OBJECTIVES: To evaluate whether the recommended observation period of 7 days for cardiac arrest survivors is sufficient for conscious recovery and to identify the variables associated with eventual neurologic recovery among patients with delayed awakening.

DESIGN: A retrospective cohort study.

SETTING: A single tertiary medical center.

PATIENTS: Five-hundred twenty-nine nontraumatic adult cardiac arrest survivors with prearrest favorable neurologic function (Cerebral Performance Category 1–2) who survived to hospital discharge during 2011–2019.

INTERVENTIONS: The enrolled patients were classified into favorable (Cerebral Performance Category 1–2) and poor (Cerebral Performance Category 3–4) neurologic recovery according to their neurologic function at hospital discharge. Among patients with favorable neurologic recovery, those who recovered within 7 days were assigned to the early recovery group or after 7 days as the late recovery group.

MEASUREMENTS AND MAIN RESULTS: There were 395 patients exhibiting favorable neurologic recovery (n = 357 in the early group, n = 38 in late group) and 134 patients exhibiting poor neurologic recovery (poor recovery group). Among patients who remained unconscious on day 7, delayed awakening was associated with male sex (odds ratio [OR], 3.905; 95% CI, 1.153–13.221), prehospital return of spontaneous circulation (OR, 7.628; 95% CI, 2.084–27.922), therapeutic hypothermia (OR, 4.320; 95% CI, 1.624–11.488), and extracorporeal cardiopulmonary resuscitation (OR, 4.508; 95% CI, 1.414–14.371). Being transferred from another hospital, however, was less likely to be associated with delayed awakening (OR, 0.061; 95% CI, 0.009–0.431). The median duration for patients to regain clear consciousness in the late recovery group was 12.12 days. No patient who recovered consciousness had an unfavorable electroencephalography pattern, however, in patients with poor recovery, the 7-day electroencephalography showed 45 patients with generalized suppression (33.6%), two with burst suppression (1.5%), 14 with seizure/epileptic discharge (10.5%), and one with status epilepticus (0.7%).

CONCLUSIONS: Up to 9.6% of cardiac arrest patients with favorable outcomes recover consciousness after the recommended 7 days of observation, indicating the observation time of 7 days seems justified but longer duration may be needed. The results of the culturally and clinically isolated population may limit the application to other population.

KEY WORDS: awakener; cardiac arrest; delayed neurologic recovery; observation period; prognosis

Despite great advance in cardiopulmonary resuscitation (CPR) and teamwork, the majority of successfully resuscitated cardiac arrest victims still present comatose or with an altered conscious level due to irreversible hypoxic-ischemic encephalopathy (1, 2). As such, studies have

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investigated postarrest care and prognostic tools to ameliorate the associated burden on public health resources.

The accuracy and timing of neuroprognostication are of the utmost importance for the avoidance of premature withdrawal of life-sustaining treatment (WLST) and futile prolongation of treatment. WLST accounts for most deaths after cardiac arrest when a poor neurologic outcome is predicted. In the targeted temperature management (TTM) trial, WLST was cited as the cause of death in 247 out of the 939 recruited patients (26%) (3). In another prospective study on 154 patients resuscitated from witnessed out-of-hospital cardiac arrest (OHCA), 63 (41%) died after WLST (4). However, predictors of neurologic recovery in cardiac arrest survivors may increase the risk of self-fulfilling prophecy since early WLST may increase false-positive results and inflate the predictive ability of the prognostic tool (5, 6). Each year, approximately 2,300 Americans die following WLST because of perceived poor neurologic prognosis within 72 hours of cardiac arrest, among whom nearly 1,500 (64%) might have made a functional recovery if allowed to live longer (7). Mulder et al (4) reported a mean time of 7.62 days to WLST in patients who received therapeutic hypothermia (TH) and 1.6 days in those without TH. Approximately one-third to one-half of patients treated with hypothermia who were discharged with favorable neurologic outcome awoke greater than 72 hours after the return of spontaneous circulation (ROSC) (4, 8, 9). Furthermore, among cardiac arrest survivors with severe disorders of consciousness, 6.2% achieved favorable functional outcome with improvement beginning 8 to 12 weeks after cardiac arrest despite poor initial prognostic markers (10). Inappropriate withdrawal of medical care may result in unnecessary loss of life and unduly influence the results of clinical trials. In 2015, the American Heart Association recommended that neuroprognostication should be carried out at least 72 hours after the completion of rewarming in patients receiving TH (usually 4.5–5 d after ROSC) and 72 hours after ROSC in patients not receiving TH (11), and further suggested in 2019 and 2020 that the observation period should be extended to 7 days after the end of TTM or the suspension of sedation (whichever occurs later) (12, 13).

