Examining Vertebrobasilar Artery Stroke in Two Canadian Provinces

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Study Design. Ecological study.

Objectives. To determine the annual incidence of hospitalized vertebrobasilar artery (VBA) stroke and chiropractic utilization in Saskatchewan and Ontario between 1993 and 2004. To determine whether at an ecological level, the incidence of VBA stroke parallels the incidence of chiropractic utilization.

Summary of Background Data. Little is known about the incidence and time trends of VBA stroke diagnoses in the population. Chiropractic manipulation to the neck is believed to be a risk factor for VBA stroke. No study has yet found an association between chiropractic utilization and VBA diagnoses at the population level.

Methods. All hospitalizations with discharge diagnoses of VBA stroke were extracted from administrative databases for Saskatchewan and Ontario. We included incident cases that were diagnosed between January 1993 and December 2004 for Saskatchewan and from April 1993 to March 2002 for Ontario. VBA cases that had previously been hospitalized for any stroke or transient ischemic attack (TIA) were excluded. Chiropractic utilization was measured using billing data from Saskatchewan Health and Ontario Health Insurance Plan. Denominators were derived from Statistics Canada’s annual population estimates.

Results. The incidence rate of VBA stroke was 0.855 per 100,000 person-years for Saskatchewan and 0.750 per 100,000 person-years for Ontario. The annual incidence rate spiked dramatically with a 360% increase for Saskatchewan in 2000. There was a 38% increase for the 2000 incidence rate in Ontario. The rate of chiropractic utilization did not increase significantly during the study period.

Conclusion. In Saskatchewan, we observed a dramatic increase in the incidence rate in 2000 and there was a corresponding relatively small increase in chiropractic utilization. In Ontario, there was a small increase in the incidence rate; however, chiropractic utilization decreased. At the ecological level, the increase in VBA stroke does not seem to be associated with an increase in the rate of chiropractic utilization.

Key words: incidence, vertebrobasilar artery stroke, population-based study, bias, chiropractic utilization.

There are few published reports of the incidence rate of vertebrobasilar artery (VBA) dissection and stroke in the general population. One quality study suggests that it is very rare. In Olmsted County and Rochester, MN, Lee et al., reported that the age- and sex-adjusted incidence rate of VBA dissection-related stroke was 0.97 per 100,000 person-years in Olmsted and 1.12 per 100,000 person-years in Rochester for the period 1987 to 2003.

Understanding the incidence of VBA stroke is important for several reasons. First, it is a potentially life-threatening condition. Second, it may result in significant morbidity. Finally, VBA stroke is viewed as a serious potentially adverse event of manual therapy to the cervical spine. For example, 2 deaths in Canada from VBA dissection and stroke after chiropractic care in the 1990s attracted much media attention; and a call by some neurologists to avoid neck manipulation for acute neck pain. The first case occurred in Ontario in 1996 and the second one in Saskatchewan in 1998. The inquest for the death in Saskatchewan occurred in 1998. In Ontario, there were calls for an inquest occurring in 1996 and 2000, which were both denied. The Ontario inquest occurred in 2002.

Our first objective was to describe the incidence rate of VBA stroke (cumulative, age-specific, and sex-specific incidence rate) in the Canadian provinces of Ontario and Saskatchewan between April 1, 1993 and March 31, 2002. Our second objective was to determine from an ecological perspective whether the annual incidence of VBA paralleled the rate of annual chiropractic utilization in Saskatchewan from January 1, 1993 to December 31, 2004 and in Ontario from April 1, 1993 to March 31, 2002.
Materials and Methods

Study Design
We conducted a population-based ecological study of individuals living in Ontario or Saskatchewan and who were registered with their respective provincial health insurance plan.

Study Population
Canada has a universal health care system whereby all necessary physician and hospital services are provided to the individual with no deductible or copayment. However, the type and amount of allied health care services covered within the universal health care system differs by province. In Saskatchewan, chiropractors were paid a negotiated fee per service by Saskatchewan Health and individuals seeking care from chiropractors pay a copayment, unless they are eligible for low-income-related supplementary benefits, in which case there is no cost at point of service for chiropractic treatment. There are no limits on the number of allowed services. In Ontario, there was a limit on the annual number of billable chiropractic services and a copayment was allowed. Since December 1, 2004, chiropractic services are no longer covered by the Ontario universal health care system.

Between 1993 and 2004, the population of Saskatchewan was stable at approximately 1,000,000 residents. In 2000, the median age of the population was 35.9 years and 50.3% were women. During the same period, the population of Ontario grew from approximately 10 to 12 million residents. In 2000, the median age of the Ontario population was 36.5 years and 50.6% were women.

