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Sudden Visual Loss and Cardiovascular Risk Factors in African Americans: The Jackson Heart Study

Paul B. Greenberg, MD^{1,2,3}, Allison J Chen, BA^{1,2,3}, and Wen-Chih Wu, MD, MPH^{4,5}

¹Section of Ophthalmology, Providence VA Medical Center, Providence, RI USA

²Division of Ophthalmology, Rhode Island Hospital, Providence, RI USA

³Division of Ophthalmology, Alpert Medical School, Brown University, Providence, RI USA

⁴Section of Cardiology, Providence VA Medical Center, Providence RI USA

⁵Department of Medicine, Alpert Medical School, Brown University, Providence, RI USA

Abstract

Purpose—The prevalence and determinants of sudden visual loss (SVL) are unknown in African Americans (AAs). Since SVL can be cardiovascular disease (CVD) related and CVD is highly prevalent in AAs, we examined the prevalence of and CVD factors related to self-reported SVL lasting 24 hours or longer in the cohort of AAs enrolled in the Jackson Heart Study (JHS).

Methods—The study population comprised of 5,301 participants enrolled from 2000–2004 in the metropolitan area of Jackson, MS. All participants who responded to the question “Have you ever had any sudden loss of vision or blurring, lasting 24 hours or longer?” on the baseline stroke questionnaire were included in the study. We estimated the prevalence of SVL and used regression modeling to identify CVD factors independently related to SVL.

Results—There were 5262 participants included, of which 63% (3334/5262) were female. The prevalence of SVL was 3.6% (193/5262) overall (4.4% in females and 2.4% in males) and 8.7% (84/965) in patients with DM. Factors independently related to SVL included coronary heart disease (OR, 1.69 [95% CI, 1.12–2.56]), cerebrovascular disease (OR, 2.81 [95% CI, 1.76–4.47]), diabetes (OR, 2.85 [95% CI, 2.05–3.94]), hypertension (OR, 1.64 [95% CI, 1.09–2.45]), female gender (OR, 1.82 [95% CI: 1.24–2.67]), and income less than \$50,000 (OR, 2.05 [95% CI: 1.28–3.30]).

Conclusions—In this cohort of AAs, self-reported SVL lasting 24 hours or longer was highly prevalent in women and those with diabetes, and was independently related to gender, CVD, CVD risk factors and household income.

Corresponding author: Paul B Greenberg, MD, Section of Ophthalmology, Providence VA Medical Center, 830 Chalkstone Ave, Providence, Rhode Island 02908, Phone: (401) 273-7100 x1506, Fax: (401) 751-1670, paul_greenberg@brown.edu.

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Keywords

visual loss; cardiovascular risk; African Americans; Jackson Heart Study

The epidemiology of sudden visual loss (SVL) lasting 24 hours or longer is not well described. Common etiologies include ischemia, infection/inflammation, migraine, retinal detachment and trauma^{1–3}. Ischemic causes of SVL such as retinal vascular occlusion, ischemic optic neuropathy and stroke are of particular importance due to their high likelihood of causing permanent visual loss from ocular or cerebral infarction⁴ and their association with cardiovascular disease (CVD) and diabetes mellitus (DM).^{5–10}

The Atherosclerosis Risk in Communities (ARIC) study reported a 1.2 percent prevalence of self-reported SVL lasting longer than 24 hours in a multi-ethnic population but the prevalence and risk factors for SVL in African Americans (AAs) were not evaluated.¹¹ Compared to their white counterparts, African American (AA) adults are at disproportionately higher risk of CVD and DM, including a greater likelihood of uncontrolled hypertension and stroke,¹² which potentially place them at higher risk for developing SVL. To better understand SVL and its CVD determinants, we investigated the prevalence of self-reported SVL lasting 24 hours or longer and its association with CVD and DM in the cohort of AAs enrolled in the Jackson Heart Study (JHS).