However, whether the suggested observation period is sufficient for successfully resuscitated patients who may have favorable neurologic recovery to recover from impaired consciousness remains unclear. Furthermore, the identification of patients with the potential of delayed recovery in those with severe consciousness disorders at the end of observation period is challenging. Ideally, this issue would be investigated in a study population in which WLST rarely occurs, to eliminate the risk of self-fulfilling prophecy. In Taiwan, WLST is rarely performed because of cultural and religious reasons; besides, greater than 99% of the Taiwanese population of 23 million people are covered by Taiwan’s National Health Insurance program, which includes expenses from outpatient clinics to hospitalization and intensive care (14). The objective of the current study was to evaluate whether the recommended observation period of 7 days is sufficient to predict recovery of consciousness and to identify the variables associated with delayed awakening (> 7 d after ROSC) in cardiac arrest survivors.

**METHODS**

**Demographics/Epidemiology**

This retrospective cohort study, approved by the Institutional Review Boards of National Taiwan University Hospital (NTUH) (202012242RINB), which is a 2,500-bed tertiary medical center located in Taipei City (population density of approximately 10,000 people/km) with 110,000 annual emergency department (ED) visits (15). Although WLST for terminally ill patients (under the agreement of all family and an ethics committee) in Taiwan had been allowed by the second amendment of the Hospice Palliative Care Act since 2011 (16), the cultures of being afraid of talking about death and of “not giving up” as a way of showing love and filial piety still constitute barriers to perform WLST. Besides, extensive expense coverage of national health insurance in Taiwan also aggravates some futile or defensive medical behaviors.

This study enrolled 2,455 nontraumatic adult cardiac arrest victims with attempted CPR in the ED during 2011–2019 at NTUH. We excluded 805 patients without ROSC, 1,054 successfully resuscitated patients without survival-to-discharge, two patients transferred to other hospitals after ROSC, and 65 patients with prearrest Glasgow-Pittsburgh Cerebral Performance Category (CPC) greater than 2. Finally, 529 patients with favorable prearrest neurologic function (CPC = 1–2) who survived to hospital discharge were enrolled. Among them, 395
patients exhibited favorable neurologic recovery (CPC = 1–2) at hospital discharge and were further classified into the early recovery group (n = 357) and the late recovery group (n = 38) based on whether they regained their clear consciousness within 7 days following ROSC. The definitions of clear consciousness and awakening following cardiac arrest varied between studies. Clear consciousness and awakening in the current study were defined as alert and oriented (to person, place, or time) or following command (motor component of Glasgow Coma Scale score = 6) (17, 18). The remaining 134 patients exhibiting poor neurologic recovery (CPC = 3–4) at hospital discharge were assigned to the poor recovery group (none regained clear consciousness) (Fig. 1). The following information was collected from the individual medical records by using a predesigned questionnaire: baseline characteristics, preexisting comorbidities, cardiac arrest events, and postarrest care.

**Cardiac Arrest Factors**

OHCA was defined as the absence of circulation outside the hospital and in-hospital cardiac arrest after triage. Transferred cardiac arrest patients were defined as successfully resuscitated patients transferred to NTUH from another hospital. Prehospital ROSC was defined as the return of heartbeat and pulsation in OHCA patients before hospital arrival documented by emergency medical service records. Cardiogenic arrest was recorded when ischemic heart disease, structural heart disease, heart failure, or arrhythmia without electrolyte imbalance was considered the cause of arrest. The causes of cardiac arrest were determined by the responsible primary care physicians, who were blinded to the current study. The TH protocol at NTUH included reducing the patient’s body temperature to the targeted temperature (33°C) within 6 hours after ROSC, maintaining the targeted temperature for 24 hours, rewarming the patient with an increase of 0.25°C every hour until the body temperature reaches 36°C by using a cooling device with automated feedback, and maintaining the body temperature at less than 36.5°C for 24 hours after rewarming is completed (15). Extracorporeal CPR (ECPR) was recorded when it was applied as indicated during index resuscitation. Emergent coronary angiography

![Figure 1. Flowchart of patient enrollment. CPR = cardiopulmonary resuscitation, ED = emergency department, ROSC = return of spontaneous circulation.](image-url)
(CAG) was recorded when indicated patients underwent CAG within 24 hours after ROSC.

