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Nationwide Incidence of Clinically Diagnosed Central Retinal Artery Occlusion in Korea, 2008 to 2011

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Purpose: To define the incidence and demographics of clinically diagnosed central retinal artery occlusion (CRAO) in Korea.

Design: Nationwide population-based retrospective study using data entered into the Korean national health claims database from 2007 to 2011.

Participants: Data of the entire Korean population (N = 47 990 761, based on the 2010 census) were analyzed.

Methods: We used the national health claims database to identify patients diagnosed with CRAO. Incident cases were those with no claims related to CRAO in 2007 and were included once on the earliest claims related to CRAO in the years 2008 to 2011. Incident cases had a disease-free period before diagnosis of at least 1 to 4 years. The average incidence rate of CRAO was estimated according to the entire Korean population.

Main Outcome Measures: The person-time incidence rates of clinically diagnosed CRAO in Korea, including the age- and sex-specific incidence rates, were estimated.

Results: A total of 3464 CRAO cases (59.1% men) were identified. The incidence rate of clinically diagnosed CRAO during the study period was 1.80 per 100 000 person-years (95% confidence interval [CI], 1.74–1.86). The incidence rate among men and women was 2.15 (95% CI, 2.05–2.24) and 1.47 (95% CI, 1.39–1.54) per 100 000 person-years (male-to-female ratio, 1.47), respectively. The age-specific male-to-female ratios were constant between the ages of 30 and 89 years (range, 1.51–2.10 years). The highest incidence of 10.08 (95% CI, 8.80–11.35) per 100 000 person-years was observed in those aged 80 to 84 years (14.65 [95% CI, 11.90–17.40] and 8.00 [95% CI, 6.63–9.37] per 100 000 person-years for men and women aged 80–84 years, respectively). The incidence rate of CRAO increased exponentially with age until the 9th decade of life.

Conclusions: To our knowledge, this is the first nationwide epidemiologic study of CRAO in individuals of all ages. The incidence rate of CRAO in Korea increased exponentially with increasing age and was highest among those aged 80 to 84 years. Moreover, the incidence rate in men was 1.47 times higher than that in women. *Ophthalmology 2014;■:1–6 © 2014 by the American Academy of Ophthalmology.*

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Central retinal artery occlusion (CRAO) is a retinal vascular occlusive disease resulting in acute, painless visual loss.[1,2] Although numerous studies regarding CRAO have been conducted, only 2 hospital-based studies in regional areas of the United States[2] and Croatia[3] have reported the incidence of CRAO. Large population-based studies have reported the epidemiology of retinal emboli, the most common cause of CRAO, but have neglected to report the epidemiologic characteristics of CRAO itself,[4–6] probably because CRAO is rare.

Despite lacking information about the epidemiology of CRAO, recent studies did suggest that CRAO might be associated with cardiovascular disease (CVD), particularly stroke.[7,8] Central retinal artery occlusion is more common in older adults and, with aging populations in the majority of industrialized countries, may increase healthcare-related burden and expense. However, epidemiologic data, particularly relating to age- and sex-specific characteristics, from large-scale national studies are lacking, presenting challenges in estimating and understanding the potential burden of CRAO.

The National Health Insurance (NHI) system in South Korea, a medical claims database that reliably captures data for the entire Korean population, provides an ideal opportunity to study nationwide CRAO incidence rates. From these data, we previously studied the nationwide incidence of retinal vein occlusion (RVO) in Korea.[9] The aims of the current study were to estimate the nationwide incidence rate of clinically diagnosed CRAO using the 2007–2011 national health claims database and to compare the results with the RVO data to provide insight into the pathophysiology of retinal vascular diseases.

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Methods

We used health claims data recorded during 2007−2011 in the Health Insurance Review and Assessment (HIRA) service of Korea, and this is the same data set from which we have reported previously.[9] The institutional review board of the Seoul National Bundang Hospital approved the study, which was conducted in accordance with the Declaration of Helsinki.

In Korea, 97% of the population is covered by the Korean NHI scheme, which is a compulsory health insurance. Patients insured by the NHI pay approximately 30% of their total medical expenses, and all health care providers are required to submit claims for the remaining 70% of the expenses related to inpatient and outpatient care. These claims, reviewed by the HIRA, include data regarding diagnoses, procedures, prescription records, demographic information, and direct medical costs. The HIRA also reviews claims from the Medical Assistance Program and the Medical Care for Patriots and Veterans Affairs Scheme, which cover the medical expenses of the Korean population not insured by the NHI. Therefore, the HIRA database covers the entire Korean population and contains all medical claims made in Korea.[9,10] Patients in the HIRA are identified by their Korean Resident Registration Number, a unique identification number assigned to each Korean resident at birth, which ensures no duplications or omissions when accessing the data.

Furthermore, because Korean health care providers charge only ≤30% of the total medical costs of CRAO-related medical care, Koreans rarely seek CRAO-related medical attention in other countries, because this would involve high costs and may be inconvenient.

