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## DIAGNOSTIC ALGORITHM FOR COGNITIVE DYSFUNCTION IN PATIENTS WITH HYPERTENSION IN MEDICAL AND SOCIAL EXPERTISE

АЛГОРИТМ ДІАГНОСТИКИ КОГНІТИВНОЇ ДИСФУНКЦІЇ У ХВОРИХ НА АРТЕРІАЛЬНУ ГІПЕРТЕНЗІЮ В ПРАКТИЦІ МЕДИКО-СОЦІАЛЬНОЇ ЕКСПЕРТИЗИ

АЛГОРИТМ ДИАГНОСТИКИ КОГНИТИВНОЙ ДИСФУНКЦИИ У БОЛЬНЫХ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ В ПРАКТИКЕ МЕДИКО-СОЦИАЛЬНОЙ ЭКСПЕРТИЗЫ

**Анотація.** Порушення когнітивних функцій відбувається значною мірою у хворих на артеріальну гіпертензію, особливо після перенесеного інсульту. У статті розглянуто підходи до визначення когнітивних функцій у пацієнтів з артеріальною гіпертензією в практиці медико-соціальної експертизи, які базуються на використанні інформаційних технологій (розробки моделі оцінки когнітивних функцій, удосконалення методів психологічної діагностики та створення математичного забезпечення). Представлено найбільш значущі показники в оцінці уваги, пам'яті, мислення, інтелекту, особистісних і характерологічних особливостей хворих із перенесеним мозковим інсультом. Розроблено діагностичний алгоритм виявлення характеру та ступеня когнітивної дисфункції при артеріальній гіпертензії для використання в практиці медико-соціальної експертизи.

**Ключові слова:** артеріальна гіпертензія, мозковий інсульт, алгоритм, когнітивні функції, медико-соціальна експертиза

**Аннотация.** Нарушение когнитивных функций происходит в значительной степени у больных артериальной гипертензией, особенно после перенесенного инсульта. В статье рассмотрены подходы к определению когнитивных функций у пациентов с артериальной гипертензией в практике медико-социальной экспертизы, основанные на использовании информационных технологий (разработки модели оценки когнитивных функций, совершенствование методов психологической диагностики и создания математического обеспечения). Представлены наиболее значимые показатели в оценке внимания, памяти, мышления, интеллекта, личностных и характерологических особенностей больных с перенесенным мозговым инсультом. Разработан диагностический алгоритм выявления характера и степени когнитивной дисфункции при артериальной гипертензии для использования в практике медико-социальной экспертизы.

**Ключевые слова:** артериальная гипертензия, мозговой инсульт, алгоритм, когнитивные функции, медико-социальная экспертиза.

### Introduction

Nowadays the issues of lungs differential diagnosis and severe cognitive impairments in patients with hypertension especially after a stroke are relevant for psychologists, neurologists, rehabilitation therapists and medical social assessment boards [1]. In Ukraine a number of the following institutions deal with these problems: National Medical Academy of Post-

graduate Education named after P.L. Shupyk, Kharkiv Medical Academy of Postgraduate Education, Donetsk National Medical University, Bogomolets National Medical University, Institute of Neurology, Psychiatry and Narcology of NAMS of Ukraine, Ukrainian State Research Institute of Medical and Social Problems of Disability, Ministry of Public Health of Ukraine. I. S. Zozulya, M. I. Chernenko, G. M. Kushnir,

A.V.Ipatov [2], N.K.Murashko [3] applied a great number of psychognostic methods in medical social expertise of disability of patients with cerebral stroke.

In Russia these problems are investigated in National Center for Mental Health, Research Institute of Cerebrovascular Pathology and Stroke of Russian State Medical University, Moscow Medical Academy named after I. M. Sechenov, Scientific Center of neurology of RAMS, in Belarus – Republic Center of Neurology and Neurosurgery [4]. In the USA – Multiple Sclerosis Center, Tomas Jefferson University, in Italy – Department of Angiocardioneurology, University of Siena, in Spain – EuroExpes Biomedical Research Center, in Chile – Unidad de Neurologia Cognitiva y Demevcial, Chile Seccion de Geriatric, Hospital Clinico Universidad de Chile – IRCCS Neuromed, in Sweden – Department of Geriatrics.

#### **Purpose and objectives of the study**

In the field of medical psychology the problem lies in the fact that various types of cognitive, emotional and behavioral impairments in patients with hypertension are limited to the problem of a single function or a few basic cognitive control functions in contemporary studies. Among current methods in clinical and psychological investigations the above mentioned problem shows insufficient research in the theoretical and methodological framework, as well as guidance in studying cognitive activity impairments in patients with hypertension caused by certain stressful factors [5].