**Neurologic Factors**

Electroencephalography and single-photon emission CT (SPECT) were performed on day 7 after ROSC to evaluate cerebral function and predict neurologic recovery. Among electroencephalography examination results, general suppression (suppressed background < 10 μV with superimposed generalized suppression pattern), burst suppression, epileptic waveform, and status epilepticus, were considered unfavorable electroencephalography patterns. Moderate or severe hypoperfusion of the brain on SPECT images was considered significant.

**Outcome Measures**

Outcomes including hospitalization duration, CPC at hospital discharge, as well as 1-month, 3-month, 6-month, and 1-year outpatient clinic follow-ups were recorded. CPC at hospital discharge was evaluated by primary care physicians of internal medicine or ICU, who were blinded to the current study.

**Statistical Analysis**

Categorical variables are expressed as percentages, and continuous variables are expressed as mean ± sd. Either the chi-square test (for categorical variables) or the independent t test (for continuous variables) was used to compare the demographic and clinical characteristics of the study subjects. Significant variables \((p < 0.1)\) were entered into a multivariate logistic regression analysis to determine relationships between neurologic recovery and variables. Results with \(p\) value of less than 0.05 were considered statistically significant. All statistical analyses were performed using Statistical Package for Social Sciences Statistics (Version 16.0; IBM, Chicago, IL).

**RESULTS**

Of the 529 enrolled patients, there were 357 patients (67.5%) in the early recovery group, 38 patients (7.2%) in the late recovery group, and 134 patients (25.3%) in the poor recovery group. The demographic and outcomes of patients successfully resuscitated but failed to survive to discharge and those with prearrest poor neurologic function (not enrolled in the current study) were shown in Table 1 (http://links.lww.com/CCM/G620) and Table 2 (http://links.lww.com/CCM/G621).

**Early Versus Late Recovery Group**

Compared with the late recovery group, the early group had a lower frequency of male (71.7% vs 89.5%), TH (24.4% vs 71.7%), ECPR (18.8% vs 36.8%), and sedative use on day 7 (16.2% vs 28.9%), but a higher frequency of epinephrine dosage less than 3 mg (66.1% vs 47.4%) (Table 3, http://links.lww.com/CCM/G622). There were a higher proportion of patients with CPC = 1 at hospital discharge (84.3% vs 63.2%), a shorter hospitalization length (25.91 ± 30.04 d vs 55.60 ± 38.26 d), and a higher 1-month follow-up rate (92.7% vs 81.6%) in the early group than in the late group (Table 4, http://links.lww.com/CCM/G623; SFig. 1, http://links.lww.com/CCM/G624 [legend, hospitalization length of each group. HT = hypothermia, nonHT = nonhypothermia.]). Logistic regression analysis revealed that age greater than 65 years (OR, 2.509; 95% CI, 1.097–5.735), TH (OR, 10.768; 95% CI, 4.584–25.295), and ECPR (OR, 4.896; 95% CI, 1.895–12.650) were associated with delayed neurologic recovery (Table 1). The distribution of patients who regained clear consciousness per day was shown in Figure 2. The median duration from ROSC to awake is 0.80 days (interquartile range [IQR], 0.11–2.80 d) in the early group, 12.12 days (IQR, 9.17–18.25 d) in the late group. The patients with hypothermia needed significantly longer duration to awake than those without hypothermia (0.40 vs 4.41 d; \(p < 0.001\)).

**Late Versus Poor Recovery Groups**

Compared with the poor recovery group, the late recovery group had a higher proportion of male (89.5% vs 67.9%), prehospital ROSC (21.1% vs 8.2%), TH (71.1% vs 53.0%), and ECPR (36.8% vs 19.4%) but lower percentage of patients who were transferred from another hospital (5.3% vs 19.4%) (Table 3, http://links.lww.com/CCM/G622). No patient who recovered consciousness had an unfavorable electroencephalography pattern, however, in patients with poor recovery, the 7-day electroencephalography showed 45 patients with generalized suppression (33.6%), two with burst suppression (1.5%), 14 with seizure/epileptic discharge (10.5%), and one with status epilepticus (0.7%). SPECT
images exhibited no differences of cerebral, thalamus, or brainstem hypoperfusion between the late and poor recovery groups (Table 4, http://links.lww.com/CCM/G623). Unfavorable electroencephalography patterns were excluded from logistic regression analysis owing to it perfectly predicted poor neurologic recovery. The following characteristics were associated with late neurologic recovery (awakening after 7 d): male sex (OR, 3.905; 95% CI, 1.153–13.221), being transferred

