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Different utilization of intensive care services (ICSs) for patients dying of hemorrhagic and ischemic stroke, a hospital-based survey

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Abstract

The intensive care service (ICS) saves lives and rescues the neurological function of stroke patients. We wondered the different utilization of ICS for patients with ischemic and hemorrhagic stroke, especially those who died within 30 days after stroke.

Sixty-seven patients died during 2011 to 2015 due to acute stroke (42 due to intracranial hemorrhage [ICH]; 25 due to cerebral infarct [CI]). The durations of hospital stay (hospital staying days [HSDs]) and ICS staying days (ISDs) and codes of the do-not-resuscitate (DNR) were surveyed among these medical records. Statistics included chi-square and descriptive analyses.

In this study, CI patients had a longer HSD (mean 14.3 days), as compared with ICH patients (mean 8.3 days); however, the ICH patients had a higher percentage of early entry within the first 24 hours of admission into ICS than CI group (95.1% vs 60.0%, $P = .003$). A higher rate of CI patients died in holidays or weekends than those with ICH (44.0% vs 21.4%, $P = .051$). DNR, requested mainly from direct descendants (children or grandchildren), was coded in all 25 CI patients (100.0%) and 38 ICH patients (90.5%). More cases with early DNR coded within 24 hours after admission occurred in ICH group (47%, 12% in CI patients, $P = .003$). None of the stroke patient had living wills. Withhold of endotracheal intubation (ETI) occurred among CI patients, more than for ICH patients (76.0% vs 18.4%, $P < .005$).

In conclusion, CI patients longer HSD, ISD, higher mortality within holidays or weekends, and higher ETI withhold; but less percentage of ICS utilization expressed by a lower ISD/HSD ratio. This ICS utilization is a key issue of medical quality for stroke care.

Abbreviations: CI = cerebral infarct, DDD = DNR-to-death duration (days), DNR = do-not-resuscitate, ETI = endotracheal intubation, HSD = hospital staying duration (days), ICH = intracranial hemorrhage, ICS = intensive care service, ISD = ICS staying duration (days).

Keywords: do-not-resuscitate code, endotracheal intubation, hospital staying days, ICS staying days, intensive care service, stroke

1. Introduction

Stroke has ranked the 2nd common cause of death globally[1] and one of the major causes of disability, which impacted patients' life quality not only estimated through the stroke scales,[2] but also through the subsequent economic burden.[3] Although the mortality rate has been declining in the past few years, cerebrovascular disease is still regarded as one of the most common cause of death with high rank in Taiwan, the 3rd since 2007 and the 4th in 2016, with about one for every 15 deaths in 2016.[4] In USA, stroke ranked as the 5th leading cause of death and responsible for one of every 20 deaths.[5] Lessening the physical and psychological dependence for the stroke survivors is the goal for acute care and subacute rehabilitation.

In our previous study, more than 70% of the stroke patients who passed away, had ever stayed in the intensive care services (ICSs).[6] The neurological deterioration among stroke patients who need ICS may be related to the stroke pattern or comorbidities, and the clinical alert system may help the emergency management.[7] Prior study has shown 14.7% of patients with ischemic stroke had died after admitted to ICS,[8] and about 60% was related to neurological condition. Our study explored the following issues: significance of ICS for stroke patients with comparison of the utilization of ICS among the ischemic and hemorrhagic stroke patients; the "weekend" effect on the mortality rate, based on the findings from previous study[9]; and the differences of the "do-not-resuscitate" (DNR) code between cerebral infarct (CI) and intracranial hemorrhage (ICH) patients.

2. Methods

We reviewed the death of patients listed in the Cardinal Tien Hospital from January 1, 2011 to December 31, 2015, and then pick up those with stroke codes by the 9th version of International Classification of Diseases (ICD-9, 430-439). The

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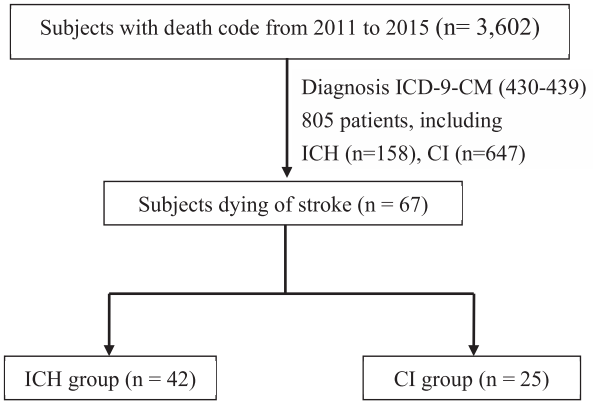

Figure 1. The flow chart for selection of the cases in this study.

