

# Ischemic Strokes in Pakistan: Observations from the National Acute Ischemic Stroke Database

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*Background:* The objective of this study was to establish a multicenter ischemic stroke registry, first of its kind in Pakistan, to provide insight into the epidemiology, subtypes, and risk factors of ischemic strokes in this country. *Methods:* Four academic centers (3 urban and 1 rural) participated in this project. The inclusion criteria for subjects included adults (>14 years) with acute neurologic deficit, consistent with clinical diagnosis of ischemic stroke and supported by neuroimaging. *Results:* Data were available for 874 subjects. Mean age of the subjects was 59.7 years, 60.5% were males, and 18% were young. Large vessel strokes were the most common subtype found in 31.7% subjects, followed by small vessel disease (25.7%) and cardioembolic strokes (10.4%). Almost 32% subjects had ill-defined etiology for their ischemic stroke. Dyslipidemia was a most common risk factor present in 83% patients. Data related to in-hospital complications were available for 808 subjects, of which 233 complications were recorded. Pneumonia was the most common of these seen in 105 (13%) subjects, followed by urinary tract infection (7.2%). Outcome at discharge was recorded for 697 subjects. Ninety-two had died during their hospital stay (13.2%). Only 36% subjects had a favorable outcome at discharge defined as a modified Rankin Scale (mRS) score of 2 or less. A total of 446 of 697 subjects had poor outcome at discharge (defined as an mRS score  $\geq 3$ ). *Conclusions:* Hypertension and dyslipidemia were the most common risk factors and large vessel atherosclerosis was the most common stroke etiology. Elderly patients were significantly more likely to have in-hospital complications, die during their hospital stay, and have a higher mRS score at discharge. **Key Words:** Stroke—Pakistan—ischemic—south Asia—outcome.

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## Introduction

Stroke is the leading cause of disability and the second leading cause of mortality in the world today.<sup>1,2</sup> Substantial variation exists in the distribution of global burden of stroke. In the years to come, the incidence of this devastating condition is expected to decrease in high-income countries, whereas it is expected to double in low- and middle-income countries.<sup>3</sup> Pakistan is no exception to this.

The true burden of stroke is unknown in our part of the world. A recent community-based study conducted in a periurban settlement of Karachi demonstrates the abundance of vascular risk factors in this region<sup>4</sup> with

alarming high rates of tobacco use, abdominal obesity, hypertension, and diabetes. Judging by the prevalence of risk factors, one can expect the burden of cardiovascular diseases, including stroke to be high.<sup>5</sup> Ischemic stroke is the predominant stroke subtype, and although its incidence has decreased in high-income countries because of better preventive strategies, it is increasing in less developed countries primarily because of increased longevity, changes in lifestyle factors, and inadequate preventive strategies.<sup>6</sup>

To capture all new strokes occurring in the country, there is a need to set up a proper stroke surveillance system. World Health Organization suggests a 3-step approach to stroke surveillance in a well-defined community.<sup>7</sup> The first and most important step in this is a hospital-based stroke registry. Because of a lack of proper health infrastructure, such registries are virtually nonexistent in this country. The published work on stroke epidemiology is also limited to single center series, reviews, and editorials,<sup>8,9</sup> which does not give an adequate idea of the overall picture the condition presents with. Therefore, our group set out to establish the first-ever multicenter ischemic stroke registry to have a more representative group of patients for understanding stroke in this country. No previous studies have enrolled patients from rural areas.

In view of the paucity of good quality data on ischemic strokes from Pakistan, the objective of this study was to establish a multicenter ischemic stroke registry, first of its kind in Pakistan, to provide insight into the epidemiology, subtypes, and risk factors of ischemic strokes in this country.

## Methods

This National Acute Ischemic Stroke Databank was established as a first multicenter effort in Pakistan to come up with a reliable stroke database. Four academic centers from 2 large cities (2 from Karachi and 1 from Islamabad) and 1 from rural area (Larkana) participated in this project. All 4 hospitals have well-established acute neurology services with trained neurologists and imaging facilities.

The inclusion criteria for subjects included adults (>14 years) with acute neurologic deficit, consistent with clinical diagnosis of ischemic stroke and supported by neuroimaging (computerized tomography [CT] or magnetic resonance imaging [MRI]). Those with intracranial hemorrhage or other causes of neurologic deficit were excluded from this study. All subjects who presented to the study centers with acute stroke between January 1, 2007 and December 31, 2007 were evaluated by trained neurologists to confirm the diagnosis. For those willing to participate, a written informed consent was taken either from the subject or their surrogate. Thereafter, a structured questionnaire was filled out by data collecting officers who recorded information on demographics, stroke severity (measured using National Institutes of

**Table 1.** Known risk factors (*n* = 874)

Hypertension	444 (50.8)
Diabetes	227 (26)
Dyslipidemia	204 (23.3)
Ischemic heart disease	135 (16.7)
Atrial fibrillation	17 (2.1)
Smoker	154/717 (17.6)
Pack years	28.07 (14.57) (Range 1-60)
Previous stroke	161 (18.4)
Family history of stroke	68/833 (7.8)

Health Stroke Scale [NIHSS]<sup>10</sup> and modified Rankin Scale [mRS]<sup>11</sup>), vascular risk factors, stroke workup, and stroke subtype (using TOAST [Trial of org10172 in acute stroke treatment] criteria<sup>12</sup>).

For risk factors, the following definitions were used. A diagnosis of hypertension was made if the patient's blood pressure surpassed 140 (systolic) and/or 90 (diastolic) (millimeters of mercury) on repeated measurements during hospitalization or physical evaluation, or if the patient was being treated with antihypertensive drugs at the time of admission. A diagnosis of diabetes mellitus was based on self-report, fasting serum glucose level of 120 mg/dL or more, or if the patient was being treated with insulin or hypoglycemic drugs. Dyslipidemia was defined as a fasting serum total cholesterol of 200 mg/dL or more, a serum low-density lipid of 100 mg/dL or more, and/or a serum high-density lipid of 40 mg/dL or less. History of cigarette smoking was positive if the patient had smoked 10 or more cigarettes daily for more than 10 years. Atrial fibrillation was evaluated on an electrocardiogram (ECG), carotid stenosis on Carotid Doppler ultrasound, and left ventricular (LV) dysfunction on an echocardiogram. Severe LV dysfunction was defined as an ejection fraction of 30% or less.

All data were coded to maintain confidentiality and centralized at the Aga Khan University Hospital. Ischemic strokes were classified according to the TOAST criteria into the following 5 categories: large artery atherosclerosis (LAA), small vessel occlusion, cardioembolism, other determined cause, and undetermined cause. One study neurologist at the center assigned each stroke to 1 of these categories based on risk factor profiles, clinical

**Table 2.** Dyslipidemia among stroke patients

HDL <40 (419)	233 (55.6)
HDL <35 (419)	151 (36.0)
LDL >100 (458)	284 (32.5)
Total cholesterol >200 (450)	122 (14)
Dyslipidemia (cholesterol >200, or LDL >100, or HDL <40) (443)	368 (83.1)

Abbreviations: HDL, high-density lipid; LDL, low-density lipid. Total number of subjects tested are in parenthesis.

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