Monday Preference in Onset of Ischemic Stroke

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The onset of stroke has a specific temporal pattern (1), characterized by a higher frequency in winter and in the mornings. According to a meta-analysis of more than 11,000 patients, an estimated 37% of strokes occurred during morning hours (2). Variability of the day of week has not been extensively investigated, however. To verify a temporal weekly pattern, we reviewed all cases of stroke admitted to our hospital during a 4-year period.

METHODS

Ferrara is a town in northeastern Italy with a population of 150,000. The only hospital is St. Anna Hospital, the teaching hospital for the University of Ferrara. House calls are made by family physicians during the daytime hours and by Emergency Department physicians during nighttime hours and on holidays at no charge to patients. Key physicians, including neurologists and neurosurgeons, are active 24 hours a day.

We ascertained the occurrence of stroke from January 1, 1994, to December 31, 1997. The diagnosis of stroke, which was always made by a neurologist, was defined according to World Health Organization criteria as rapidly developing clinical symptoms or signs of focal, and at times global, loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin. In all patients, diagnostic and laboratory investigations included computed tomography (CT), blood tests, 12-lead electrocardiography, chest radiography, carotid duplex imaging, transcranial doppler imaging, cerebral angiography, echocardiography (transthoracic or transesophageal), and assessment of prothrombotic syndromes were done.

We observed 1610 consecutive cases of stroke (987 [61%] men). The mean (± SD) age of patients was 70 ± 12 years. There were 1,395 (87%) ischemic strokes and 315 (13%) hemorrhagic strokes. Stroke onset was defined as the earliest time the patient or witness noted definite neurologic symptoms or signs; this information was obtained from patients, their relatives, or bystanders. Precise determination of the day of onset was possible in all cases.

We performed the main statistical analysis using a partial Fourier series, using a least-squares minimization fitting, and fitting a cosine function to the data by means of a regression method using a 168-hour period. Analyses were made using Chronolab software (3). This method selects the harmonic, or the combination of harmonics, that best explains the variance of the data. The percentage of overall variability of the data about the arithmetic mean that is attributable to the fitted rhythmic function estimates goodness of fit; and an F statistic is used to test the hypothesis of zero amplitude. Significance levels were set at $P < 0.05$.

A circaseptan rhythm, with a significant peak on Monday (Figure, Table), was observed for all strokes ($P = 0.012$) and for ischemic strokes ($P = 0.004$). Stratified analyses of selected subgroups (hypertension and diabetes) showed a Monday peak only for nondiabetic patients ($P = 0.04$). For ischemic strokes, the Monday peak was found only for retired patients ($P = 0.03$).

DISCUSSION

Monday seems to be a critical day for the occurrence of acute cardiovascular diseases. A Monday peak in the onset of cardiac arrest has been reported in a series of more than 6000 out-of-hospital cardiac arrests in Seattle (4) and in a cohort of more than 24,000 sudden deaths in Berlin (5). As there is no evidence of weekly variations for life-threatening ventricular arrhythmias (6), it is possible
that sudden deaths on Monday may be attributable mainly to coronary artery disease. Among Scottish men and women under 50 years of age, mortality from coronary artery disease was about 20% higher on Mondays than on other days of the week (7). Increased mortality from cardiovascular diseases has been observed in Lithuania throughout the weekend and on Monday (8), perhaps due to alcohol use. Two previous studies (9,10) reported about a 20% increase on Mondays in the occurrence of myocardial infarction.

Data from a Norwegian study (11) suggested that biochemical factors associated with cardiovascular risk—such as measures of hematosis and carbohydrate and lipid metabolism—were less favorable on Mondays compared with other days of the week. Thus, similar to the association between increased thrombophilia in the mornings (12,13) and the circadian pattern of other thrombotic disease such as myocardial infarction (14) and limb ischemia (15), the Monday risk of ischemic stroke may reflect an increased thrombogenic condition. On the other hand, in other cardiovascular diseases that have a well-defined circadian pattern (16–19), emotional stress and greater blood pressure may be important factors (20,21).

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REFERENCES


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