After the analysis of literature data, it was revealed that in current cognitive control studies one of the reasons is in the theoretical position of “responsiveness” due to the impression that the structure of human cognitive activity control is rigid and static but not flexible and dynamic. This impression is opposite to methodological principle of kinesis and systematization that was elaborated by N. A. Bernstein, P. K. Anokhin, L. S. Vygotsky, A. R. Lurii, B. F. Lomov and other founders of national psychology and physiology. Fundamental ideas represented in papers of P. K. Anokhin, L. S. Vygotsky, A. R. Lurii allow us to make a new theoretical and methodological approach to understand the mechanisms of human cognitive activity control. On the basis of application of advanced technologies, it is possible to model human cognitive

processes under specific stressful conditions. This approach can promote investigation of pathopsychological factors of cognitive activity control [6].

However, there are no methodological approaches and cognitive functions assessment criteria in the practice of medical social expertise based on not only “Regulations of detecting disability status” [7], but also on the principles of International Classification of Functioning, Disability and Health [8]. A complicated issue for psychologists is a combination of true cognitive impairments and attempts of patients to represent themselves in a “favorable light” or hysteroid reactions and demonstrative behavior typical of most patients who are examined by medical social assessment boards. It made possible to suggest a hypothesis as for “psychology that limits life activity” vs “psychology of disability”.

Purpose of the research is to develop a diagnostic algorithm to detect cognitive dysfunction in patients with hypertension in general practice of medical and social expertise.

#### **Materials and methods**

139 patients aged 30–59 suffering from hypertension (AH) of stage I and stage II (with the consequences of cerebral stroke) agreed to be examined and monitored in open investigation, which was conducted in SI «Ukrainian State Research Institute of Medical and Social Problems of Disability, Ministry of Public Health of Ukraine», Dnipro. The patients were divided into 2 groups:

- the first group – patients with stage II AH (29 patients);
- the second group – patients with stage III AH (110 patients).

An average age of the patients with AH stage II was  $48.1 \pm 3.1$ , with stage III –  $45.3 \pm 5.6$  years old. 59,7% male and 40,3% female patients were examined. The patients under examination suffered a stroke about  $4,4 \pm 1,8$  years ago; 84 patients (76,3%) suffered a stroke less than 5 years ago, 19 patients (17,3%) – 5–10 years ago, 7 patients (6,4%) – 11–20 years ago. Nine patients experienced recurrent stroke, one patient had two strokes. According to diagnostic criteria of International Classification of Diseases [9], mild cognitive impairments were detected by a psychologist in 100 (74,2%) patients with stage I and stage II AH, moderate ones – in 25,8% of patients with stage III AH.

Accentuation of personality traits of patients was identified according to Shmishek questionnaire test, personality features according to the "Methods of personality factors research" [10], character traits – according to R. Cattell's "Analysis of personality", types of attitude towards the disease (TATD) – according to "Personality questionnaire of Bekhterev Institute (PQBI)". The peculiarities of emotional intelligence were evaluated according to Emln questionnaire for emotional intelligence of D.V.D.V.Lusin. Shulte tables, Munsterberg methods, Benton's corrective table were used to detect attention. Memory investigations were conducted with the help of the following tests: image memory test, visual memory test, logical memory test, short-term memory capacity test, Luria's test on memorizing 10 words. General mental abilities were studied by means of short oriented test, mental processes – with the help of methods to identify key features, Ebbinhausers methods, oddball tasks, similarity tasks [11–13].

Database in Microsoft Excel and Access was established to conduct statistical processing. Student's t-test was used to compare average value and  $\chi^2$  criterion – to compare relative number [14]. Cognitive functions significance in patients with AH was assessed by ranging the research indicators according to their individual value to detect mild and moderate cognitive impairments. Kendall's method was used for this purpose [14]. According to the method scheme for mild and moderate cognitive impairments in patients with AH stage II and stage III, for each  $x$  indicator exponent rate was specified as  $[x_{\min}; x_{\max}]$ , where  $x_{\min}$  – minimal,  $x_{\max}$  – maximal indicator value. Then the exponent range change was found, the same in both cases, and the number of patients with different exponent range was calculated. This number was taken as a weight status: the higher it was, the more significant the indicator was. To get more stable results, the method was used a few times with occasionally chosen 95% of patients, the obtained weight status was averaged.

### Results of research and discussion

As it was described in our previous papers, 22,2 and 9,4% patients with AH of both groups had their attention in normal condition. Mild attention impairments in patients with AH stage II and stage III were in 77,8 and 81,2% of cases; moderate impairments were observed

in patients with AH stage III – 9,4%. 55,6 and 2,7% patients of both groups examined by psychologists had healthy memory. Mild memory impairments in patients with AH stage II and stage III were in 22,2 and 62,2% of cases; moderate impairments were observed in 22,2 and 35,1% respectively. Healthy thought process had 55,6 and 35,1% patients in both groups. Mild disorders in patients with AH stage II and stage III were in 44,4 and 29,8% of cases; moderate disorders were observed in patients with AH stage III – 35,1%.