All hospitals in Ontario submit data to the discharge abstract database (DAD) which is maintained by the Canadian Institute of Health Information. All hospital discharges for acute inpatient, chronic inpatient, and rehabilitation admissions as well as same day surgeries are captured in DAD. The historical database holds records from the 1981/82 fiscal year to the present. The DAD was used for Ontario case ascertainment.

Saskatchewan case ascertainment was based on Saskatchewan Health’s hospital separation files, which date back to 1970. The files include all hospitalization for Saskatchewan Health’s hospital separation files, which date back to 1970. The files include all hospitalization for Saskatchewan Health beneficiaries in Saskatchewan, out-of-province, and out-of-country hospitals.

Ascertainment of VBA Cases
To be eligible, individuals must have had 2 years of health care coverage in the province of Ontario or in the province of Saskatchewan before the incident stroke.

Ontario
All individuals admitted to an acute care hospital with a discharge diagnosis of an incident vertebrobasilar occlusion or vertebrobasilar stenosis stroke [International Classification of Diseases, Ninth edition (ICD-9CM) 433.0 and 433.2] between April 1, 1993 and March 31, 2002 were included as cases. Individuals who had any type of stroke (ICD-9 433.0, 433.2, 434, 436, 433.1, 433.3, 433.8, 433.9, 430, 431, 432, and 437.1; ICD-10 165.0xx, 165.1xx, G46.0-G46.2xx, I63.xxx, I66.xxx, G46.4-G46.7xx, I64.xx, I65.2xx, I65.3xx, I65.8xx, I65.9xx, I60.xxx, I61.xxx, and I62.xxx), transient cerebral ischemia (ICD-9 435; ICD-10 G45.xxx) or late effects of cerebrovascular diseases (ICD-9 438; ICD-10 I69.xx) were excluded.

Saskatchewan
All Saskatchewan Health beneficiaries admitted to hospital with a discharge diagnosis of an incident vertebrobasilar occlusion or vertebrobasilar stenosis stroke (ICD-9 433.0 and 433.2) during January 1, 1993 to December 31, 2004 were included as cases. From January 1, 1976 to March 31, 2002, the ICD-9 codes were used to code the diagnoses after which ICD-10CA codes were used. Under the ICD-10CA classification, VBA was defined as I65.0xx and I65.1xx where “x” represents all subcategories associated with that specific code. Individuals who had a previous hospital admission from January 1, 1970 to December 30, 2004 for any type of stroke (ICD-9 433.0, 433.2, 434, 436, 433.1, 433.3, 433.8, 433.9, 430, 431, 432, and 437.1; ICD-10 165.0xx, 165.1xx, G46.0-G46.2xx, I63.xxx, I66.xxx, G46.4-G46.7xx, I64.xx, I65.2xx, I65.3xx, I65.8xx, I65.9xx, I60.xxx, I61.xxx, and I62.xxx), transient cerebral ischemia (ICD-9 435; ICD-10 G45.xxx) or late effects of cerebrovascular diseases (ICD-9 438; ICD-10 I69.xx) were excluded.

Chiropractic Utilization Rates
Two different chiropractic utilization rates were calculated for each province. The first rate was based on the number of patients who had an encounter with at least one chiropractor during the fiscal year. If an individual saw more than one chiropractor during the fiscal year, the individual was only counted once. The second rate was based on the total number of services provided by chiropractors during the fiscal year. We assumed that the type of services and in particular, the proportion of cervical manipulations conducted by a chiropractor for any given year would remain constant over time. The number of chiropractors practicing in a given year was based on the number of chiropractors registered with the provincial Ministry of Health and Long-Term Care provided to the Ontario Chiropractic Association was used to determine chiropractic utilization rates. The annual number of patients per 100,000 population per chiropractor and the annual number of services per 10,000 population per chiropractor was calculated for Ontario. Radiograph services provided by chiropractors were excluded in Ontario. In Ontario, chiropractors cannot order radiographs from medical clinics reimbursed by the provincial health care system. Instead, chiropractors use their own radiograph machine, refer patients to chiropractic radiology clinics, or recommend that patients consult with their family physician for a radiograph.

Using data provided to the Chiropractic Association of Saskatchewan by the Medical Services Branch of Saskatchewan Health, we calculated the annual number of services per 1000 population per chiropractor (provided to the authors by the Chiropractic Association of Saskatchewan 2007). The services included services received outside of the province; however, these services were usually provided to Saskatchewan residents who live in one of the border towns of Saskatchewan such as Flin Flon, Manitoba and Lloydminster, Alberta. Three percent to 4% of chiropractic services were provided to Saskatchewan residents outside the province. In Saskatchewan, chiropractors are allowed to request radiographs from medical clinics. These radiograph services were not included in the calculation for the total number of services. We did include radiograph services which occurred in the chiropractor offices using privately owned machines. Less than 1% of all chiropractic services provided to Saskatchewan residents can be attributable to radiographs provided in chiropractor