Methods

Jackson Heart Study

The details of the JHS have been described elsewhere.¹³ Briefly, the JHS is a National Heart, Lung, and Blood Institute (NHLBI)-funded 12-year population-based observational study of CVD and DM in AAs from three counties in the metropolitan area of Jackson, Mississippi. Between 2000 and 2004, 5,301 AA men and women aged 21–84 years were enrolled in the study. During the baseline exam (Visit 1; 2000–2004), participants underwent clinical examinations, provided blood samples and medical and health histories, and completed psychosocial assessments administered by trained interviewers. Eye examinations were *not* conducted on participants. The Brown University School of Public Health is a Vanguard Collaborative Center¹² for the JHS and has obtained Institutional Review Board (IRB) approval to conduct studies with JHS datasets. This study also received approval from the Providence VA Medical Center IRB.

Outcome

Information on self-reported SVL was derived from the stroke symptoms form, which participants completed on Visit 1. The JHS stroke questionnaire was based on a similar one standardized and validated in the ARIC study.^{14,15} Sudden visual loss was assessed by interview in response to the question: “Have you ever had any sudden loss of vision or blurring, lasting 24 hours or longer?” Only those who responded with a “Yes” or “No” were included in the study. Monocular versus binocular visual loss was assessed by a response to the following question: “During the episode, which of the following parts of your vision were affected: only the right eye, only the left eye, both eyes?”¹⁶

Covariates

Demographic data were collected at Visit 1, including age, gender, highest level of education, income, and type of health insurance. For analysis purposes, age was categorized as <40, 40–65, >65 years. Highest education level attained was categorized as <High School (HS), HS/General Educational Development (GED) test certification/Some College, and College/Associate degree or higher. Income was grouped into two categories: (0–49,999k and 50k and higher). Participants were dichotomized as having or not having health insurance.

Clinical exams provided measurements for body mass index (BMI), diagnosis of Type I or II diabetes, and CVD including its risk factors: hypertension, total cholesterol (mg/dL), high density lipoprotein (HDL) levels (mg/dL), coronary heart disease (CHD), cerebrovascular disease, and peripheral vascular disease. The BMI was grouped into normal (<25 kg/m²), overweight (25–30), and obese (≥30). Total cholesterol and HDL was combined into one variable defined by total cholesterol divided by HDL, as recommended by Adult Treatment Panel III (ATP3).¹⁷ Participants were defined as smokers if they were either a former or current smoker. Participants were defined as hypertensive if they had hypertension stage 1 or higher as classified by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 8)¹⁸ or received anti-hypertensive medication.

Participants were defined as having CHD if participants answered “yes” to any of the following interview questions: “Have you had a coronary bypass?,” “Ever had balloon angioplasty on coronary arteries?,” “Told exercise stress test results were abnormal?,” and “Has doctor said you had a heart attack?”

Participants were considered to have cerebrovascular disease if they had had a previous stroke as defined by a positive answer to the following question: “Have you ever been told by a physician that you had a stroke,” or answered affirmatively to one of the two following questions: “Have you had carotid endarterectomy,” “Ever had angioplasty in arteries of neck?”

Participants were defined as having peripheral vascular disease if they responded “yes” to the questions “Ever had surgery on arteries of neck/legs?” “Ever had balloon angioplasty on those arteries?” “Ever had angioplasty of lower extremity?” and “Ever had revascularization/bypass on those arteries?” Participants were also defined as having peripheral vascular disease if they had an ankle brachial index (ABI) of less than 0.90. The ABI was calculated from (average of 1st and 2nd brachial systolic blood pressure / (average of 1st and 2nd right and left posterior tibial blood pressure).

Statistical Methods

Descriptive statistics, such as frequencies and percentages, were used to describe the prevalence of baseline characteristics in SVL and non-SVL groups. Baseline characteristics were evaluated using 2-sided t-tests for continuous variables, Wilcoxon rank-sum tests for ordered but non-interval variables and chi-square tests for categorical variables. In addition,

prevalence of SVL and 95% confidence intervals (CI) estimates were computed by a priori defined subgroups of age, gender, and diabetes status.