55,6 and 24,4% patients examined of both groups had their intellectual abilities in normal condition. Mild impairments in patients with AH stage II and stage III were in 22,2 and 32,4% of cases; moderate impairments were observed in 22,2 and 43,2% respectively. Thus, it should be concluded that patients with AH stage II and III suffer the most significant cognitive impairments of memory (44,4 and 97,3%), attention (77,8 and 90,6%), intellectual ability (44,4 and 75,6%) and thought process (44,4 and 64,9%) [6; 15].

If temperament and personality functions can be considered as cognitive ones according to International classification of Functioning, Disability and Health, as well as our suggested cognitive functions assessment model in medical social expertise [6], patients with AH had the following characteristics more meaningful:

- desire to represent themselves in a "favorable light".....4,7;
- Pa – paranoia .....4,3;
- Sc – schizoid .....3,9;
- Ma – hypomania .....2,9;
- D – depression .....2,9;
- Pt – psychastenia .....2,6;
- Hy – hysteria .....2,1;
- Hs – hypochondria ..... 2,1;
- Pd – psychopathy .....1,8;
- disthymic .....3,1;
- anxiety .....2,2;
- irritation .....2,1;
- pedantic .....2,0;
- cyclothymic ..... 1,2;
- stuck .....1,2;
- accentuation of personality traits.

The defined indicators rates of temperament and personality functions of patients with AH mild and moderate cognitive impairments were different according to these criteria: desire to represent themselves in a "favorable light",

Pa – paranoia, Sc – schizoid, Ma – hypomania, D – depression, Pt – psychastenia, which proved more significant differences based on these data.

Assessment of intellectual, volition and imperative functions in patients with AH resulted in the following obtained data:

- conformity – non-conformity .....2,6;
- relaxation – tension .....2,2;
- emotional resilience – non-resilience .....2,0;
- straightforwardness – diplomacy .....1,9;
- self-confidence – anxiety .....1,8;
- restraint – expressiveness .....1,6;
- timidity – bravery .....1,5;
- trust – suspicion .....1,4.

Their upper rates in patients with AH were distinctive in conformity – non-conformity, emotional resilience – non-resilience, straightforwardness – diplomacy, self-confidence – anxiety, trust – suspicion, high-low level of self-control, practicality – developed attention that showed the necessity to study these indicators to detect mild and moderate cognitive impairments.

Having assessed the types of response to the disease in patients with AH, the most significant were apathetic (3,8), euphoric (2,9), melancholic (2,7), neurasthenic (2,5), sensitive (2,4), hypochondriac (2,2), anosognosic (1,8), egocentric (1,8), obsessive and phobic (1,3) types of attitude toward the disease (TATD). Their upper rates in patients with AH were different in apathetic, euphoric, melancholic, hypochondriac, anosognosic types that showed evident distinctions in patients with mild and moderate cognitive impairments.

Concerning attention as a cognitive function in patients with AH, differences were detected in work efficiency (4,4), attention capacity (2,5), Dynamic Index of Mental stability (1,8). Their upper rates in patients with AH of both groups were different in work efficiency, attention capacity, Dynamic Index of Mental stability, coefficient of attention asymmetry, selective attention that showed the necessity to study them to assess cognitive impairments differences.

As for the memory as a cognitive function in patients with AH, such indicators as short-term memory capacity (5,2), immediate memory (3,9), short-term voice and aural memory (3,1), logical memory (3,9), image memory (2,7). Upper rates of memory indicators in patients

with AH of both groups were different. Immediate memory, short-term voice and aural memory, logical memory, visual memory were identified as the most distinctive.

In the thought process the following indicators were of significant value: understanding logical connections of concepts (4,1), productive thinking (3,6), distinction of heterogeneous concepts (3,2), integral indicator of mental abilities (2,8), level of logical thinking (2,2). Upper rates of thought process indicators in patients with AH of both groups were different in integral indicator of general mental abilities.

Concerning emotional intelligence in patients with AH, the most significant were ability to understand emotions of others (2,0), ability to understand personal emotions (2,0), interpersonal emotional intelligence (1,6), understanding personal emotions (1,6), integral level of general emotional intelligence (1,5), intrapersonal emotional intelligence (1,2). Upper rates of emotional intelligence in patients with AH of both groups were different in understanding personal emotions and emotions of others, interpersonal, intrapersonal and integral level of emotional intelligence that indicates their significance in medical and social expertise.

Therefore, the most significant and informative cognitive functions in patients with AH based on the research are:

- short-term memory capacity ...5,2;
- desire to present oneself in “a favorable light” .....4,7;
- work efficiency .....4,4;
- Pa – paranoia .....4,3;
- ability to understand logical connections of concepts .....4,1;
- Sc – schizoid .....3,9;
- immediate memory (test 4) ....3,9;
- logical memory .....3,9;
- apathetic TATD .....3,8;
- immediate memory (test 3) .....3,6;
- productive thinking .....3,6;
- distinction of heterogeneous concepts .....3,2;
- image memory .....2,7.

Upper rates of all cognitive disability function indicators in patients with AH had considerable differences in the following aspects: desire to present oneself in “a favorable light”, work efficiency, Pa – paranoia, Sc – schizoid.