| TABLE 1. Association Between Variables and Delayed Awakening |
|-------------------------------------------------------------|
| **Variables**                                               | **OR (95% CI)** | **p**  |
| Early vs late (delayed awakening among patients with favorable neurologic outcome) |                |        |
| Age > 65                                                   | 2.509 (1.097–5.735) | 0.029 |
| Sex (male)                                                 | 2.994 (0.968–9.259)  | 0.057 |
| Epinephrine ≤ 3 mg                                         | 0.576 (0.252–1.317)  | 0.191 |
| CPR duration ≥ 20 min                                      | 0.846 (0.359–1.995)  | 0.702 |
| Hypothermia                                                | 10.768 (4.584–25.295) | <0.001 |
| ECPR                                                       | 4.896 (1.895–12.650)  | 0.001 |
| Sedatives on day 7                                          | 1.473 (0.627–3.456)  | 0.374 |
| Late vs poor (delayed awakening among unclear patients on day 7) |            |        |
| Age > 65                                                   | 1.335 (0.495–3.604)  | 0.568 |
| Sex (male)                                                 | 3.905 (1.153–13.221) | 0.029 |
| Prehospital return of spontaneous circulation              | 7.628 (2.084–27.922)  | 0.002 |
| Cardiac arrest place                                        |                |        |
| Out-of-hospital cardiac arrest                             | 0.278 (0.047–1.653)  | 0.159 |
| In-hospital cardiac arrest                                 | 0.061 (0.009–0.431)  | 0.005 |
| Transfer                                                   | 1.844 (0.632–5.377)  | 0.263 |
| Shockable rhythm during CPR                                 | 4.320 (1.624–11.488) | 0.003 |
| Hypothermia                                                | 4.508 (1.414–14.371) | 0.011 |

CPR = cardiopulmonary resuscitation, ECPR = extracorporeal cardiopulmonary resuscitation, OR = odds ratio.

*Unfavorable electroencephalography patterns is excluded from the logistic regression analysis due to it predicts poor recovery perfectly.

Figure 2. The distribution of patients who regained clear consciousness per day. HT = hypothermia, nonHT = nonhypothermia.
from another hospital (OR, 0.061; 95% CI, 0.009–0.431), prehospital ROSC (OR, 7.628; 95% CI, 2.084–27.922), TH (OR, 4.320; 95% CI, 1.624–11.488), and ECPR (OR, 4.508; 95% CI, 1.414–14.371) (Table 1). Subgroup analysis revealed significant interaction ($p = 0.006$) between sex and prehospital ROSC. The frequency of late awakening in men is consistently higher than in women, regardless of prehospital ROSC or not. The difference of frequency between female and male is more prominent in patients with prehospital ROSC than those without.

**Hypothermia Subgroup**

Among 185 cardiac arrest survivors who underwent TH, there were 87 patients (47.0%) in the early recovery group, 27 patients (14.6%) in the late recovery group, and 71 patients (38.4%) in the poor recovery group. The comparisons of demographic/cardiac arrest events/postarrest care between the early and late groups, and between the late and poor groups are shown in Table 5 (http://links.lww.com/CCM/G625). Compared with the early group, the late group had a lower percentage of CPC equals to 1 at hospital discharge (92.0% vs 63.0%), and lower follow-up rates within 1 year after discharge as well as a longer hospitalization length (20.62 ± 15.68 d vs 50.86 ± 37.82 d) (Table 6, http://links.lww.com/CCM/G626). Among patients with favorable outcomes, only witnessed collapse (OR, 0.195; 95% CI, 0.048–0.795) remained significantly associated with late awakening after regression analysis (Table 2). The median duration for patients to regain clear consciousness in the late recovery group was 11.84 days (IQR, 8.77–15.89 d).

