"Weekend Effects" in Patients with Intracerebral Hemorrhage

Fan Jiang, John H. Zhang, and Xinyue Qin

Abstract Studies have shown that weekend admissions are associated with outcomes of patients with different diseases. Our aim is to evaluate the weekend effects in patients with intracerebral hemorrhage (ICH) in our hospital. A retrospective analysis of patients with ICH was performed. Weekend admission was defined as the period from Friday, 6:01 p.m., to Monday, 7:59 a.m. The ICH score was used to evaluate severity on admission. The chi-square goodness-of-fit test was applied to analyze weekly distribution. The rank sum test was conducted to calculate the functional outcomes (modified Rankin scale, MRS), and the mortality was compared by binary logistic regression. Between 2008 and 2009, 313 patients with ICH were included, of which 30% (95/313) were admitted on the weekend. Patients with ICH were equally distributed on weekdays and weekends (P = 0.7123). Weekend admission was not a statistically significant predictive factor for in-hospital mortality (P = 0.315) and functional outcomes (P = 0.128) in patients with ICH. However, a significant correlation was found between the ICH score and the mortality (OR = 6.819, 95%CI: 4.323–10.757; P = 0.009). Our results suggest that compared with weekday admission, weekend admission is not significantly associated with increased short-term mortality and poorer functional outcome among patients hospitalized with ICH.

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Introduction

Prior studies have demonstrated that in-hospital mortality for patients presenting on weekends is higher than for those presenting on weekdays, including cases of heart failure, myocardial infarction, upper gastrointestinal hemorrhage, pulmonary embolism and so on [1–4]. This is known as the "weekend effect" [5, 6]. However, some other literature has shown that there is no statistical difference among the outcomes of patients with some of these diseases [7, 8]. To investigate the theory, we examined the circaseptan variation in fatality and function outcome of patients with intracerebral hemorrhage by day of admission.

Patients and Methods

A retrospective study of all patients with ICH admitted in our hospital (a major teaching hospital) from January 2007 to August 2009 was performed. They were identified by data using the International Classification of Disease, ninth revision, Clinical modification diagnosis code for intracerebral hemorrhage, 431. Patients who were transferred from other hospitals were excluded. The characteristics, including age, sex, comorbid disease, symptoms and complications, were collected.

Criteria for Grouping and Evaluation

Patients were categorized into two groups: weekend admission and weekday admission. Weekend admission was defined as the period from Friday, 6:01 p.m., to Monday, 7:59 a.m.

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Weekday admission was defined as the rest of the time. ICH score was performed to evaluate the severity on admission [9]. Functional outcome was measured by the modified Rankin Scale (MRS). Poor functional outcome was defined as MRS 3–6. In-hospital mortality was also calculated.

Statistical Analysis

T test was used to calculate the ICH score variation between two groups. The chi-square goodness-of-fit test was applied to analyze weekly distribution. The functional outcomes (modified Rankin scale, MRS) were tested by the rank sum test method. In-hospital mortality was compared by binary logistic regression and adjusted for ICH score.

Results

This study involved 313 patients with ICH, 30.35% (95/313) of whom were admitted on the weekend. Table 1 shows the baseline characteristics of all the ICH patients on admission. The ICH score indicated no statistically significant difference between weekday admission and weekend admission groups ($P > 0.05$, Table 2), nor for the incidence of the two groups ($P > 0.05$, Table 3). The rank sum test demonstrated that the function outcome of weekend admission had no significant difference with weekday admission (Table 4). A positive correlation was found between ICH score and in-hospital mortality (OR = 6.819, 95%CI: 4.323–10.757; $P = 0.009$). However, weekend admission was not associated with increased mortality ($P = 0.315$, Table 4).

Discussion

Recently, an analysis was performed including 13,821 patients with ICH using the Agency for Healthcare Research and Quality Health Care Utilization Project Nationwide Inpatient Sample (NIS) data from 1,004 US hospitals across 37 states adjusting for admission severity of illness. They found weekend admission was associated with increased mortality [10]. There have been conflicting reports on the "weekend effect" among patients with ICH in Australia. There were 30,522 chronic obstructive pulmonary disease (COPD), 17,910 acute myocardial infarction, 4,183 acute hip fracture and 1,781 intracerebral hemorrhage patient admissions involved in the