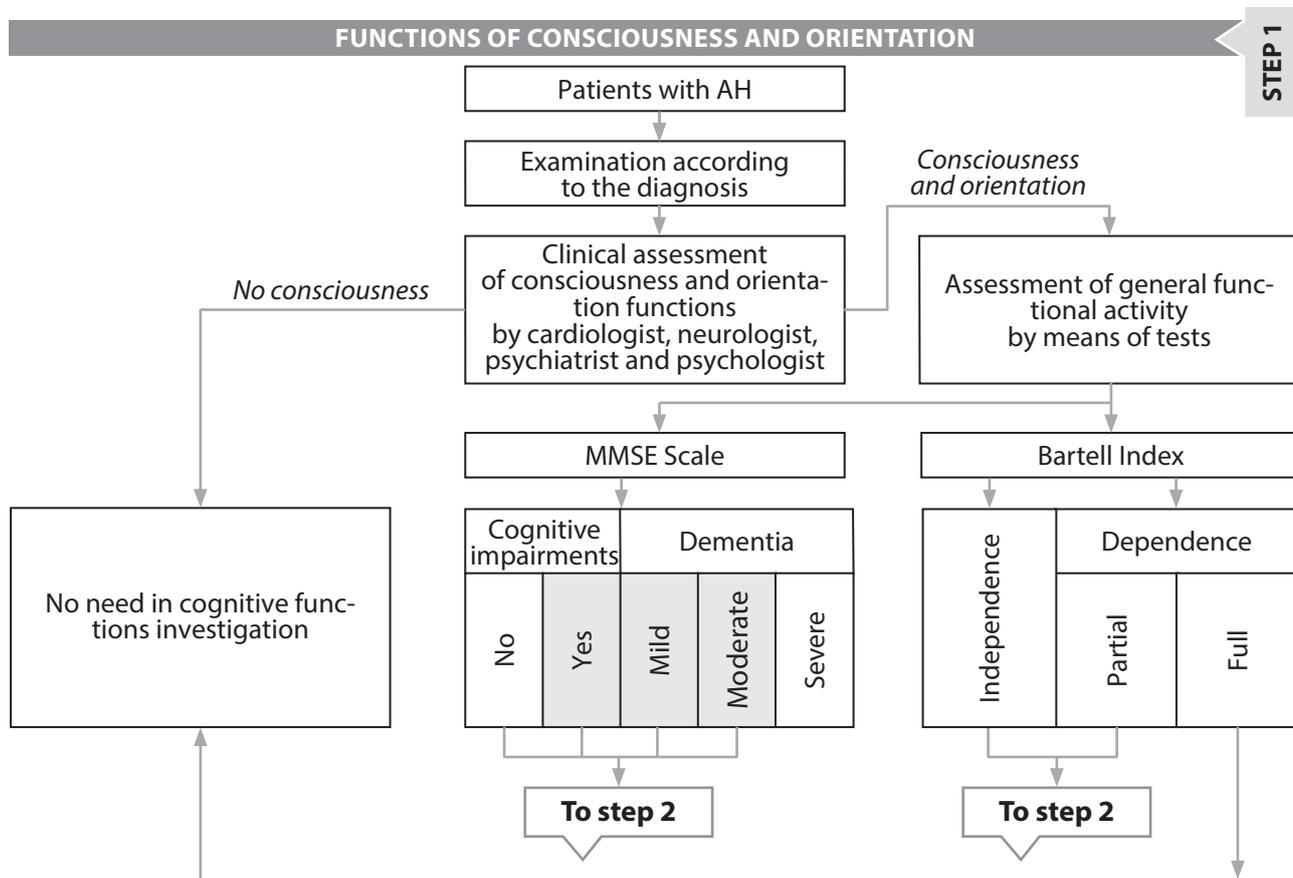
We have developed a step-by-step diagnostic algorithm to detect the nature and stage of cognitive impairment in patients with AH for medical and social expertise. It represents extended and express (highlighted in the grey text) versions, step-by-step nature and according to ICF the following assessment in patients with AH: functions of consciousness and orientation (**Step 1**), temperament and individual functions (**Step 2**), intellectual, volition and imperative functions (**Step 3**), global psychological and social functions (**Step 4**), memory (**Step 5**), thought process (**Step 6**) and attention (**Step 7**) (Fig. 1–7).