Table 1

Demography of the patients in ICH and CI groups in this study.

	ICH (n = 42)	CI (n = 25)
Female (n = 26)	15 (35.7%)	11 (44.0%)
Age, mean (ranges)	79.0 (56–98)	85.5 (68–103)
ICS, patient number	14	11
Male (n = 41)	27 (64.3%)	14 (56.0%)
Age, mean (ranges)	61.4 (39–89)	73.5 (56–94)
ICS, patient number	27	14

CI = cerebral infarct, ICH = intracranial hemorrhage, ICS = intensive care service.

stroke diagnoses were further verified by the application documents for 30-days relief from the partial fee burden for the major or catastrophic illness in the National Health Insurance Administration, Ministry of Health and Welfare, Taiwan. These patients were divided into the cerebral ischemic (CI) group, including all ischemic subtypes due to thrombosis or embolism, and the group of hemorrhagic strokes (ICH) consisting of nontraumatic hemorrhagic subarachnoid and ICH. This work obtained the approval of IRB by the Ethics Committee of the Cardinal Tien Hospital, IRB No. CTH-105-3-5-007 (issued date: June 8, 2016).

From the medical records, the patients' demographic data such as age, sex, and background stroke illnesses were registered. Furthermore, the following topics were analyzed: hospital course, including whether ever ICS staying, early ICS entry within 24 hours after admission, hospital staying days (HSDs, especially those with 7 or more days, for the assessment of severity),[10] and ICS staying days (ISDs, especially those with 3 days or longer)[11]; public holidays or weekends (Saturdays and Sundays) of the admission day and death day for each patient; and the DNR code including the DNR items (the following 7 items: endotracheal intubation [ETI]), chest compression, resuscitation medicines, cardiac defibrillation, cardiac pacing, mechanic ventilation, and other resuscitation procedures)[6] and the days after DNR requested until death (DNR-to-death days [DDD]); and the proxies signing the DNR (eg, spouse, children, parents, grandchildren, siblings, or others). We defined the "early DNR" within 24 hours after admission by the ratio DDD/HSD = 1, meaning the DNR requested on the same admission day. There were patients who did not accept all 7 DNR items, defined as "partial DNRs," also subjected to count their ISDs and HSDs. In addition, the patients with DNR codes but without ETI among patients were also highlighted.

All of the data were listed and then subjected to statistic works, including descriptive, chi-square, and Fisher exact analyses.

3. Results

3.1. Patient survey

There were 3602 hospitalized patients with death code through 2011 to 2015, and 805 in-patients from the stroke registry in this hospital with stroke codes by ICD-9. The latter compassed 647 CI patients (80.4%) and 158 ICH patients (19.6%), and all of them were verified by the 30-days relief of the partial fee burden due to acute stroke, as one of the major or catastrophic illness defined in the National Health Insurance Administration, Ministry of Health and Welfare, Taiwan. As calculating from the original stroke registry data, the ICH patients had higher mortality (26.6%) by 6.9 folds than CI patients (3.9%). After intersection work (Fig. 1), only 67 patients died due to acute stroke, 42 with ICH, and 25 with CI, the latter older (CI, mean 78.8 years and ICH, mean 68.0 years), and in both groups males outnumbered females (Table 1).

All 67 stroke patients had median and mean HSDs, 7 and 10.5 days (1–39 days), respectively. In the ICH group, 15 female patients had a mean HSD of 9.1 days, but the 27 males had mean of 7.9 days; in the CI group, 11 females had a mean HSD of 12.2 days, and 14 males had a mean of 15.9 days (Table 1). Table 2 demonstrated shorter HSD among the patients with ICH (median 6 days, mean 8.3 days) than those with CI (median 12 days, and mean 14.3 days in CI group).