Table 1 Baseline characteristics of ICH patients

ICH ($n = 313$)	–	Weekday admission ($n = 218$)	Weekend admission ($n = 95$)
Age group	<30 years	7 (3.21%)	3 (3.15%)
	30–39 years	8 (3.67%)	5 (5.26%)
	40–49 years	28 (12.84%)	18 (18.94%)
	50–59 years	58 (26.61%)	23 (24.21%)
	60–69 years	52 (23.85%)	20 (21.05%)
	70–79 years	42 (19.27%)	19 (20.00%)
	>80 years	23 (10.55%)	7 (7.37%)
Sex	Female	71 (32.57%)	35 (36.84%)
	Male	147 (67.43%)	60 (63.16%)
Comorbid disease	Hypertension	91 (41.74%)	33 (34.74%)
	Hyperlipidemia	26 (11.93%)	16 (16.84%)
	Diabetes	16 (7.34%)	11 (11.58%)
	Gout	2 (0.92%)	2 (2.11%)
	Fibrillation atrial	4 (1.83%)	0 (0)
	Pulmonary emphysema	2 (0.92%)	1 (1.05%)
	Pulmonary tuberculosis	1 (0.46%)	1 (1.05%)
	Coronary heart disease	3 (1.38%)	3 (3.16%)
ICH score	–	1.18 ± 1.405	1.05 ± 1.266*

*$P > 0.05$ compared with weekday admission

Table 2 Distribution variation between weekend admission and weekday admission

ICH ($n=313$)	Weekday admission	Weekend admission	X^2	P
–	–	–	0.136	0.712
Observed	218	95	–	–
Expected	221	92*	–	–
O/E	0.99	1.03	–	–

*$P>0.05$ compared with weekday admission

Table 3 Modified Rankin Scale

Weekday admission ($n=218$)		Weekend admission ($n=95$)		$P=0.218$
MRS	n	MRS	MRS	–
0	51	0	0	–
1	53	1	1	–
2	20	2	2	–
3	25	3	3	–
4	13	4	4	–
5	7	5	5	–
6	49	6	6	–

Table 4 Adjusted risk of in-hospital death associated with weekend admission and ICH score

ICH ($n=313$)	Weekday admission	Weekend admission	OR	95% CI	P
Percent in-hospital mortality	21.56	17.89	–	–	0.315
ICH score	–	–	6.819	4.323 – 10.757	0.009

retrospective analysis of state-wide administrative data from public hospitals , but a significant weekend effect was only found for acute myocardial infarction [2].

A positive correlation was found between increased mortality and weekend admissions among patients with heart failure, myocardial infarction, upper gastrointestinal hemorrhage and pulmonary embolism [1–4]. However, different results were reported among patients suffering from trauma, tumor, upper gastrointestinal bleeding caused by peptic ulcers, subarachnoid hemorrhage, COPD and so on [2, 7, 8, 11, 12]. Based on these data, we can propose that the "weekend effect" is associated with service provision factors (e.g., access to invasive procedures).

Global mortality was similar in both the weekend and weekday group among patients admitted to the emergency department from 1999 to 2003 in Spain [13]. The inverse correlations were also found in the pediatric intensive care unit (PICU) and intensive care unit (ICU) [14–17]. These studies were generally consistent in postoperative and non-operative patients. A subgroup analysis indicated a positive correlation between weekend admission and higher adjusted hospital mortality rates in the surgical ICU, but not in the medical or multispecialty ICUs [18]. For patients with myocardial infarction, the difference in mortality at 30 days between the weekend and weekday admission group became insignificant after additional adjustment for invasive cardiac procedures. The result is that higher mortality is associated with lower use of invasive cardiac procedures [19]. The authors [20] suggested that preoperative delay will influence the quality of outcome.

In addition, Albright et al. [21] observed that no significant differences were found in comprehensive stroke centers (CSC) when comparing stroke patients with weekend admission and weekday admission groups. Their results suggested that CSC may ameliorate the "weekend effect" in stroke patients. On the other hand, nosocomial external factors may also influence the "weekend effect." A study of weekly variation of stroke showed that the onset of stroke was more frequent on weekdays than on weekends [22]. This phenomenon may be associated with changes in lifestyle between working days and the weekend, such as alcohol consumption, smoke, reveling until dawn, etc. Chinese people, especially middle-aged women, enjoy sitting down at the table and playing mah-jong for the whole night without moving much. Onset of stroke during the weekend is associated with longer median delay (11–16 h) rather than onset on a weekday (4–8.5 h) [23]. All these above-mentioned factors may contribute to the "weekend effect." The difference between these studies could be due to all the data collected from hospitals with stratification of service levels.

Conclusion

Our study found that patients with ICH who were admitted on weekends had the same risk of mortality and disability in our hospital, which is equipped with patient management guidelines and staffed by intensivists on call 24 h. The "weekend effect" was found in many diseases, especially diseases with short time to peak and for which invasive procedures are needed. This phenomenon alerts people to the need to improve medical service quality on the weekends.

Conflict of interest statement We declare that we have no conflict of interest.

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