**Conclusions**

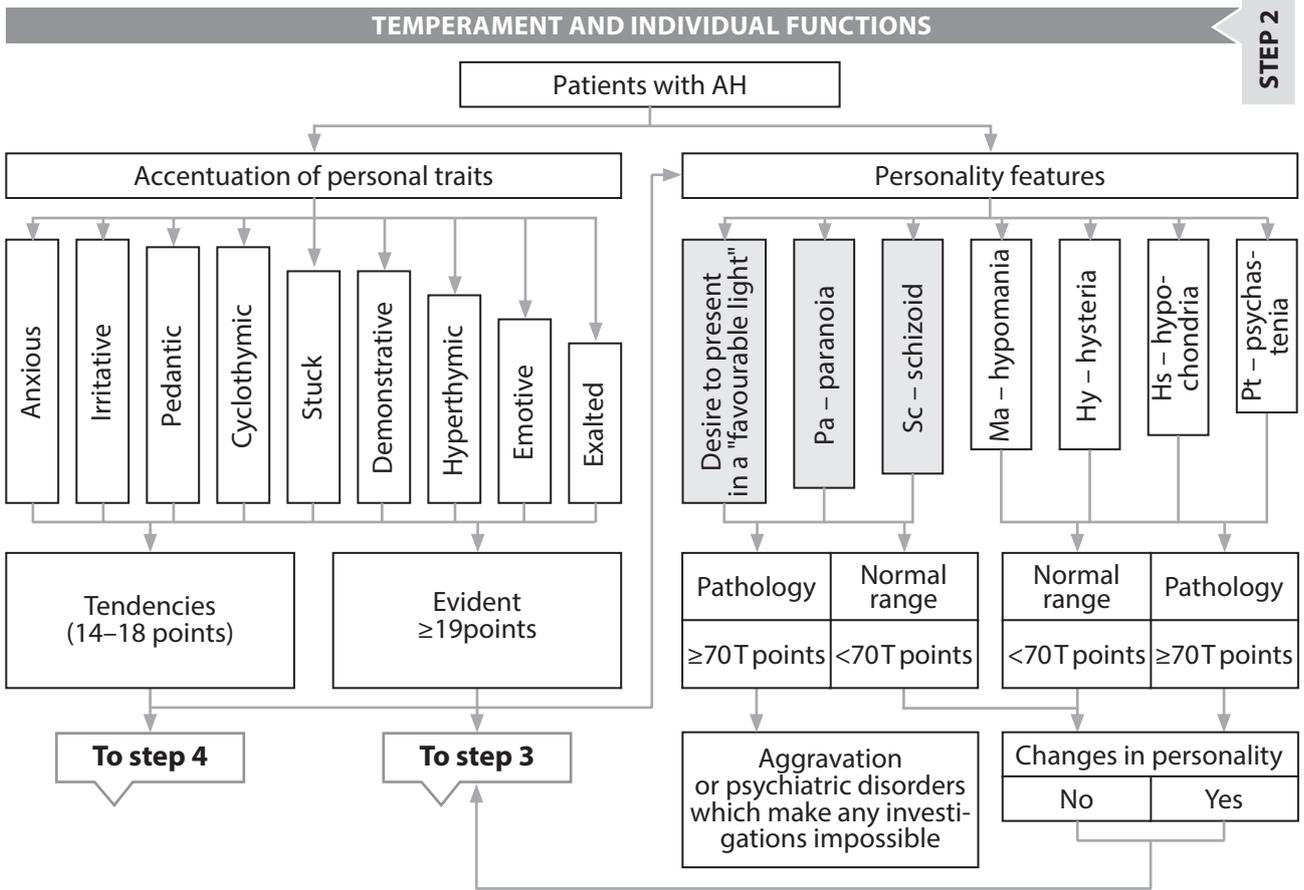
As a result of investigation and assessment of cognitive functions in patients with AH the following indicators of informative value were identified: in attention – work efficiency, dynamic attention capacity and index of attention fatigue; in memory – short-term memory capacity, short-term voice and aural memory, logical and image memory; in thought process – ability to understand logical connections of concepts, productive thinking, distinction of heterogeneous concepts, general mental

abilities and level of logical thinking; in emotional intelligence – ability to understand personal emotions and emotions of others, interpersonal, intrapersonal and integral level of emotional intelligence. The above mentioned impairments in patients with AH lead to certain limitations and disabilities in interpersonal relations, key life aspects, learning and knowledge application, self-care, household and mobility.