To identify CVD and demographic factors related to SVL, we fitted a logistic regression model that included variables of CVD (CHD, cerebrovascular disease, peripheral vascular disease) and its risk factors mentioned above, DM and demographic variables such as sex, age, income, and health insurance. To understand the potential interaction between age, gender and diabetes status on the risk of having SVL, the predicted probability of having SVL (based on our multivariate model) was plotted against age and stratified by gender for patients without DM in Figure 1 and with DM in Figure 2. The percent of missing data for variables ranged from 2.0% (DM) to 14.4% (income level). Missing data was imputed using the *mi impute* command in Stata 12 statistical software (StataCorp LP, College Station, TX, USA). There were five imputed datasets, and the multiple datasets were merged using the *mi estimate* command in Stata.

Results

Of 5,274 eligible adults in the JHS study, five participants were excluded for responding “Don’t know” to the question on if they ever had SVL or blurring for 24 hours or longer, and seven participants were excluded for having missing information. The remaining 5,262 participants were included in the study.

The overall prevalence of SVL in this AA cohort was 3.6% (95% CI: 3.1–4.1). Of the 193 participants with SVL, 65% (125/193) had binocular SVL and 35% had monocular-only SVL ($\chi^2 = 16.8$, $p < .001$).

Baseline characteristics of participants are presented in Table 1. The mean age (SD) of the 193 participants with SVL was higher than those without SVL (57.3 [0.75] years versus 54.8 [0.18]; $p = 0.001$). Relative to the non-SVL group, the SVL group had a greater percentage of female participants, and higher rates of CHD, cerebrovascular disease, DM, hypertension, and income <50k.

At study visit 1, 19.1% (13/68) of participants with monocular SVL and 13.6% (17/125) of participants with binocular SVL also reported having had a stroke ($p = 0.22$). This is in contrast to the 4.2% (214/5050) of participants without SVL reported having a stroke ($\chi^2 = 59.4$, $p < 0.0001$).

Women had a higher prevalence of SVL than men (4.3% [95% CI: 3.6–5.0] vs. 2.4% [1.7–3.1], $p < 0.001$). The prevalence of SVL was higher among persons with DM than among persons without DM (8.7% [6.9–10.4] vs. 2.4% [1.7–3.1], $p < 0.001$). Those with DM also had a higher prevalence of stroke compared to those without DM (9.3% [7.4–11.1] vs. 3.5% [2.9–4.0]). Prevalence of SVL in patients with both DM and CVD was 12.4% (19/153) whereas for those with solely DM without CVD it was 7.9% (64/806).

Multivariable logistic regression modeling (Table 2) revealed independent predictors of SVL to be female gender (OR, 1.82 [95% CI: 1.24–2.67]), CHD (OR, 1.69 [95% CI: 1.12–2.56]), cerebrovascular disease (OR, 2.81 [95% CI: 1.76–4.47]), DM (OR, 2.85 [95% CI:

2.05–3.94]) and hypertension (OR, 1.64 [95% CI: 1.09–2.45]). Compared to those who had an income of >50k, those who earned 0–\$49,999 had increased risk of SVL (OR, 1.82 [95% CI: 1.15–2.88]). Although females had a slightly higher age distribution than males (55.3 yrs in females vs. 54.1 in males), the positive association between female gender and SVL remained the same when the regression used age as a continuous variable.

The gender differences in the predicted probabilities of having SVL persisted across distinct age groups and were described for patients without DM in Figure 1 and with DM in Figure 2. For both patients with and without DM, women had a consistently higher probability of SVL than men. In addition, the relationship between increased age and increased probability of SVL appears blunted in patients with DM.