3.2. ICS utility

On reviewing the medical records of the ICS utility, one ICH female did not have ICS, with 97.6% of ICS utility ratio among ICH group. There were 2 male CI patients without ICS staying (ICS utility ratio in CI group, 92.0%) and 3 patients with 2 courses of ICS staying. For the ISDs, significant difference of the early ICS utilities within the first 24 hours of admission existed between these 2 groups ($P = .003$), the 39 out of 41 ICH patients (95.1%), and 15 out of 23 CI patients (65.2%). The calculated ISD/HSD ratios, by ISDs and the whole hospitalization days, implied that all of these patients of both groups entered into ICS during the first half of hospital staying, earlier among ICH group than CI ones (mean, 0.97 in ICH group; and 0.78 in CI group) (Table 2). The median and mean ISDs for ICH group (0–34) were 6 and 7.7 days, respectively; and for CI group (0–26), median and mean were 7 and 9.4 days.

3.3. Weekend effect

After the analysis of deaths among the 42 ICH patients, 13 patients admitted into ICS on holidays or weekends (8.2% of all ICH admissions, 31.0% of ICH deaths), and 9 patients passed away within holidays or weekends (13.4% among all stroke deaths; and 21.4% of all ICH deaths). In the CI group, there were 9 patients who entered our ICS on holidays or weekends (1.1% of all CI admissions, 36.0% of all CI deaths), but 11 patients (16.4% of all stroke deaths; and 44.0% of all CI deaths) died on the holidays or weekends. In other words, total 20 stroke patients died on holidays or weekends (29.9% of the 67 patients), higher

Table 2

Utility differences of ICS services between the patients with ICH and those with CI.

	ICH, n = 42	CI, n = 25	*P*
ICS utility, n, %	41 (97.6%)	23 (92.0%)	.282
Early entry into ICS, n, %	39 (95.1%)	15 (65.2%)	.003*,†
HSD (median, mean: 7, 10.5 d)	1–38 (6, 8.3)	1–39 (12; 14.3)	
ISD (median, mean: 6, 8.3 d)	0–34 (6, 7.7)	0–26 (7, 9.4)	
ISD/HSD ratio, mean	0.97	0.78	
Weekends effect			
Admission on weekends or holidays, n, %	13 (31.0%)	9 (36.0%)	.670
Deaths on weekends or holidays, n, %	9 (21.4%)	11 (44.0%)	.051
DNR codes, n, %	38 (90.5%)	25 (100.0%)	.146*
DDD (median, mean: 3.5, 4.8 d)	1–11 (3, 4.0)	1–15 (4, 6.4)	
DDD/HSD ratio, mean	0.64	0.57	
DDD/ISD ratio, mean	0.64	0.67	
Early DNR, n, %	18 (47.4%)	3 (12.0%)	.003*,†
Withhold ETI, n, %	7 (18.4%)	19 (76.0%)	<.001*,†
"Partial" DNR	16 (42.1%)	8 (32.0%)	.419
HSD ≥ 7 d	10 (26.3%)	6 (24.0%)	.836
ISD ≥ 3 d	15 (39.5%)	7 (28.0%)	.350

DDD = DNR-to-death days, DNR = do-not-resuscitate, ETI = endotracheal intubation, HSD = hosptial staying days, ICS = intensive care service, ISD = ICS-staying days, early DNR means DDD/HSD = 1.
* Fisher exact test.
† Significant *P* value.

ration among CI patients ($P = .051$). Furthermore, we found 1 patient with CI, who admitted on a Sunday and died on the coming Saturday (maybe defined as "dual weekends," ie, onset on a weekend and end on one of the coming weekends), and 3 ICH patients also experienced the "dual weekends" events.

