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Weekends: A Dangerous Time for Having a Stroke?

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Background and Purpose—Weekend admissions are associated with higher in-hospital mortality. However, limited information is available concerning the “weekend effect” on stroke mortality. Our aim was to evaluate the impact of weekend admissions on stroke mortality in different settings.

Methods—We analyzed all hospital admissions for ischemic stroke from April 2003 to March 2004 through the Hospital Morbidity Database. The Hospital Morbidity Database is a national database that contains patient-level sociodemographic, diagnostic, procedural, and administrative information including all acute care facilities across Canada. The major inclusion criterion was admission to an acute care facility with a principal diagnosis of ischemic stroke. Clinical variables and facility characteristics were included in the analysis.

Results—Overall, 26 676 patients were admitted to 606 hospitals for ischemic stroke. Weekend admissions comprised 6629 (24.8%) of all admissions. Seven-day stroke mortality was 7.6%. Weekend admissions were associated with a higher stroke mortality than weekday admissions (8.5% vs 7.4%; odds ratio, 1.17; 95% CI, 1.06 to 1.29). Mortality was similarly affected among patients admitted to rural versus urban hospitals or when the most responsible physician was a general practitioner versus specialist. In the multivariable analysis, weekend admissions were associated with higher early mortality (odds ratio, 1.14; 95% CI, 1.02 to 1.26) after adjusting for age, sex, comorbidities, and medical complications.

Conclusions—Stroke patients admitted on weekends had a higher risk-adjusted mortality than did patients admitted on weekdays. Disparities in resources, expertise, and healthcare providers working during weekends may explain the observed differences in weekend mortality. (Stroke. 2007;38:1211-1215.)

Key Words: hospital volume ■ mortality ■ outcomes research ■ stroke

The incidence of stroke increases during weekends and some other stressful days.1–3 However, hospitals face shortages of staff and specialized services during those periods. Previous studies have shown increased mortality for different conditions or procedures such as cancer, aortic aneurysm, duodenal ulcer, epiglottitis, and pulmonary embolism, among others, during weekend admissions.4,5 This phenomenon was defined by some authors as the “weekend effect.”6 However, limited information is available regarding ischemic stroke. It is possible that stroke care is not homogeneous across the week, thus affecting the outcome.

We hypothesized that (1) stroke mortality increases for weekend admissions and (2) this weekend effect varies by facility type, location, and physician specialty. Our aim was to examine the effect of weekend admissions and their impact on in-hospital stroke mortality in a large population-based study across Canada. The identification of factors associated with in-hospital mortality for weekend admissions can contribute to implementation of quality improvement initiatives.

Subjects and Methods

We identified all stroke patients admitted to acute care hospitals between April 1, 2003, and March 31, 2004, through the Hospital Morbidity Database (HMDB) managed by the Canadian Institute for Health Information. HMDB is a national database that contains patient-level sociodemographic, diagnostic, procedural, and administrative information across Canada. Inclusion criteria included admission to an acute care facility due to ischemic stroke as identified through the patient’s principal diagnosis recorded according to the International Classification of Diseases, either the ninth (ICD-9) or 10th (ICD-10) revision (ICD-9 codes 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91 and ICD-10 codes I63, I64). Validation studies have also established a high accuracy rate for these codes.6,7 All provinces and territories except Manitoba and Quebec use ICD-10 codes. The first 7 days after admission are crucial for acute stroke management, preventing complications, identifying the stroke mechanism, and discharge planning.8,9 This was the rationale for using the 7-day case-fatality indicator to analyze the impact of weekend admissions. In addition, this indicator has the advantages of high case ascertainment and limited influence of length of stay when comparing different facilities. Patients with transient ischemic attack and hemorrhagic stroke were excluded owing to major prognostic differences. We also
excluded records containing an invalid health card number or missing discharge disposition.

Canada’s healthcare system includes universal government-funded insurance coverage. This study evaluated all stroke admissions from 606 hospitals across Canada, which represent a comprehensive range of facilities, including academic and community hospitals located in metropolitan and rural areas. Similar to other studies, weekend was defined as the period from midnight on Friday to midnight on Sunday. All other times were defined as weekdays.4

In this analysis, the influence of the following variables on early stroke outcome was assessed: age (categorized as <65, 65 to 74, 75 to 84, and ≥85 years old), sex, comorbid conditions, major medical complications, socioeconomic status, facility type by location (rural/urban), teaching status, most responsible physician (general practitioner/specialist), length of hospital stay, and discharge disposition (dead, home, residential/nursing home, or other transfer to another hospital). For patients transferred between hospitals, the day of admission was defined as the day they presented to the initial acute care facility.

We used the Charlson-Deyo index to quantify patients’ comorbidities.10 This index is a summary score based on the presence or absence of 17 medical conditions. A score of 0 means that no comorbid index is present, and higher scores indicate a greater burden of comorbidity. The Charlson-Deyo index was classified as having none, 1, 2, or >3 comorbidities.11,12 Socioeconomic status was estimated through an approach developed by Statistics Canada that assigns neighborhoods to 5 equally sized quintiles based on income data reported on the 2001 census.13 A higher quintile value of a residential area is associated with higher socioeconomic status of residents in that area. Teaching status was defined according to the Association of Canadian Academic HealthCare Organizations.14

Each hospital in the HMDB is assigned a unique, encrypted identifier. This identifier was used to determine the annual acute ischemic stroke volume for each hospital that contributed to the database. As expected in administrative-clinical databases, no specific data were available for estimating acute neurological status (National Institutes of Health Stroke Scale) or measures of functional disability such as the Barthel index and modified Rankin scale. We were able, however, to adjust for some other important clinical predictors, including age, sex, comorbid illnesses, and major medical complications in the multivariable analysis.

