

Predictors of Functional Outcome among Stroke Patients in Lima, Peru

Carlos Abanto, MD,* Thanh G. N. Ton, PhD,† David L. Tirschwell, MD,†
Silvia Montano, MD,|| Yrma Quispe, MD,* Isidro Gonzales, MD,¶ Ana Valencia, MD,*
Pilar Calle, MD,* Arturo Garate, MD,* and Joseph Zunt, MD†‡§

Background: Because of the aging population in low- and middle-income countries, cerebrovascular disease is expected to remain a leading cause of death. Little has been published about stroke in Peru. We conducted a retrospective cohort study of hospitalized stroke patients at a referral center hospital in Lima, Peru to explore factors associated with functional outcome among stroke patients. **Methods:** We identified 579 patients hospitalized for ischemic stroke or intracerebral hemorrhage stroke at the National Institute of Neurologic Sciences in Lima, Peru in 2008 and 2009. A favorable outcome was defined as a modified Rankin scale score of ≤ 2 at discharge. **Results:** The mean age was 63.3 years; 75.6% had ischemic stroke; the average duration of stay was 17.3 days. At hospital discharge, 231 (39.9%) had a favorable outcome. The overall mortality rate was 5.2%. In multivariate models, the likelihood of having a favorable outcome decreased linearly with increasing age ($P = .02$) and increasing National Institutes of Health Stroke Scale (NIHSS) score ($P = .02$). Favorable outcome was also associated with male gender (relative risk [RR] 1.2; 95% confidence interval [CI] 1.0-1.5) and divorced status (RR 1.3; 95% CI 1.1-1.7). Patients on *Salud Integral de Salud* (SIS; public assistance-type insurance; RR 0.7; 95% CI 0.5-1.0) were also less likely to have a favorable outcome. **Conclusions:** Favorable outcome after stroke was independently associated with younger age, a lower NIHSS score, male gender, being divorced, and not being on SIS insurance. These findings suggest that additional study of worse functional outcomes in patients with SIS insurance be conducted and confirm the importance of risk adjustment for age, stroke severity (according to the NIHSS scale), and other socioeconomic factors in outcomes studies. Future studies should preferentially assess outcome at 30 days and 6 months to provide more reliable comparisons and allow

From the *Departments of Cerebrovascular Disease; ¶Communicable Diseases and Neuropediatrics, National Institute of Neurological Sciences, Lima, Peru; †Department of Neurology, Harborview Medical Center; ‡Departments of Global Health; §Medicine, University of Washington, Seattle, Washington; and ||U.S. Naval Medical Research Unit 6, Lima, Peru.

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Address correspondence to Thanh G. N. Ton, PhD, Department of Neurology, Box 359775, Harborview Medical Center, 325 9th Ave, Seattle, WA 98104. E-mail: thanhton@uw.edu.

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additional study of Peruvian end-of-life decision-making and care. **Key Words:** Functional outcome—modified Rankin scale—Peru—stroke.
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The World Health Organization estimates that noncommunicable diseases will comprise three-quarters of all deaths worldwide by 2030.¹ Because of the aging population in low- and middle-income countries, cerebrovascular disease is expected to remain a leading cause of death. A recent study of population-based stroke incidence studies found an alarming increase in stroke incidence over the past 4 decades in the developing world; while stroke incidence decreased by 42% in high-income countries, there was a 100% increase in incidence in low- and middle-income countries.²

Little has been published about stroke in Peru. One population-based study among 1933 residents 65 years of age and older living in Peru reported a prevalence of 6.8% of self-reported stroke in urban sites and 2.7% in rural sites.³ The same population-based study reported that stroke was the most common cause of death, accounting for 28.6% of deaths among residents in urban sites and 13.7% in rural sites.³ A community screening for stroke among residents living in Cuzco City—a Peruvian Andean town 3380 meters above sea level—reported a crude stroke prevalence of .647% among 3246 people 15 years of age and older, corresponding to 5.74 per 1000 adjusted to the World Health Organization population,⁴ which is within the range of estimates (1.74–6.51 per 1000) reported by other community-based studies in other South American countries.⁵

Although mortality rates related to stroke have declined steadily over the last 3 decades throughout the Americas, decreases have been less dramatic in Latin America, where mortality rates remain 2 to 4 times higher than in the United States or Canada.⁶ These differences may partially reflect decreased public awareness of stroke, limited health service capacity to offer acute interventions or affordable treatments,⁶ or underlying fundamental differences in the populations.

In a first step toward improving stroke outcomes in Peru, our objective in this study was to identify factors associated with good functional outcome. Such factors might identify targets for interventions and may serve as risk adjustment variables in future studies of comparative effectiveness.

Methods

We conducted a retrospective cohort study in which we identified patients hospitalized for the evaluation and treatment of ischemic stroke or intracerebral hemorrhage (ICH) at the National Institute of Neurological Sciences (ICN) in Lima, Peru—a national referral center for

patients with neurologic diseases. In Lima, patients may present with stroke at 14 other hospitals: 3 in the Social Security (public health for indigent patients) system, 8 in the network of Ministry of Health hospitals, and 3 in the military system. Approximately 60% of patients admitted to the ICN are referred from other hospitals. We included all patients who were admitted between January 1, 2008 and December 31, 2009. Those with evidence of stroke, such as sensory deficit, motor and speech impairment, or other signs of stroke, underwent brain imaging and were diagnosed with ischemic stroke or ICH.

The ICN is managed by the Ministry of Health (MOH; Fig 1) and serves patients from hospitals and clinics throughout Peru regardless of insurance status. The Department of Cerebrovascular Diseases within the ICN offers specialized care for any stroke patient and typically serves patients who are transferred from other hospitals. Transfer to the ICN is affected by distance and travel to Lima; patients traveling from the coast or Andean highlands travel between 2 to 16 hours, while those from the jungle require several days of travel. Air transfer, however, is not a practical means for most patients. Once admitted, patients with stroke are hospitalized according to level of care required: in the intensive care unit for severe patients, in the stroke unit for acute cases within 48 hours of stroke onset or patients with mild to moderate severity, or in the inpatient wards for stroke patients arriving after 48 hours with mild to moderate severity. We abstracted information from medical records including risk factors, sex, age, National Institutes of Health Stroke Scale (NIHSS) scores, duration of stay, hospital ward, and status and functional outcome at discharge. We also collected information on whether patients receive coverage from *Salud Integral de Salud* (SIS), a governmental program that provides health insurance to indigent people, similar to Medicaid in the United States. All research procedures were approved by the Humans Subjects Committee of the National Institute of Neurological Sciences in Lima, Peru.

We defined functional outcome based on the modified Rankin scale (mRS) score assessed at discharge and dichotomized between 2 and 3. A favorable outcome was defined as a mRS score of ≤ 2 , and an unfavorable outcome ≥ 3 . We examined frequencies and means (standard deviation [SD]) to characterize our patient population. For pairwise comparisons, we used the Pearson Chi-square and Fisher exact tests for categorical variables and the Student *t* test for continuous variables. Because the outcome was common, we used generalized linear models with a log link, robust standard errors, and

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