3.4. DNR codes

Of all of the 67 patients, there were 38 ICH patients with DNR codes (90.5%), and all 25 patients with CI had DNR codes (100.0%) (Table 2). No one in this study had living wills, except 1 CI patient who had dementia and with DNR requested 3 years ago. Little difference of in-hospital DDD existed between the ICH and CI group as the expression by the median (3 and 4 days, respectively) or after adjustment by the DDD/HSD or DDD/ISD ratios (Table 2). Less than one third of our patients had early DNR within 24 hours after admission, 18 ICH patients (47.4%) and 3 CI patients (12.0%). All of the 21 patients with early DNR code included 15 males (3 CI patients and 12 ICH ones). The DDD/ISD ratio did not differ between ICH and CI groups (0.64 and 0.67, Table 2), implying the similar end-of-life care and life expectancy in ICS for both stroke groups.

Listed are the proxies of DNR requests among ICH patients: children or grandchildren (18), spouses (10), siblings (7), parents (2), and 3rd collateral consanguinity (1); and the proxies among CI patients requesting DNR included children or grandchildren (18), spouses (6), and siblings (1). That is, most of the DNR codes were requested by the direct descendants among our patients, no matter in ICH or CI group. Although analyzing the 7 DNR items, we paid the first attention on the ETI, for the sake that serial resuscitation procedures follow frequently after ETI. Higher ETI rate occurred among ICH patients (35 out of 42, 83.3%) than those with CI (6 out of 25, 24.0%), with significant difference ($P < .004$). Among these 63 patients with DNR codes, 7 patients (18.4%) in ICH group did not have ETI, and 19 patients (76.0%) of CI group withholding ETI, also with significant difference ($P < .001$). Two CI patients used bi-level positive airway pressure (BiPAP), but no one with ICH used this respiration mode.

Those without all of the 7 DNR items, listed in our survey, by the families or proxies were identified as the "partial" DNR group. There were 17 CI patients who had all of the 7 DNR items requested (68.0%), and the rest 8 patients had "partial" DNR codes. Twenty-two ICH patients of the 38 patients with DNR codes had the request of all DNR items (58.9%), and 16 with "partial" DNR. Of all the 24 ones with "partial DNR" codes (16 with ICH and 8 with CI), there were 16 patients having HSDs of 7 days or longer (6 in the CI group, 24.0%; and 10 in the ICH group, 26.3%); and 22 patients with ISDs of 3 days or longer (7 in CI group, 28.0%; and 15 ICH patients, 39.5%). These longer staying days among these with "partial DNR" may be related to the usage of resuscitation medicines in the ICS, 7 of 8 (87.5%) in CI group and 8 of 16 (50%) in ICH group. All these patients did not have requests for ETI before death.

4. Discussion

In this study, our CI patients had longer HSD and ISD, more DNR requests and more ETI withholds, attributed to the older CI population who had more comorbidity such as diabetes mellitus and heart dysfunction. On the other hand, the ICH group had higher mortality, shorter HSD, and ISD, more patients with earlier entry into ICS since admission and early DNR during the first hospital day. These might imply that ICH had a poorer prognosis with higher mortality and tendency for rapid deterioration during the hospital stays. This is also supported by a higher ETI rate among ICH patients. The worsening of neurological conditions was most likely attributed to the elevated intracranial pressure by the mass effect of the ICH hematoma.

On reviewing the medical records in this study, although no statistical significance, more CI patients died on weekends or holidays than ICH patients (Table 2). The impression of the "weekend" effect on mortality is more evident for CI patient than ICH patients concurs with the observation in a South Carolina study.[12] However, 5.1% of ICH patients (8 out of 158 total ICH admissions) died during weekends or holidays, which was a higher rate than the CI patients (1.7%, 11 out of 647 total

CI patients). We did not check the admission dates of all of the 805 stroke patients and were uncertain about the percentage of weekend admission. The nontraumatic ICH patients with admissions on weekends had been stated to have higher mortality and more adverse discharge.[13] Another analysis in Taiwan stated higher mortality and severity of stroke occurred among those with weekend admissions.[14] However, the association disappeared after adjustment by the stroke severity index. In our study, 22 of 67 stroke patients (13 ICH and 9 CI ones) died with history of admission on a weekend or a holiday, and few with "dual weekend" effect. We speculate the significance of "dual weekend" effect on the mortality of stroke patient, but we lacked the additional parameter to investigate on this issue. Although limited case numbers in this study, mortality rate during the weekends may be adjusted by the stroke severity index, as proposed in the Taiwanese analysis.[15] In trauma, the weekend effect influenced the outcomes or prognosis of the patients.[16] The quality of medical care during the weekends, for example, delays or errors in processing from the lab support services.[17]