We identified CRAO cases registered during 2007−2011 according to the first CRAO diagnostic code (H34.1) in the Korean Classification of Disease, 6th edition, a version of the International Classification of Diseases, 10th edition, adapted for the Korean health care system. The date of the earliest claim related to the CRAO diagnostic code was defined as the index date and considered the incident time, and the patient was considered an incident case in that year. The CRAO cases diagnosed before 2007 could not be excluded because we were not allowed to access the HIRA database for the prior years. Therefore, to remove any potential preexisting cases of CRAO, we excluded cases that had a CRAO diagnostic code during the first year of the study period (2007).[9,11,12] All remaining cases had a disease-free period of at least 1 to 4 years before the index date and were considered new incident cases of CRAO. Then, among these incident cases of CRAO, we ascertained the diagnostic code of giant cell arteritis (M31.6) in their claims with CRAO on their index date or later. The ascertained case(s) would be regarded as an arteritic type of CRAO.

The Population and Housing Census was conducted in 2005 and again in 2010 and is scheduled for 2015. The 2010 census (available at http://kosis.kr, accessed September 23, 2013) was used to define the entire population of Korea (N = 47 990 761) as the population at risk. The number of health insurance beneficiaries in 2010 was 50 581 191; however, according to the official government estimate (available at http://index.go.kr, accessed September 17, 2013), there were 2.8 million Korean residents living overseas in 2011. Therefore, the Population and Housing Census data, instead of the beneficiaries of health insurance, were used.

The person-time incidence rates for 2008−2011 were calculated as the number of people who developed CRAO divided by the total person-time at risk during the study period. Therefore, in this analysis, person-years were counted after the incident time. The CRAO incidences in those aged ≥40 and ≥50 years were also estimated during the study period. The age-standardized incidence rate of CRAO was calculated according to the standard populations of the World Health Organization (WHO) and the Organization for Economic Co-operation and Development (OECD).

In addition, the annual CRAO incidence rates in each of the 4 years were calculated as persons who developed CRAO divided by the total population, based on the 2010 census. Last, we estimated the incidence of CRAO cases using follow-up CRAO claims (claims submitted after the index date) during the study period. We assigned patients with CRAO with follow-up claims into 3 groups based on the time period between their index date and the first follow-up claim (within 3, 6, or 9 months for groups A, B, and C, respectively). Analyses of CRAO incidences for these subgroups may verify the characteristics of the entire group of incident CRAO cases. The age- and sex-specific CRAO incidence rates were estimated in all analyses. A 95% confidence interval (CI) of the incidence rate was estimated on the basis of the Poisson distribution. The male-to-female ratio for the CRAO incidence rate also was calculated. Chi-square analysis was used to compare the observed incidence rates between the sexes. The association between the CRAO incidences and the age groups was analyzed using sex-adjusted logistic regression analysis. A multiple linear regression analysis was performed to evaluate the ability of age group and sex to predict the log-transformed CRAO incidence in individuals aged 0 to 79 years. We used SAS version 9.3 (SAS Inc, Cary, NC) for all analyses. Statistical significance was set at $P < 0.05$.

Results

In total, 3464 clinically diagnosed CRAO cases (59.1% men) were identified during the 4-year study period (2008−2011). The number of CRAO cases in 2008, 2009, 2010, and 2011 was 930 (26.8%), 831 (24.0%), 824 (23.8%), and 879 (25.4%), respectively. The mean age at the index date was 62.3 years (range, 0−96 years) in the total population, 61.5 years (range, 0−93 years) in men, and 63.5 years (range, 0−96 years) in women. The diagnostic code for giant cell arteritis was not identified on any patient's CRAO-related claims on their index date or later.

The CRAO incidence rate during the 4-year study period was 1.80 per 100 000 person-years (95% CI, 1.74−1.86) in the total population, 2.15 (95% CI, 2.05−2.24) per 100 000 person-years in men, and 1.47 (95% CI, 1.39−1.54) per 100 000 person-years in women. The incidence of CRAO in men was 1.47 times higher than that in women ($P < 0.001$) (Table 1). Men had a higher CRAO incidence than women in the majority of the age groups, and the male-to-female ratio ranged from 1.51 to 2.10 between the ages of 30 and 89 years (Figs 1 and 2).

Individuals aged 80 to 84 years had the highest CRAO incidence in the total population at 10.08 per 100 000 person-years (95% CI, 8.80−11.35), with the incidence rates in men and women in that age group at 14.65 (95% CI, 11.90−17.40) and 8.00 (95% CI, 6.63−9.37) per 100 000 person-years, respectively. The CRAO incidence rate increased as the age of the population increased until the age group of 80 to 84 years, and the sex-adjusted regression analysis resulted in significantly increased odds of CRAO incidence with increasing age, when compared with the age group of 10 to 14 years (Table 1). The CRAO incidence rate approximately doubled every 10 years until the 8th decade of life; the incidence rate per 100 000 person-years was 0.03, 0.08, 0.24, 0.54, 1.19, 2.44, 5.85, and 8.56 per 100 000 person-years among those aged 0−9, 10−19, 20−29, 30−39, 40−49, 50−59, 60−69, and 70−79 years, respectively. The linear regression analysis resulted in an adjusted $R^2 = 0.974$ ($P<0.001$).