Stroke Incidence and Usage Rate of Thrombolysis in A Japanese Urban City: The Kurashiki Stroke Registry

Yasuyuki Iguchi, MD,* Kazumi Kimura, MD,* Keiichi Sone, MD,† Hiroshi Miura, MD,‡ Hiroshi Endo, MD,§ Sen Yamagata, MD,‖ Hisashi Koide, MD,¶ Kenji Suzuki, MD,# Tomoichiro Kimura, MD,** Masaru Sakurai, MD,†† Nobuya Mishima, MD,‡‡ Kenji Yoshii, MD,*** Hiroyuki Fujisawa, MD,††† and Sunao Ebisutani, MD,‡‡‡ for the Kurashiki Stroke Registry investigators

Background: To investigate stroke incidence and rate of thrombolytic therapy in an urban city of around 500,000 residents. *Methods:* Patients suffering acute stroke in Kurashiki City (population 474,415) between March 2009 and February 2010 (inclusive) and admitted to 1 of 10 hospitals throughout the city were prospectively enrolled. *Results:* We enrolled patients with first-ever stroke (n = 763; men 415; median age 72 years) and first-ever/recurrent stroke (n = 1009; men 552; median age 73 years). Among first-ever strokes, 68% were cerebral infarctions, 23% were intracerebral hemorrhages, and 8% were subarachnoid hemorrhages. Crude incidences for first-ever stroke per 100,000 residents were 159.8 (95% confidence interval [CI] 148.4-171.1) for all strokes, 108.8 (95% CI 99.4-118.1) for cerebral infarction, and 36.5 (95% CI 31.0-41.9) for intracerebral hemorrhage. After adjustment using the world population model, age-adjusted incidences were 60.7 (95% CI 45.4-75.9) for all strokes, 38.4 (95% CI 26.3-50.5) for cerebral infarction, and 16.1 (95% CI 8.3-24.0) for intracerebral hemorrhage. Among 698 cases with first-ever and recurrent cerebral infarction, thrombolysis was administered for 31 (5%). Of 197 cerebral infarction patients admitted within 3 hours of onset, the thrombolysis rate was 16%. *Conclusion:* In this urban Japanese city, the age-adjusted incidence of first-ever stroke between March 2009 and February 2010 was 60.7 per 100,000 residents, which was relatively low compared with findings for other countries. Thrombolysis was given to approximately 5% of patients with acute ischemic stroke. **Key Words:** Cerebral hemorrhage—cerebral infarct—epidemiology—stroke incidence—thrombolysis.

The socioeconomic burden caused by stroke in both Japan and high-income Western countries is likely to grow as the populations age.[1] With regard to stroke incidence in Japan, we have been able to refer to a couple of ideal studies,[2-4] with the most recent revealing a stroke incidence of approximately 120 per 100,000 adjusted by

From the *Department of Stroke Medicine, Kawasaki Medical School; †Kurashiki City Public Health Center; ‡Kurashiki City Medical Society; §Department of Internal Medicine, Kurashiki Rehabilitation Hospital; ‖Department of Neurosurgery, Kurashiki Central Hospital; ¶Department of Internal Medicine, Kurashiki Kinen Hospital; #Departments of Neurosurgery at Kurashiki Heisei Hospital; **Kojima Central Hospital; ††Tamashima Central Hospital; ‡‡Mizushima Central Hospital; ***Mizushima Kyodo Hospital; †††Fujisawa Neurosurgical Hospital; and ‡‡‡Ohji Neurosurgical Clinic, Kurashiki, Japan.

Received August 9, 2011; revision received September 14, 2011; accepted September 19, 2011.

Supported by Science Research Grants (2009) from the Kurashiki City Public Health Center, Japan.

Address correspondence to Yasuyuki Iguchi, MD, Department of Stroke Medicine, Kawasaki Medical School, 577 Matsushima, Kurashiki City, Okayama, 701-0192, Japan. E-mail: yigu@med.kawasaki-m.ac.jp.

1052-3057/$ - see front matter

doi:10.1016/j.jstrokecerebrovasdis.2011.09.015

the Japanese standard population model.[4] However, we are uncertain of equivalent data for stroke incidence adjusted by the world standard population model in comparison with findings for other districts. In addition, previous investigations have been conducted in rural districts with small populations (<100,000), and most patients had been diagnosed with stroke based on computed tomography (CT), not by magnetic resonance imaging (MRI).