More than 90% of our overall patients had DNR codes before their death. We considered that the high percentage of DNR requests in the CI group was related to the older age (Table 1) and longer hospital stay (Table 2). The DDD/HSD ratios more than 0.5 in both groups implied DNR requested during the first half of the hospital stay period before their deaths, and we found the earlier DNR requests among our patients as compared with the prior Taiwan reports.[18] "Partial" DNR existed in more than 30% of our subjects, mainly because of the continuous administration of the resuscitation medicines. Some of those with "partial" DNR lived more than 7 days, and stayed in ICS more than 3 days. There was no one implemented by withdrawal of life-sustaining managements, as the report among other Asian hospitals.[19] "Partial" DNR requests by the family may perceive the conservative attitudes about the patients' illness, and the reluctance to face the death of their stroke patient; on the other hand they cannot bear to stand idly by for the medical deterioration and request something to lower their subconscious anxiety. But sometimes "DNR" also means "do not resign," urging no give-up by health care providers if patient recovery was still possible.[20] Among the DNR items, we found many CI patients with DNR codes that withheld ETI; but only 7 ICH patients had no ETI, and fewer with DNR code. This may imply early ETI due to the rapid clinical deterioration and higher mortality among these ICH patients. However, the ETI did not bring beneficial outcome from mortality for our ICH patients. On emergent cardiopulmonary resuscitation, the pithy formula ABCD (airway, breathing, circulation, and defibrillation) had already been put on clinical practice.[21] However, an appeal for another ABCD (attitudes, behaviors, compassion, and dialogue) for dignity conserving care seemed more meaningful for end-of-life care,[22] especially in the ICS. Although the dialogue or communication executed by questionnaires in the ICS,[23] discomfort still existed while discussing the end-of-life care between the family and the clinical staff,[24] such as ETI or the "partial" DNR request. However, no matter what the symptoms, there is no difference of the awareness of end-of-life care between stroke and cancer patients,[25] and early DNR may be still a critical issue for the stroke patients regardless of the variation of mortality in different hospitals.[26] Although all 25 CI patients had a DNR request, the early DNR rate was much less than those in the ICH group. This, in part, is attributed to less image evidence on brain CT for CI as comparing to ICH in the emergency room. In addition, we found gender-age gap among our ICH patients with early DNR, 12 males (mean 63.4 years old, 46–78 years) younger than the 6 females (mean 86.0 years old, 74–98 years), which is different from the prior report by Nakagawa et al.[27]

There are some limitations to our studies. First, we did not assess the stroke risk factors. Some patient lacked the well documented past histories such as the atrial fibrillation[28] or comorbid diabetes mellitus,[29] especially the spontaneous ICH patients. Second, this retrograde review did not include the economic burden analyses in ICS between these 2 stroke group, nor the daily cost, the 3rd-party or out-of-pocket cost. Instead, we estimated the cost from the hospital staying by counting the HSD and ISD. Shorter ISD and lower ISD/HSD ratio did occur among those with DNR codes.[6] Third, this study did not investigate the patient factors about the severity of stroke, such as the proposed stroke severity index,[15] or the Charlson comorbidity index for the survival analyses or APACHE II for prognosis during the hospital stay. Instead, we conducted another simplified method by recording the durations of HSD and ISD more than 7 and 3 days, respectively, as an indication for survival. Fourth, we lacked age- and sex-matched patients with each stroke pattern for the sake of the limited sample size in this study. We mainly focused on 3 clinical issues: hospital course with ICS utility, weekend effect, and DNR codes. The distributions of these 3 domains differed between CI and ICH groups. Multicenter survey may have more significance.

We found different utilities of ICS between ICH and CI patients before their deaths. Effort on early DNR codes by public education and awareness by the medical staff may render different results for stroke patients in the years to come. No matter how it is, there is still a long journey for us to devote in stroke care.

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