**TABLE 2.**

| Variables | OR (95% CI) | $p$ |
|-----------|------------|-----|
| Early vs late (delayed awakening among patients with favorable neurologic outcome) | | |
| Age > 65 | 2.590 (0.820–8.185) | 0.105 |
| Diabetes mellitus | 1.804 (0.507–6.415) | 0.362 |
| Malignancy | 1.372 (0.253–7.483) | 0.714 |
| Prearrest CPC = 1 | Reference | |
| Prearrest CPC = 2 | 5.197 (0.666–40.541) | 0.116 |
| Cardiac arrest place | | |
| OHCA | Reference | Reference |
| IHCA | 1.066 (0.254–4.743) | 0.930 |
| Transfer | 0.458 (0.068–3.070) | 0.421 |
| Witnessed collapse | 0.195 (0.048–0.795) | 0.023 |
| Cardiac origin | 0.514 (0.115–2.309) | 0.386 |
| Coronary angiography | 1.065 (0.265–4.276) | 0.929 |
| Late vs poor (delayed awakening among unclear patients on day 7)$^a$ | | |
| Age > 65 | 2.055 (0.675–6.259) | 0.205 |
| Sex (male) | 3.456 (0.682–17.502) | 0.134 |
| Cardiac arrest place | | |
| OHCA | Reference | Reference |
| IHCA | 0.175 (0.021–1.437) | 0.105 |
| Transfer | 0.021 (0.002–0.258) | 0.003 |
| Prehospital return of spontaneous circulation | 10.092 (2.065–49.315) | 0.004 |
| Shockable rhythm during cardiopulmonary resuscitation | 1.657 (0.467–5.876) | 0.434 |

CPC = Cerebral Performance Category, IHCA = in-hospital cardiac arrest, OHCA = out-of-hospital cardiac arrest, OR = odds ratio.

$^a$Chronic obstructive pulmonary disease and unfavorable electroencephalography patterns are excluded from the logistic regression analysis due to they predict poor recovery perfectly.
Electroencephalography examinations on day 7 in the poor recovery group revealed 29 patients with generalized suppression (40.8%), one with burst suppression (1.4%), eight with seizure/epileptic discharge (11.3%), and one with status epilepticus (1.4%); no such findings were observed in the late recovery group (Table 6, http://links.lww.com/CCM/G626). Among patients whose consciousness were impaired on day 7 after ROSC, being transferred from another hospital (OR, 0.021; 95% CI, 0.002–0.258) and prehospital ROSC (OR, 10.092; 95% CI, 2.065–49.315) were associated with late neurologic recovery (Table 2).

Nonhypothermia Subgroup

Among 344 cardiac arrest survivors who did not undergo TH, there were 270 patients (78.5%) in the early recovery group, 11 patients (3.2%) in the late recovery group, and 63 patients (18.3%) in the poor recovery group. Both the early and poor groups had a lower frequency of ECPR than the late group (early: 21.5%, late: 72.7%, poor: 25.4%). The patients were older in the poor group as compared with those in the late group (55.58 ± 13.21 yr vs 69.14 ± 16.73 yr) (Table 7, http://links.lww.com/CCM/G627). The median duration for patients to regain clear consciousness in the late recovery group was 13.85 days (IQR, 9.28–26.37 d). Electroencephalography examinations in the poor recovery group showed 16 patients with generalized suppression (25.4%), one with burst suppression (1.6%), six with seizure/epileptic discharge (9.5%), and none with status epilepticus (Table 8, http://links.lww.com/CCM/G628). No factors remained associated with late awakening after regression analysis.

DISCUSSION

In this study, approximately 9.6% of patients with favorable neurologic recovery regained clear consciousness after 7 days following ROSC, as did 23.7% of those who underwent TH and 3.2% of those who did not undergo TH. Among patients who remained unconscious on day 7, delayed awakening (> 7 d) was associated with male sex, prehospital ROSC, TH, and ECPR. But being transferred from another hospital was less likely to be associated with delayed awakening. In those who underwent TH, prehospital ROSC and being transferred from another hospital remained associated with delayed awakening. Unfavorable electroencephalography patterns were predictive of never regaining clear consciousness, regardless of whether patients received hypothermia. Underlying comorbidities did not impact recovery.

Older age, postresuscitation shock and renal impairment may reduce drug clearance and cause delayed awakening (> 48 hr after discontinuation of sedation) in cardiac arrest survivors treated with TTM (19). In a case series of 89 OHCA survivors with TTM, late awakeners (> 72 hr after rewarming) had longer 911 call-advanced life support care time and less witnessed collapse as compared with early awakeners (< 72 hr after rewarming) (20). In the current study, delayed awakeners (> 7 d) were older and underwent TH and ECPR more frequently than early awakeners (< 7 d). Among patients who received TH, less witnessed collapse was associated with delayed awakening. Early awakeners typically have shorter length of hospitalization (20) and more favorable neurologic outcomes (4, 19, 20). Our results also demonstrated better neurologic recovery, a shorter hospitalization length, and a higher follow-up rate after discharge in the early recovery group than the late group.