Discussion

This paper provides the first population-based estimates of SVL in AAs and contributes to our understanding of factors related to self-reported SVL lasting 24 hours or longer in a community-based cohort at high risk for CVD and DM. Although the prevalence of SVL was 3.6% overall, the prevalence in patients with DM was alarmingly high at close to 9%. Aside from DM, other factors independently related to SVL included female gender, CVD, hypertension and household income <50k.

Several findings merit further investigation. First, the prevalence of self-reported SVL lasting 24 hours or longer (3.6%) was higher than in the ARIC study (1.2%).¹¹ This difference may reflect the higher rates of CVD and risk factors in AAs.¹² Second, women were at higher risk than men for SVL, which has not been reported in the literature. These findings are counterintuitive since both CVD and its risk factors are more prevalent in men. Men may have sought medical attention sooner than women due to other presenting neurological symptoms given the higher incidence of stroke and accompanying symptoms in men¹⁹; this may have led to earlier resolution of visual loss in men and recall bias. In addition, men may have had a greater burden of illness than women, lowering the participation rate of men in the study. Other possible factors include differences in the amount of smoking (i.e., pack-years) between women and men or the impact of hormone replacement in women²⁰. Third, while DM was associated with a consistently higher likelihood of having SVL across all ages, DM blunted the positive relationship between age and likelihood of having SVL. This may stem from the similar findings in coronary artery disease (CAD), where DM is often considered a CAD equivalent,²¹ suggesting that a much higher “vascular” age conferred by diabetes status trumps the chronological age. Furthermore, our finding that prevalence of SVL was almost three times higher in patients with DM when compared to patients with cerebrovascular disease suggests a role for potential non-ischemic causes of SVL such as changes in refraction: poor metabolic control and its treatment can lead to transient bilateral visual loss lasting from days to weeks from refractive alterations from lenticular swelling.^{22,23} Fourth, there were higher reported rates of binocular versus monocular SVL. The impact of DM on non-ischemic SVL noted above may be a factor. Of note, stroke is unlikely to be the explanation: while it typically presents with bilateral SVL due to visual field deficits, the reported stroke rates between the two groups of participants with SVL were similar. Finally, SVL was related to lower income.

This may reflect the association between lower socioeconomic status and risk of DM-related complications²³, CVD^{23,25} and stroke²⁶.

This study has several limitations, many related to its retrospective nature. The data on SVL was self-reported from the stroke history forms in the JHS, and is thus subject to the recall bias of the participants. Since the questionnaire did not specify whether the SVL was transient or permanent, patients suffering from permanent vision loss may have been more likely to respond yes to the question while in those in whom the vision loss was temporary may have been more likely to underreport their symptoms. Also, as participants in the JHS did not receive ophthalmic clinical examinations and diagnostic testing, such as fundus photography or automated visual fields, it was not possible to verify the cause or the degree of visual loss in participants. However, the association of the self-reported SVL with CVD and risk factors in this patient cohort suggests that ischemia--ocular and/or cerebral--is an important cause of SVL. Lastly, this study surveyed 6.5% of AAs aged 35–84 residing in Jackson County, Mississippi, and thus it is unknown if the findings of this study are generalizable to other AA populations in other geographic regions, especially those with different rates of CVD and risk factors.

In conclusion, this study suggests that self-reported SVL lasting 24 hours or longer is highly prevalent in AAs. It is linked to female gender, DM, CVD, hypertension and socioeconomic status. Given gender and socioeconomic trends in the prevalence of SVL, it will be important for future studies to conduct eye examinations in this population to define the underlying causes of SVL and any associated visual impairment. Through such study, the prognostic significance of SVL with respect to being a harbinger of CVD-related events such as fatal and nonfatal CHD and stroke may ultimately be determined.^{10,27}

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Figure 1.
Probability of Sudden Visual Loss by Age and Gender for Patients without Diabetes.

