Cardiovascular Health and Cognitive Decline 2 Decades Later in Men with Preexisting Coronary Artery Disease

Miri Lutski, PhD; Galit Weinstein, PhD; Uri Goldbourt, PhD; and David Tanne, MD

Cardiovascular health (CVH) factors are associated with lower risk of cardiovascular disease, stroke, and mortality. We investigated the association between a modified CVH metrics score and change in cognitive functions 2 decades later in patients with pre-existing coronary artery disease. A subset of 200 men (mean age at baseline 57.3 ± 6.3 years) who previously participated in a secondary prevention trial (1990 to 1997) underwent cognitive evaluation 14.6 ± 1.9 years after baseline (mean age 72.3 ± 6.2 years, T1 evaluation), and were re-evaluated for cognitive performance 19.9 ± 1.0 years after baseline (mean age 77.2 ± 6.4 years, T2 evaluation). A CVH metrics score at baseline was calculated, including 3 health parameters and 4 health behaviors. We have scored each of these CVH metrics into best (2 points), intermediate (1 point), and poor (0 points) levels. Cognitive function was assessed using the NeuroTrax Computerized Battery. A linear mixed model was used to assess change in cognitive functions between T1 and T2 cognitive evaluations. Among the 200 patients, 68 (34.0%) had ≤7 (bottom group), 85 (42.5%) had 8 to 9 (middle group), and 47 (23.5%) had ≥10 (top group) CVH metrics points. After adjustments, the top group of CVH score versus others was associated with slower decline in the overall cognitive performance composite z-score (0.23 ± 0.09, p = 0.009) and on tests of executive and visual spatial functions (0.23 ± 0.11, p = 0.047, and 0.49 ± 0.17, p = 0.004, respectively). In conclusion, an inverse association was observed between the score of best CVH metrics and cognitive decline. Lifestyle factors are important predictors of late-life decline in cognitive function among high-risk patients.

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Many vascular risk factors are shared predictors for poor brain health and have been found to be associated with cognitive impairment and dementia. In 2010, the American Heart Association introduced a metric defining the concept of ideal cardiovascular health (CVH) metrics for the healthy general population. Several studies have demonstrated that a higher number of ideal CVH metrics were associated with a lower rate of cardiovascular events, stroke, and all-cause mortality. The CVH score was shown to be linked to lower risk of cognitive impairment and dementia. However, little is known about the collective association between CVH metrics and cognitive decline among patients with pre-existing coronary artery disease (CAD), which are characterized by their high-vascular-risk profile and have a high risk of cognitive impairment. Furthermore, most studies estimated cognitive function at only a single time and therefore were unable to determine whether ideal CVH is associated with cognitive decline. We based our study on components of the CVH metrics, yet with modifications to adjust the tool to patients with pre-existing CAD. We investigated the association between the modified CVH metrics score and change in cognitive functions 2 decades later in patients with pre-existing CAD.

Methods

The sample for the present study includes participants who previously participated in the Bezafibrate Infarction Prevention (BIP) study, a large multicenter, placebo-controlled randomized clinical trial that has investigated the efficacy of bezafibrate 400 mg daily in secondary prevention among participants with established stable CAD, who are participating in the BIP Neurocognitive study. Patients included in the BIP Neurocognitive Study (mean age at baseline 57.3 ± 6.3 years) were recruited from 8 medical centers located at the center of Israel; have completed a diary food evaluation (48% of a total of 1,232), and have undergone 2 follow-up evaluations. The first follow-up evaluation (T1, n = 558; 308 of the patients had complete cognitive and CVH metrics measurements; mean age 72.3 ± 6.2 years) was performed during 2004 to 2008, an average of 15.0 ± 3.0 years after recruitment, assessing neurovascular and cognitive functions. Patients were reassessed for cognitive function 19.9 ± 1.0 years after recruitment during 2011 to T2 (n = 351; 200 of the patients
had complete cognitive and CVH metrics measurements; mean age 77.2 ± 6.4 years). The mean time interval between the 2 cognitive assessments was 4.8 ± 1.3 years. A study flowchart is depicted in Figure 1. The 2 late-life evaluations took place at a central research center (the Sagol Neuroscience Center) or, if unable or unwilling to attend the medical center, were assessed at their residence. The study was approved by the local institutional review board and informed consent was obtained from all patients.

We have measured the following 3 health factors (fasting plasma glucose, low-density lipoprotein cholesterol, blood-pressure) and 4 health behaviors (smoking, obesity, physical-activity and adherence to Mediterranean diet). We have scored each of these CVH metrics into best (2 points), intermediate (1 point), and poor levels (0 points) (each of these CVH metrics into best (2 points), intermediate (1 point), and poor (none)). We have scored the cognition of mental disorders, 4th Edition (DSM-IV) criteria. Dementia was determined based on the sum of cognitive evaluation, clinical interview, and data collected, determined by an adjudication committee composed of 3 investigators, 2 of which were experienced board-certified neurologists. Dementia was determined based on the sum of cognitive evaluation, clinical interview, and data collected, and in accordance with the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria. Stroke was defined according to World Health Organization criteria.

Methods for assessment of vascular risk factors at baseline of the BIP study are described elsewhere. Blood samples were drawn from each study participant at baseline of the BIP trial (1990 to 1992), before randomization. Education, occupation, and place of birth, important indicators of socioeconomic status, were assessed through a baseline questionnaire. We included data on birthplace, which is an important key indicator of socioeconomic status disparities and, possibly, of genetic predisposition. In addition, previous studies suggest that risk of cognitive impairment differs between Israeli-born and immigrant populations.

Participants completed a computerized cognitive testing (NeuroTrax Corporation, Bellaire, TX). A description of the tests included has been published elsewhere. The psychometric properties of the tests exploit the advantages of computerized testing, providing precise accuracy and reaction time measurements. The tests are interactive and adaptive, adjusting the level of difficulty depending upon performance. The NeuroTrax software calculates raw composite scores for each cognitive domain, namely, memory, executive function, visual spatial processing, and attention. In addition, a composite score was computed as a weighted average of all summary scores from each domain.

Dementia and incident stroke during follow-up were determined by an adjudication committee composed of 3 investigators, 2 of which were experienced board-certified neurologists. Dementia was determined based on the sum of cognitive evaluation, clinical interview, and data collected, and in accordance with the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria. Stroke was defined according to World Health Organization criteria.
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