Among patients who survived cardiac arrest and remained unconscious days following ROSC, family members usually experience the initial chaos and would like to know the prognosis to help determine further plans. The present findings suggest that the observation period should be prolonged in patients with male sex, prehospital ROSC, TH, or ECPR. Whereas a 7-day electroencephalography that demonstrates an unfavorable pattern may suggest that a longer observation period is unlikely to be beneficial. Furthermore, patients transferred from another hospital might have a lower probability of delayed awakening. Among resuscitated OHCA patients, men have significantly higher discharge survival than women, especially in those without do not resuscitate or WLST (21). Our results also demonstrated better neurologic recovery in men than women. Significant interaction existed between prehospital ROSC and sex. The association between sex and prehospital ROSC is rarely reported. In our previous study investigating patients with prehospital ROSC, a high proportion of male patients (77.8%) was noted but not associated with survival and neurologic outcomes (15). Further well-designed studies are necessary to clarify the relationship between sex and prehospital ROSC.
Prehospital ROSC (15), TH (22, 23), and ECPR (24) have been reported to improve neurologic outcomes in cardiac arrest survivors. Patients receiving TH or ECPR may need more time to recover from sedation or to be weaned from extracorporeal membrane oxygenation support. In contrast, inter-facility transfers are associated with increased probability of clinical deterioration of postcardiac arrest (25), which may in turn impair the neurologic recovery. A highly malignant electroencephalography pattern (suppression or burst suppression with or without discharges) after cardiac arrest strongly predicts poor neurologic outcome (26, 27). In the current study, patients with unfavorable electroencephalography patterns on day 7 after ROSC never recovered consciousness.

Among comatose cardiac arrest survivors treated with TTM, approximately 80% with favorable neurologic recovery regained clear consciousness within 3.5 days following ROSC (28). Gold et al (20) reported a median duration from rewarming completion to awakening of 126 hours in late awakeners (> 72 hr after rewarming) who received TTM. In the TTM trial, the formal neurologic prognostication was not performed until 108 hours after ROSC (3). In our current study, the median duration from ROSC to awake was approximately 12 days in delayed awakeners (> 7 d). This indicated that an observation period longer than the suggested 7 days for some patients with cardiac arrest is warranted. The moderate extension would allow patients with delayed awakening to be identified, because patients are highly susceptible to unstable hemodynamics, metabolism of sedatives and neuromuscular blockers, and the causes of arrest during the early postarrest period, which may confound neuroprognostication (12).

This study had several limitations. First, due to the retrospective nature, selection bias was unavoidable, and unidentified confounding factors may be present. Second, patients with “death after awakening” due to non-neurologic causes may be excluded since patients without survival-to-discharge were excluded. Besides, excluding patients without survival-to-discharge and those without prearrest favorable function may inducing the risk of falsely inflating favorable neurologic outcomes. Third, the change of postarrest care over time could have affected the results. Fourth, the small sample size may have resulted in nonsignificant differences between groups in some variables. Besides, some exams usually used for neuroprognostication such as corneal reflex, motor movement, somatosensory evoked potential, or serum biomarkers were not performed. The functional assessment such as self-care, paid employment, and emotional adaptability were also not evaluated. Fifth, the sex difference in outcomes may resulted from physiologic, etiology, and possible societal/cultural effect. Lastly, the longer duration allowed for neurologic recovery inevitably increased the risk of providing futile interventions to patients with a minimal chance of recovering to live a meaningful life. However, given the effort and resources devoted to care for cardiac arrest survivors, the present findings not only suggest that premature WLST should be avoided but also define those that may represent futile (and potentially costly) care. The results of the culturally and clinically isolated population may not be easily applied to other population. Further well-designed prospective research on the patients who could benefit from a longer observation period and the optimal observation period length is warranted.

CONCLUSIONS

In cardiac arrest survivors, the usual recommended observation period of 7 days should be prolonged for those with male sex, prehospital ROSC, TH, and ECPR, but prolongation might not be warranted in those with an unfavorable electroencephalography pattern.

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1 Department of Emergency Medicine, National Taiwan University Medical College and Hospital, Taipei, Taiwan.
2 Department of Internal Medicine (Cardiology Division), National Taiwan University Medical College and Hospital, Taipei, Taiwan.

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For information regarding this article, E-mail: wjchen1955@ntu.edu.tw; chhuang730@gmail.com
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