# THE ASSOCIATION BETWEEN STABLE CHRONIC ISCHEMIC HEART DISEASE, ATRIAL FIBRILLATION AND ARTERIAL HYPERTENSION AND THE SEVERITY OF COGNITIVE IMPAIRMENT AFTER FIRST EVER ISCHEMIC STROKE.

**Valkova M. [1, 4], Veleva I. [2], Atanasova G. [3], Burgov R. [4], Guerguelcheva V. [1, 5], Kostadinova P. [6]**

*[1] Clinic of Neurology, University Hospital Sofiamed, Sofia, Bulgaria*
*[2] Department of Psychiatry and medical psychology, Medical University of Pleven, Pleven, Bulgaria*
*[3] Department of General Medicine, Forensic Medicine and Deontology, Medical University of Pleven, Pleven, Bulgaria*
*[4] Department of Psychology, The University of Veliko Tarnovo "Sv. Sv. Kiril I Metodi", Veliko Tarnovo, Bulgaria*
*5 Sofia Universitu "Sv. Kliment Ohridski", Sofia, Bulgaria*
*[6] Department of Social Health Sciences, Faculty of Public Health, Medical University of Pleven, Pleven, Bulgaria*
*Corresponding author:*
*Mirena Valkova*
*GSM +359 89 87 82 372*
*E-mail: dr.plamenova@gmail.com*
*Working address: Clinic of Neurology, University hospital Sofiamed, 16 G.M. Dimitrov Str. Sofia, Bulgaria*

**Summary:**

Introduction: Post-stroke cognitive impairment (PCI) is associated with poor outcome and low quality of life. Stroke is associated with high level of vascular and heart pathology. The aim of our study was to examine the impact of stable chronic ischemic heart disease (CIHD), atrial fibrillation (AF) and arterial hypertension (AH) on PCI.

Material and methods: We examined 109 patients (67males and 42 females) at first three days and at 90th day after the first ever ischemic stroke (with average result on National health stroke scale 12.23±2.50 points) via Mini Mental State Examination (MMSE), 10words Luria test for verbal memory (working memory and delayed recall at 30th minute), Isaack Set Test (IST) and Benton visual retention test (BVRT, variant A, E). 45 of them were with CIHD, 89 with AH and 18 AF. All results were interpreted at 95% confidential level.

Results: The AH and AF had no significant influences on our tests, although the low arterial pressure was associated with poor MMSE test results at 90th day (p=0.0348). Patients with CIHD showed lower MMSE test results at 90th day than those without (p=0.0149), lower first and 90th day verbal working memory (p=0.0316, p= p=0.0074) and delayed recall (p= p=0.0118), lower points on 1st day IST (p=0.0122) and 90th day IST (p=0.0165) and more errors on 90th day BVRT (p=0.0177).

Conclusions: CIHD is associated with memory and processing speed worsening after stroke. Not AH, but maintaining low blood pressure is related to poor global cognitive performance. AF has no additional impact on PCI.

***Key words:*** *cognitive impairment, arterial hypertension, atrial fibrillation, stable chronic ischemic heart disease, stroke*

## Introduction:

Poststroke cognitive impairment (PCI) has been defined as specific form of vascular cognitive impairment developed after ischemic stroke - IS [1]. About ¼ of all patients with IS have developed dementia during the first three months after the incident [6], although the frequency of PCI during the first year arises to 41% [1, 17]. PCI development is associated

with accumulation of cortical strokes, strategic subcortical strokes and functional cortical disconnection [6]. Although some studies on PCI in acute IS stage, there are some uncertainties for its characteristics [17]. According to Jaillard et al. [10], 75% of all patients with IS have Mini Mental State Examination (MMSE) below 23 points, 65% have executive dysfunctions, 65% memory problems and 25% impaired instrumental activities. Nys et al. [13] have suggested that at acute IS stage the most impaired are executive functions and visual perception, although Hurford et al. [8] have found processing speed and attention are most impaired domains. However, some of these dysfunctions are partially reversible which is due to recanalization and reperfusion in impaired zones and specific brain reorganization [7, 8, 17]. There are many studies on PCI in chronic IS stage, that have showed different degrees and kinds of cognitive changes [17]. Age, education, severity and localization of IS, the severity of acute PCI and depression are suggested as main determinants for PCI [12, 17]. However vascular risk factors also significantly affect cognitive abilities after IS [12, 17].

The aim of our study was to examine the impact of chronic ischemic heart disease (CIHD), atrial fibrillation (AF) and arterial hypertension (AH) on PCI.

