A Prescription at Discharge Improves Long-term Adherence for Secondary Stroke Prevention

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Background: Medication adherence is important for optimal secondary stroke prevention. We evaluated short-term adherence to antihypertensive and lipid-lowering agents after a new ischemic stroke, as predictor of adherence at 1 and 2 years. *Methods:* A 5-year cohort of patients from 11 institutions in the Registry of the Canadian Stroke Network was linked to population-based administrative health records. Patients diagnosed with acute ischemic stroke and discharged home were included. Medication adherence was assessed through documented prescription filling at 7 days, 1 year, and 2 years. *Results:* From 2003 to 2008, 6437 ischemic stroke patients were discharged home from hospital, and 1126 patients filled a prescription for antihypertensive and lipid-lowering agents within 7 days of discharge. Patients provided with a prescription at discharge were more likely to show adherence at 7 days. Adherence at 1 year remains higher in these patients for antihypertensive (93.8% vs. 87.7%; odds ratio [OR], 2.31; 95% confidence interval [CI], 1.69-3.16), lipid-lowering agents (88% vs. 81.6%; OR, 1.77; 95% CI, 1.36-2.32), or both (85.8% vs. 79.9%; OR, 1.72; 95% CI, 1.32-2.25). Findings are similar at 2 years for antihypertensive (92.2% vs. 87.7%; OR, 1.78; 95% CI, 1.3-2.43), lipid-lowering agents (82.6% vs. 79.0%; OR, 1.31; 95% CI, 1.01-1.69), or both (81.1% vs. 77.0%; OR, 1.4; 95% CI, 1.09-1.82). *Conclusions:* Provision of a prescription strengthens adherence at 1 week from discharge for both prior and new users of antihypertensive and lipid-lowering drugs. Medication adherence at 1 week after discharge for acute ischemic stroke predicts adherence for secondary preventive therapies at 1 and 2 years. **Key Words:** Ischemic stroke—stroke prevention—medication—outcomes.

Ischemic stroke accounts for over 970,000 annual hospitalizations in the United States.[1] The projected annual cost of stroke is 85 billion dollars by 2020.[1] Recurrence risk is highest within 3 months after an ischemic stroke: 17% for transient ischemic attacks and 18% for 'minor' ischemic strokes.[2] Implementing adequate secondary prevention is crucial for reducing the incidence or recurrence of cerebrovascular events.[1,3]

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Hypertension and dyslipidemia are important modifiable cerebrovascular risk factors.[1,4] Treatment targets are well established, and previous studies support early initiation and adherence in achieving desired effects.[2,5-9] Angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB) are effective in blood pressure reduction and prevention of recurrent ischemic strokes.[10-12] Early initiation of statins is an important intervention via low-density lipoprotein cholesterol reduction and the associated 17% reduction in stroke risk per decrease in 1 mmol/L of low-density lipoprotein cholesterol.[13,14] Optimal secondary stroke prevention therapy provides an 80% reduction in the risk of recurrent cardiovascular events.[15] However, many patients do not receive the expected benefit of therapy because of suboptimal adherence.[5,6]

Identifying determinants of adherence is thus important to optimize secondary prevention.[6] Different strategies used in ambulatory care suggest better adherence within a structured program and in-hospital initiation of therapy.[5-8,16] However, long-term adherence has not been correlated with short-term adherence after discharge. We investigated the association between adherence at 7 days, 1 year, and 2 years for ischemic stroke patients discharged home.

Methods

Study Design

We conducted a retrospective cohort study among patients with acute ischemic stroke admitted to any of the 11 stroke centers participating in the Registry of the Canadian Stroke Network (RCSN). Patients 66 years of age and older discharged home from hospital for a primary diagnosis of ischemic stroke, between July 1, 2003, and June 30, 2008, were eligible for inclusion. Diagnosis of ischemic stroke for inclusion in the RCSN database was based on clinical assessment supported by neuroimaging, either by computed tomography (CT) or magnetic resonance imaging (MRI). We excluded patients younger than 65 (not eligible for universal provincial drug coverage, n = 2803); having had a stroke after hospital admission for a procedure or pre-existing illness, as an active alternate illness may confound use of a secondary prevention agent, (n = 527); and patients deceased or discharged to palliative care or an assisted living setting (n = 1596).

Data Sources

We linked 6 databases to obtain relevant information for the present study (Fig 1). Under the Ontario Health Insurance Plan, in Ontario, Canada, access to medical care includes full coverage for physician fees, charges associated with emergency department (ED) and clinic visits and hospital admissions, prescription drug coverage for individuals more than 65 years of age, and direct public transport between home and hospital for patients with limited mobility.

Since 2001, the Ontario Stroke System also established 24 Stroke Prevention Clinics, fully funded by the Ontario Ministry of Health and Long-Term Care to ensure early diagnosis, assessment, and management of nondisabling stroke patients.[17] This health care system model allows for a province-wide, comprehensive assessment of stroke patients after discharge.

Through linkage of encrypted unique identifiers in several provincial health care administrative databases (Fig 1), we obtained all information necessary for this study. The index stroke was identified from the RCSN, which also provides a record of the patients' preadmission medications collected at the time of admission. Details regarding the RCSN can be accessed at https://osr.ices.on.ca.[18] It is a clinical database initiated in 2001 with the goal of measuring and monitoring delivery of stroke care, containing records on over 40,000 stroke and transient ischemic attacks patients. Trained neurology nurses collect detailed data for the RCSN through chart abstraction and using custom software, both during and after hospital admission for the index event. Stroke severity was scored on admission using the Canadian Neurological Scale (CNS), which assesses comprehension, level of consciousness, speech and motor function of the face, arm, and leg. It is a simple and validated scale where lower scores indicate greater stroke severity, with good to excellent inter-rater agreement.[19] In this study, stroke severity was categorized a priori as mild (CNS $\geq$ 8), moderate (5-7), or severe stroke (1-4); a score of 0 was assigned to comatose patients.

Hospital readmissions and ED visits were identified through the Canadian Institute for Health Information and the National Ambulatory Care Reporting System, respectively. The most responsible diagnosis and secondary diagnoses of all hospitalizations are recorded in the Canadian Institute for Health Information's discharge abstract database, using the International Classification of Diseases codes, version 9. Similar data pertaining to ED visits are available through the National Ambulatory Care Reporting System. Demographic data, including date of birth, gender, and date of decease, are provided by the Registered Persons Database. Both in-patient and ambulatory physician services received are identified through the Ontario Health Insurance Plan's billing database. Information on filling of outpatient prescription under the provincial drug plan was obtained through the Ontario Drug Benefit database (ODB). Although the RCSN collects information on medications at discharge, filling of the prescription provided is ascertained through the ODB database. Each prescription supplies medications for up to 3 months, requiring a refill at this maximal interval.