Statistical Analysis

Descriptive statistics were used to assess the effect of various patient and hospital characteristics on 7-day in-hospital mortality. Multivariable logistic-regression analysis was used to calculate odds ratios (ORs) and the corresponding 95% CIs. Multivariable regression analysis of in-hospital mortality was performed by entering all relevant patient and hospital variables into the model. The estimated weekend effect was adjusted for patient age, sex, Charlson-Deyo index, and complications.

The presence of potential interactions between age and sex, hospital type (teaching status, location), and intensive care unit (ICU) admission were tested by adding interaction terms to the regression model. Except for the interactions between ICU and teaching status and ICU and hospital location (rural/urban), the remaining ones were not statistically significant. A Kaplan-Meier estimated survival function of the time from hospital admission to hospital death was plotted to determine the weekend effect.

Statistical analysis was performed with a commercially available software package (SAS statistical software, version 9; SAS Institute Inc; and STATA version 8.2, Stata Corp LP). All tests were 2 tailed, and probability values <0.05 were considered significant.

Ethics

The design of the study was approved by the ethics review board at the University of Western Ontario, London, Canada. Because the identity of the patients was completely anonymous, no specific informed consent was required. The data pooling center was blinded to hospital identities.

Data Quality

According to a reabstraction study conducted after implementation of ICD-10 by the Canadian Institute for Health Information for quality assurance, diagnosis in the abstract coincides with diagnosis in the chart in 92% of stroke cases. The reliability of the coding of data collected for day of admission was 97% and for death was >99%. Nonmedical and sociodemographic data elements in this study had agreement rates ranging from 96% to 100%.15

Other Canadian studies on hospital coding of stroke and vascular risk factors according to ICD-9 and ICD-10 showed a high accuracy rate.16,17 On the whole, ICD-9 coding was excellent, with 90% (95%
Among 26,676 patients hospitalized for ischemic stroke at 606 centers across Canada, 6,609 (24.8%) were admitted during weekends. Patients admitted on weekends were older and more frequently male. There were no statistically significant differences in the remaining baseline characteristics, including major medical complications, between patients admitted on weekends versus weekdays in the univariable analysis (Table 1).

Overall, 7-day case fatality was 7.6% (2,039/26,676), whereas mortality at discharge was 15.6% (4,165/26,676). Early stroke mortality was higher among patients admitted on weekends (8.5%) compared with weekdays (7.4%) (OR 1.17; 95% CI, 1.06 to 1.29). Similar results were observed for mortality at discharge (16.4% versus 15.3%; OR 1.08; 95% CI, 1.004 to 1.17). Patients admitted on weekends were less likely to be discharged to the same place of residence (P < 0.001; OR 0.85; 95% CI, 0.80 to 0.90; Table 2).

The analysis of stroke mortality on weekends by facility characteristics is shown in Table 3. The weekend effect was larger in rural hospitals (OR 1.26; 95% CI, 1.02 to 1.54) compared with urban hospitals (OR 1.14; 95% CI, 1.02 to 1.28) and when the most responsible physician was a general practitioner (OR 1.17; 95% CI, 1.06 to 1.29). For weekend admissions, early stroke mortality was significant in non-teaching hospitals (OR 1.15, 95% CI, 1.03 to 1.29) and for ICU hospitalizations (OR 1.52; 95% CI, 1.23 to 1.88). Two interaction terms (ICU admission × non-teaching hospital, P < 0.001; and ICU admission × rural location, P < 0.001) were significant, suggesting higher mortality for patients requiring ICU admission in nonteaching and rural hospitals.

Multivariable analysis for 7-day case fatality showed that patients admitted on weekends had 13% higher odds of dying compared with patients admitted during weekdays (OR 1.14; 95% CI, 1.02 to 1.26) after adjusting for age, sex, Charlson-Deyo comorbidity index, and medical complications (pneumonia, respiratory tract infection, and pulmonary embolism; Table 4). Kaplan-Meier curves demonstrated a significantly lower 30-day survival function for patients admitted on weekends than for weekday admissions (log-rank = 0.0005; the Figure).

Our study shows that stroke patients admitted on weekends had an increased mortality rate and were less likely to be discharged to the same place of residence than those admitted on weekdays. After adjusting for age, sex, comorbidities, and major medical complications, weekend admissions increased the risk of death by 14%. The effect of weekend admissions may be greater in nonteaching hospitals and for patients requiring ICU admission. Although the weekend effect affected patients admitted to both rural and urban hospitals and those treated by general practitioners versus specialists, the effect may be larger in patients admitted to rural hospitals and when the most responsible physician is a general practitioner (Table 3). In agreement with prior studies that examined the weekend effect in other medical conditions,4,5,18–21 our study demonstrated a significant impact on several stroke outcomes, including visit disposition, 7-day case fatality, and mortality at discharge.

In a large study analyzing the weekend effect in the top 100 causes of hospital death, Bell and Redelmeier4 found that weekend admissions for any condition were associated with a 4% increase in mortality and that 23% of causes were
effect diminished when stroke mortality decreased. There-
grant advertisements. The investigators acted as sponsors of the study. Neither the HSFC nor the CIHR had input on the design, access to the data, analyses, interpretation, or publication of the study.

Disclosures
None.

References