**Material and methods:**

We examined 109 patients with first ever IS (mean age 66.67±9.03 years, 67 males and 42 females, 33 with basic, 62 with middle and 14 with high education, with average result on National health stroke scale - NIHSS 12.23±2.50 points). 45 of them were with stable CIHD, 89 with AH and 18 with AF according to the criteria of American College of Cardiology. The inclusion criteria for the study were: 1. age above 8 years and below 80 years; 2. first ever IS, verified by clinical examination and brain imaging (brain computer tomography or magnetic imaging technique); 3. Stroke severity above 4 and below 15points on NIHSS; 4. IS volume below 1/3 of the hemisphere; 5. Lack of other brain or decompensated somatic diseases; 6. Patients with additional multi-infarct encephalopathy should not have lacunar zones above 4 mm in diameter; 7. Lack of family history for degenerative dementia or psychiatric disorders; 8. Lack of psychiatric conditions; 9. Lack of history data of taking drugs that could impact on cognitive parameters, alcohol or drug abuse, 10. None of the patients was treated with fibrinolysis or trombectomy (all should be outside the treatment window), 11. Ability to fulfil neuropsychological battery, 12. Lack of aphasia, apraxia or moderate to severe agnosia.

After giving informed consent, all participants underwent full somatic and neurological examination, electrocardiography, blood and urine tests, imaging techniques (for verifying IS) and NIHSS assessment. All eligible for the study were accessed on two step model – during the first three days after the incident and at 90$^{th}$ day. We applied MMSE, 10words Luria test for verbal memory (working memory and delayed recall at 30th minute), Isaack Set Test (IST) and Benton visual retention test (BVRT, variant A, form. E).

Statistical analysis was done on the basis of parametrical and nonparametrical methods, using Excel 2010, Statgraphics 5.0 Plus and SPSS 20. The results were interpreted in 95% confidential level (p 0.05).

**Results:**

CIHD was associated with low MMSE (at 90$^{th}$ day after IS), poor verbal memory and slow processing speed (see table 1).

**Table 1.**

AH gave no additional impact on PCI ($p>0.05$), although the low arterial pressure was associated with poor MMSE test results at 90th day ($p=0.0348$).

There was no statistical significant difference in neurocognitive performance between patients with and without AF.

**Discussion:**

CIHD is one of the main risk factors for cognitive decline in population and is frequently associated with brain vascular disease and vascular cognitive impairment [5, 9, 12, 16]. Our analysis has shown additional worsen of PCI associated with CIHD during the first three months after the IS. The most impaired cognitive domains have been verbal and non-verbal memory and processing speed. Although the role of CIHD on developing vascular brain pathology, some authors have suggested nonvascular mechanisms of its action [5, 16]. It is associated with high mental stress and increase of glucocorticoid levels leading to decline of brain cognitive reserve [3]. Coexistence of IS increases the stress effect and modifies CIHD cognitive changes. This simultaneous effect is most evident for the stress vulnerable cognitive functions – working memory and processing speed.

AF is associated with cognitive dysfunction and dementia in stroke free patients [2,4,15]. However anticoagulation reduces the risk for silent strokes, brain vascular disease and even cognitive changes in such patients [4]. Although this, we have failed to find any additional cognitive decline due to AF in patients with already developed IS in 3 month interval after the incident.

AH has complex effect on cognitive functions. According to many authors, AH is risk factor for cognitive decline due to brain vascular disease [12]. Sachdev et al. [14] have pointed that if AH increases the risk for vascular dementia, maintaining high blood pressure plays protective role for cognitive abilities. Moreover, aggressive hypotensive treatment may have negative impact on cognitive functions [11]. Our analysis also has shown that sustained low blood pressure after IS is associated with poor global cognitive functioning.

**Conclusions:**

CIHD is associated with memory and processing speed worsening after IS. Not AH, but maintaining low blood pressure is related to poor global cognitive performance. AF has no additional impact on cognitive functioning in 3 month interval after IS.

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**Table 1. The impact of chronic ischemic heart disease on cognitive abilities of patients with first-ever ischemic stroke.**

| | Patients with CIHD | Patients without CIHD | Statistical significance |
|---|---|---|---|
| Neuropsychological battery | n=64 | n=45 | |
| MMSE 1 (points) | -- | -- | p>0.05 |
| MMSE 2 (points) | 22.41±0.55 | 20.16±0.67 | p=0.0149 |
| Working memory 1 (average words) | 5.69±0.18 | 5.09±0.22 | p=0.0316 |
| Working memory 2 (average words) | 5.97±0.18 | 5.24±0.21 | p=0.0074 |
| Delayed recall 1 (words) | -- | -- | p>0.05 |
| Delayed recall 2 (words) | 4.62±0.24 | 3.61±2.29 | p=0.0118 |
| Number of corrects on BVRT 2 | 2.14±0.20 | 1.51±0.25 | p=0.0255 |
| Number of errors on BVRT 2 | 13.45±0.61 | 15.80±0.78 | p=0.0177 |
| IST 1 (points) | 19.42±1.01 | 15.43±1.25 | p=0.0122 |
| IST 2 (points) | 21.64±0.91 | 18.04±1.12 | p=0.0165 |

Legend: CIHD – chronic ischemic hearth disease

1- examination during the first three days after the incident, 2 – examination at 90$^{th}$ day

MMSE – Mini Mental State Examination; Working memory – average score from five attempts on 10 words Luria test, Delayed recall – words at 30$^{th}$ minute on 10 words Luria test; BVRT – Benton visual retention test; IST – Isaack Set Test.