Figure 2.
Probability of Sudden Visual Loss by Age and Gender for Patients with Diabetes

Table 1**Participant Characteristics by Self-Reported Sudden Vision Loss**

Characteristic	SVL No. (%)	No SVL No. (%)	Test statistic, P-value
Age, mean (SD)	57.3 (0.75) years	54.8 (0.18)	$t=-2.67$, $p=0.0076$
<40	8 (4.1)	629 (12.4)	
40–65	139 (72)	3310 (65.3)	
>65	46 (23.8)	1130 (22.3)	$\chi^2 = 11.9$, $p=0.003$
Gender			
Male	47 (24.4)	1881 (37.1)	
Female	146 (75.6)	3188 (62.9)	$\chi^2 = 13.0$, $p=0.0003$
BMI, mean (SD)	33.0 (0.58) kg/m ²	31.7 (0.10)	$t=-2.40$, $p=0.016$
<25	25 (13.0)	734 (14.5)	
25–30	51 (26.4)	1642 (32.4)	
>=30	117 (60.6)	2685 (53.1)	$\chi^2 = 4.39$, $p=0.11$
Coronary heart disease	41 (21.5)	440 (8.7)	$\chi^2 = 35.4$, $p < 0.0001$
Peripheral vascular disease	114 (59.3)	3171 (62.9)	$\chi^2 = 1.02$, $p = 0.31$
Cerebrovascular disease	31 (16.2)	214 (4.24)	$\chi^2 = 59.4$, $p < 0.0001$
Type II Diabetes *	84 (45.7)	881 (17.8)	$\chi^2 = 89.8$, $p < 0.0001$
Hypertension/BP med	153 (80.1)	3069 (60.7)	$\chi^2 = 29.1$, $p < 0.0001$
Previous or current smoker	73 (38.4)	1601 (31.8)	$\chi^2 = 3.7$, $p=0.055$
Total cholesterol, mean (SD)	194.4 (2.68)	198.9 (0.57)	$t=1.64$, $p=0.10$
HDL, mean (SD)	50.5 (1.05) mg/dL	51.6 (0.21)	$t=1.02$, $p=0.31$
Total chol/HDL per 0.1 increment, mean(SD)	4.10 (0.088)	4.11 (0.019)	$t=0.15$, $p=0.87$
Income			
0–49,999	134 (84.8)	2810 (65.2)	
50,000+	24 (15.2)	1500 (34.8)	$\chi^2=26.0$, $p<.0001$
Health insurance type			
Has health insurance	155 (81.2)	4386 (86.9)	
No insurance	36 (18.8)	660 (13.1)	$\chi^2=5.31$, $p = 0.021$

* 1 participant had Type I diabetes – the individual did not have sudden visual loss

Abbreviations: SVL, sudden visual loss; BMI, body mass index (kg/m²); HDL, high-density lipoprotein; HS, high school; GED, general educational development certificate.

Table 2

Multivariate Analysis of the Association Between Cardiovascular Risk Factors and Sudden Visual Loss

Characteristic	Odds Ratio (95% CI)
Age	
<40	1 (reference)
40–65	1.99 (0.94–4.20)
>65	1.23 (0.54–2.77)
Gender	
Male	1 [reference]
Female	1.85 (1.26–2.70)*
Comorbidities	
Diabetes	2.78 (2.01–3.85)*
Coronary heart disease	1.69 (1.12–2.55)*
Cerebrovascular disease	2.71 (1.71–4.32)*
Peripheral vascular disease	1.03 (0.75–1.41)
BMI	
<25	1 [reference]
25–30	0.81 (0.47–1.38)
≥30	0.85 (0.51–1.40)
Total chol/HDL per 0.1 increment	1.00 (0.88–1.13)
Current or previous smoker	1.19 (0.86–1.65)
Hypertension or BP medication	1.62 (1.08–2.41)*
Income	
0–49,999	1.82 (1.15–2.88)*
50,000+	1 [reference]
Insurance	
Has insurance	1 [reference]
No insurance	1.39 (0.92–2.11)

Abbreviations: CI, confidence interval; BMI, body mass index; chol, cholesterol; HDL, high-density lipoprotein; BP, blood pressure.