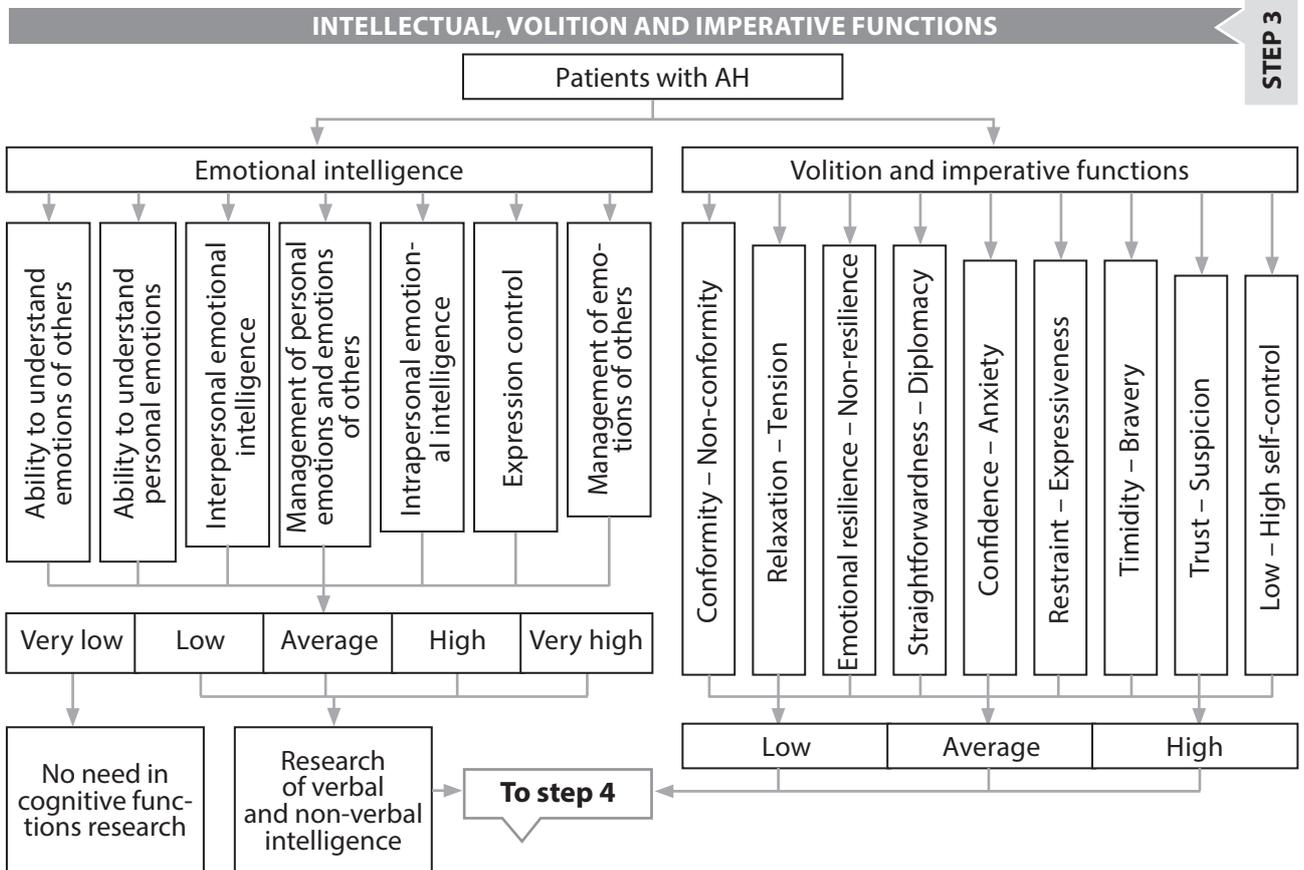
Investigation of personal and character traits, inner picture of disease and their interrelations, attention, memory, thought process, intelligence should be included into the examination standard in order to detect cognitive functions in medical and social expertise. The assessment of personality organization, as well as cognitive functions research contributes into specification of the nature and stage of psycho-emotional disorders. Investigation of personality organization (personal and character traits, internal picture of the disease) and cognitive functions (attention, memory, thought process, intelligence) is perspective and essential to detect psycho-emotional disorders in patients with AH. Therefore, such research in the practice of medical and social expertise in this pathology is obligatory.