Since the approval of intravenous (IV) recombinant tissue plasminogen activator (rt-PA) by the Japanese government in 2005, safety and efficacy of IV rt-PA from retrospective and observational surveillance in Japan have appeared similar to those reported by the National Institute of Neurological Disorders rt-PA Stroke Trial,[5,6] but no epidemiologic inspections of IV rt-PA use have been described, such as the usage rate of IV rt-PA per stroke patient in a Japanese urban city of 474,415 residents. In order to plan adequate health care for individuals suffering acute stroke in Japan, we established a prospective stroke register to determine approximate stroke incidence based on MRI and usage rate of IV rt-PA in Kurashiki City, a city in midwestern Japan able to provide a high level of specialized stroke care.

Methods

Kurashiki City, adjacent to Okayama City, is the second largest community (covering 354.7 km^2) in Okayama Prefecture in midwestern Japan. The population of the city has been stable for several years (2009 population 474,415; men 232,244) and has been shown to be representative of a medium-sized Japanese city.[7]

Study Protocol and Stroke Ascertainment

We used Kurashiki Stroke Registry investigators from the Kurashiki City Public Health Center, Kurashiki City Medical Society, 2 comprehensive stroke centers, and 8 primary stroke centers to collect the data. Acute stroke patients who were treated within 7 days of onset at one of these 10 stroke centers were prospectively registered between March 2009 and February 2010. Paramedics in the Kurashiki City emergency medical service transferred possible acute stroke patients to these 10 stroke centers. We had already established an excellent consultation system between stroke centers and outpatient clinics, and consequently acute stroke patients who went to an outpatient clinic, with or without a stroke specialist, were referred to one of these 10 stroke centers.

All data were recorded, including clinical background (gender, age, and cohabitation status), vascular risk factors (history of hypertension, diabetes mellitus, dyslipidemia, and smoking), alcohol consumption, atrial fibrillation, past history of illness (stroke and ischemic heart disease), interval from onset to stroke center, method of admittance (ambulance transference), diagnosis of cerebrovascular disease (cerebral infarction, intracerebral hemorrhage, and subarachnoid hemorrhage), use of IV rt-PA based on previously published criteria,[8] and in-hospital death. The diagnosis of stroke within 7 days of onset was determined on the basis of the neurologic examination. In principle, stroke was defined as a focal neurologic deficit persisting for >24 hours, classified into categories of cerebral infarction, intracerebral hemorrhage, subarachnoid hemorrhage, or other/unknown. Neuroimaging including MRI was performed for all stroke patients. If contraindicated, CT was used. Subjects who died within 24 hours of symptom onset and had evidence of stroke on neuroimaging were also included as stroke cases. After investigators recorded the data on check sheets, these sheets were sent to the central office of the Kurashiki Stroke Registry at the Kurashiki City Public Health Center. The protocol for this investigation was approved by the ethics committee of Kawasaki Medical School.

Statistical Analysis

We calculated the gender- and age-specific rates of first-ever stroke (all subtypes of stroke, cerebral infarction, and intracerebral hemorrhage) per 100,000 residents of Kurashiki City after categorizing all cases into 17 age groups; <10, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and ≥85 years. We also analyzed the first-ever stroke incidence using the age distribution of the Japanese population from the 2005 census (Japanese model population 127,767,000),[9] the European standard population model, and the Segi standard population model (Segi model) using the direct method.[10] Direct method is the adjustment of crude rate to eliminate the effect of differences in population age structures when comparing crude rates for different periods of time, different geographic areas, and/or different population subgroups, as follows:

$$\mathrm{SR} = (\mathrm{SUM}(\mathrm{r}i * \mathrm{P}i))/\mathrm{SUM}\ \mathrm{P}i$$

where SR is the age-adjusted rate for the population being studied, r*i* is the age group–specific rate for age group *i* in the population being studied, and P*i* is the population of age group *i* in the standard population.

The standard population used for purposes of international comparisons is generally the Segi model. Five-year age groups should normally be used (eg, <10, 10-14, 15-19…80-84, and 85). Because the age distribution was quite different between the Japanese population and the Segi standard model (eg, 15% of >70 years old in Japanese population *v* 4% in the Segi model), age-adjusted incidence by Segi model is extremely lower than crude incidence, especially in a disease occurring in elder residents. The 95% confidence interval (CI) was calculated for all incidence rates.

We compared age-adjusted incidences of all strokes,[1,4,11-24] cerebral infarctions,[1,4,16,24] and intracerebral