Eighty percent of elderly CPR patients went home and 20\% of them went to a nursing home\(^23\). Initial survivors with either impaired consciousness or functional impairment after the arrest had a significantly worse chance of survival than patients without these impairments. Of the survivors, those who had ventricular arrhythmias and were resuscitated within minutes were noted\(^5\). The post-resuscitation survival, although high, in older patients is less than that in age-matched healthy controls, and physical and emotional quality of life scores are decreased\(^29\).

**CPR Outcome in Taiwanese Reports**

The disease profile for elderly patients in Taiwan is significantly different than in Western countries\(^48\,49\). If we conduct a survey to determine the preferences of the elderly for CPR in Taiwan, it would help clinical workers to better understand the needs of elderly patients.

The in-hospital survival to discharge rate is 17\% for the Taiwan National University Hospital, and is 3.9\% for those patients who lived up to 1 year after CPR\(^48\). Age appears not to be the determining factor in the survival rate; instead, it is the timing of arrival at life support facilities and the confirmation of the heart rhythm that count. Huang et al.\(^48\) reported that most Taiwanese
patients receive CPR because of problems such as septic shock, whereas various heart diseases are the main reasons in Western countries. Therefore, the chance of having VF/VT at the time of cardiac arrest is 13.6%, which is lower than the corresponding data in Western studies (16–45%). The percentage of coronary heart disease is also lower (17% vs. 43%). These factors would definitely affect the results of CPR. The out-of-hospital survival discharge rate for patients receiving CPR is 2.9% in Taipei and 4% in Kaoshiung. Age is not a factor in these statistics. Similar to the in-hospital data, the chance of having VF/VT at the time of cardiac arrest is lower than in Western data (11.8% vs. 25–70%). There are no statistics concerning CPR results for elderly patients in nursing homes in Taiwan; since there are fewer cases of ventricular fibrillation, ventricular tachycardia and heart diseases in Taiwan, the local emergency medical network is not as complete as in Western countries. It is logical to assume that compared with Western countries, elderly patients living in nursing homes in Taiwan have a lower survival to discharge rate after receiving CPR. To date, there has been no survey that reveals the percentage of elderly selecting to receive CPR in Taiwan. Those whose spouses died in pain after receiving CPR choose not to receive CPR themselves. Despite cultural differences, the situation in Taiwan is similar to that in Western countries. In 2008, Chien et al. collected data on 299 non-traumatic OHCA adult patients who received CPR upon arrival at the ED in Mackay Memorial Hospital between January 1, 2005 and December 31, 2005. The overall survival rate of patients was 7.4%. The survival rate of the elderly OHCA patients was 6.1%, while the adult group was 9.9%. However, there were no significant differences between the two groups. Demographic and clinical characteristics of the patients showed that the adult group included more males, and the patients had more VF/VT; these findings were similar to a study by Bonnin et al. In this study, 198 patients were elderly. Of the 198 elderly patients who were 65 years or older, 85 patients (42.9%) had ROSC, 50 patients (25.3%) survived to admission, and 12 patients (6.1%) survived to hospital discharge. In comparison, of the 101 adult patients aged 18–65 years, 32 patients (31.7%) had ROSC, 21 patients (20.8%) survived to admission and 10 patients (9.9%) survived to hospital discharge. There were statistically significant differences in the outcomes between the two groups. In the subgroup of patients who had ROSC at the ED, the adult group had a higher rate of survival to hospital discharge than the elderly (31.3% vs. 14.1%; p = 0.035); but in multivariate analysis, only the initial VF/VT rhythm predicted survival rate (OR, 7.912; p = 0.007). The factor that predicted ROSC was a witnessed arrest. Factors that predicted hospital discharge included a witnessed arrest and a shorter duration of resuscitation in the ED. Post-resuscitation neurologic outcomes of the survivors showed no significant difference between the elderly and the adult group.

Conclusion

The population of Taiwan is aging. As the medical system improves, physicians and other medical professionals deal with more and more elderly patients, and the unique health problems of this patient group require improved medical expertise and care. The outcome of CPR for elderly patients differs with each diagnosis. However, age is not the only factor affecting the failure of CPR in elderly patients. Doctors should consider factors other than age and perform CPR only on suitable patient groups based on the diagnosis. For those who would not benefit from receiving CPR, doctors should take on the ethical responsibility to communicate with patients and families before initiating CPR. Furthermore, do-not-resuscitate agreements should be signed prior to cardiac arrest to avoid patients suffering unnecessary pain. Considering the data above, the outcome of elderly patients who have suffered from cardiac arrest because of VF/VT and who received CPR within a few minutes of cardiac arrest is no less positive than that of young patients. On the contrary, the outcome may not be so positive for the following elderly patients: individuals suffering from cardiac arrest because of asystole or pulseless electrical activity; patients without a witness at the time of the cardiac arrest; seniors undergoing CPR for more than 25 minutes; patients in otherwise poor health; bedridden patients; residents in nursing homes; patients with preexisting diseases including cancer, septicemia, gastrointestinal bleeding, pneumonia, heart failure, kidney failure, and acute stroke; individuals with more than three comorbidities; seniors with low blood pressure at the time of cardiac arrest; and patients with a terminal illness as the cause of the cardiac arrest. Age is definitely not a determinant for CPR effectiveness, and doctors should not use it as an excuse to refuse CPR. It is rational and
necessary to aggressively resuscitate in cases of cardiac arrest among the elderly, since their age does not significantly decrease their chances of survival or worsen their post-resuscitation neurologic outcomes compared with non-elderly patients.

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