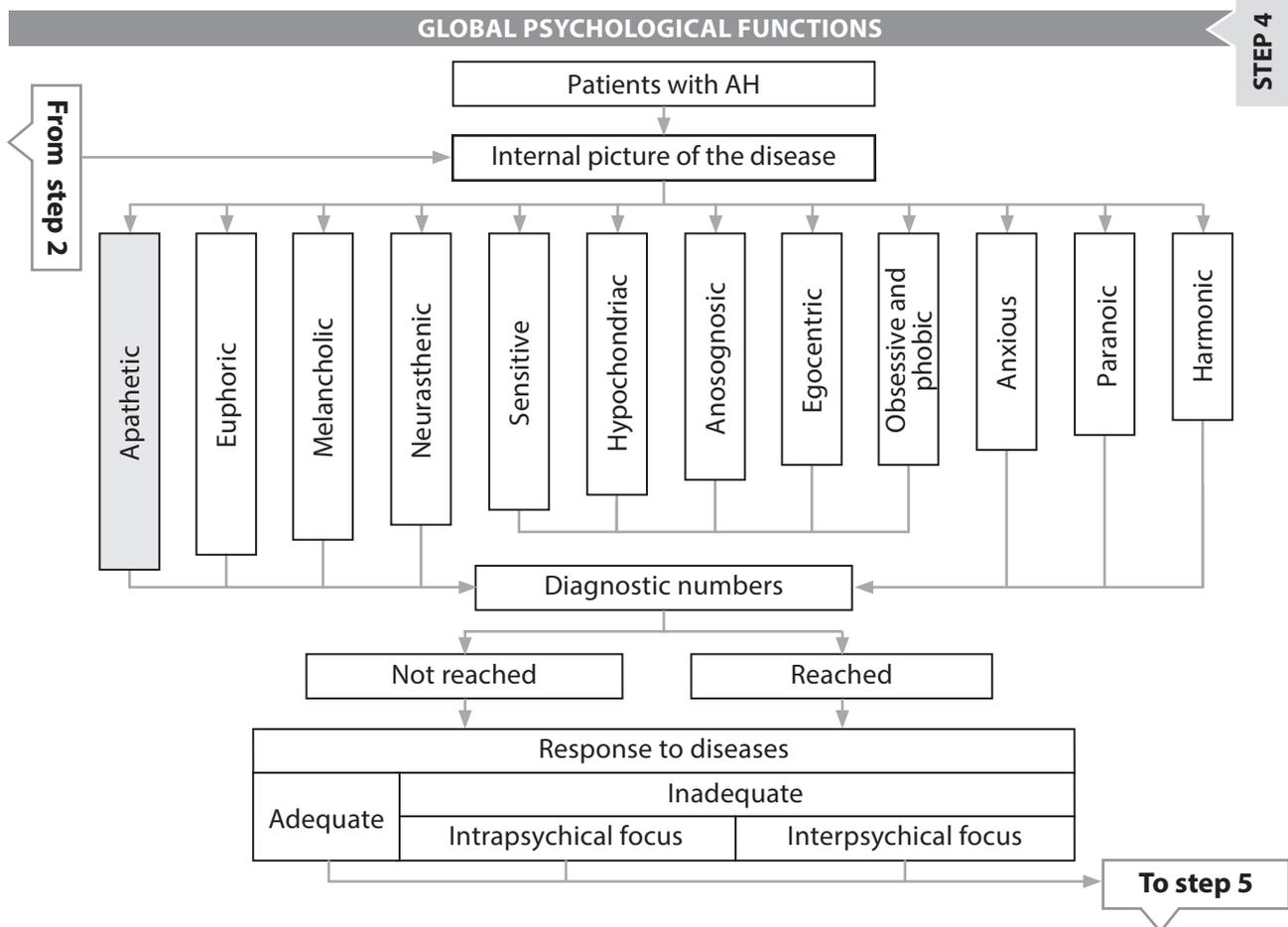
**Fig. 1.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with arterial hypertension



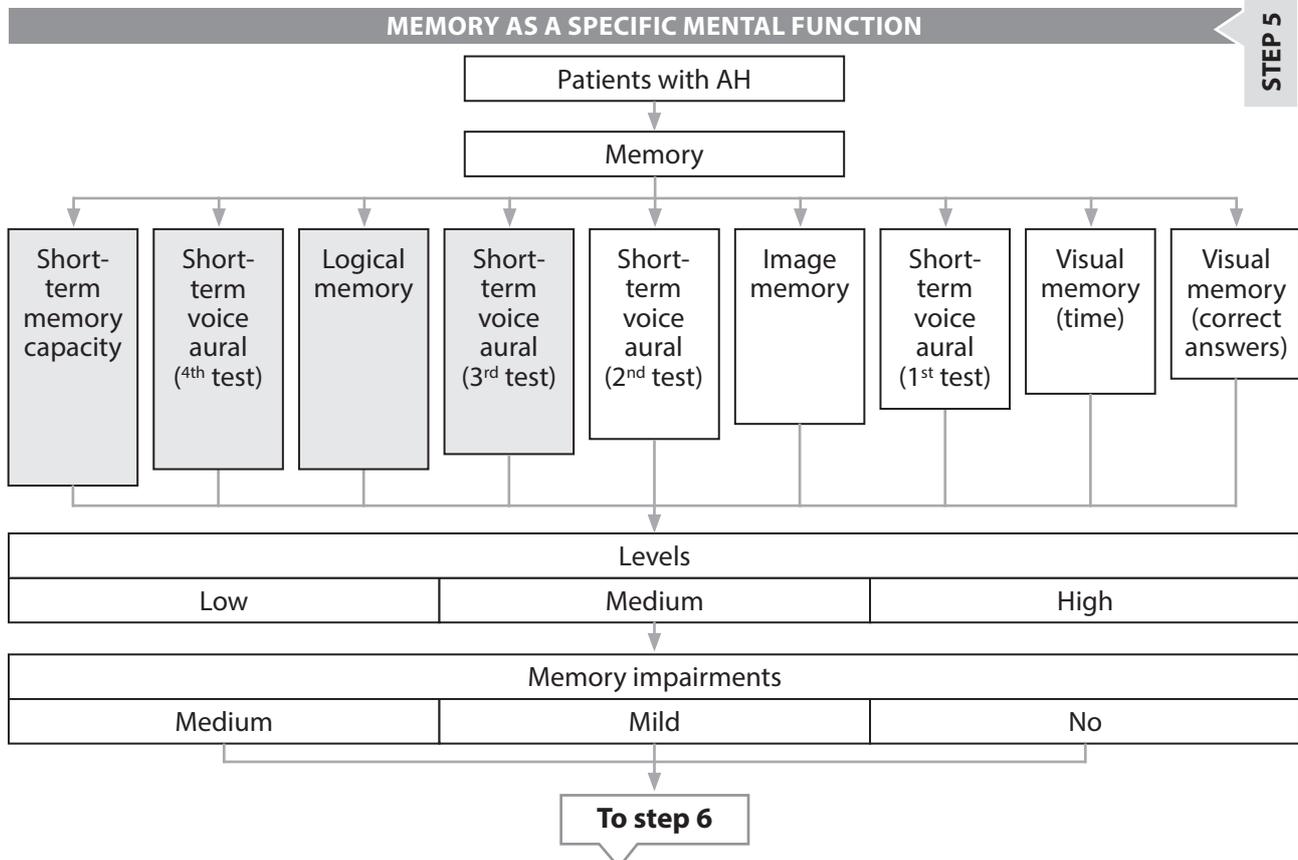
**Fig. 2.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH



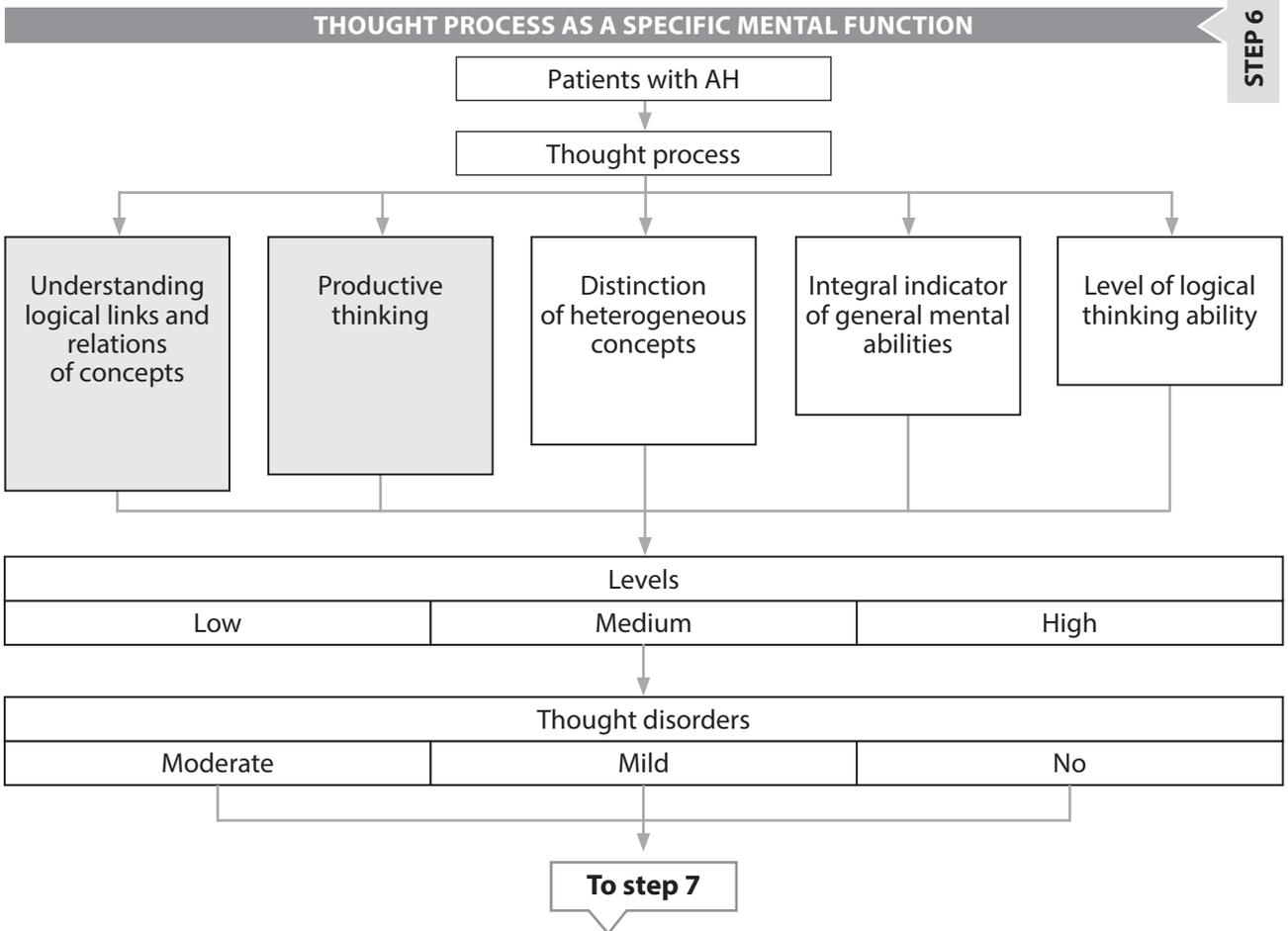
**Fig. 3.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH



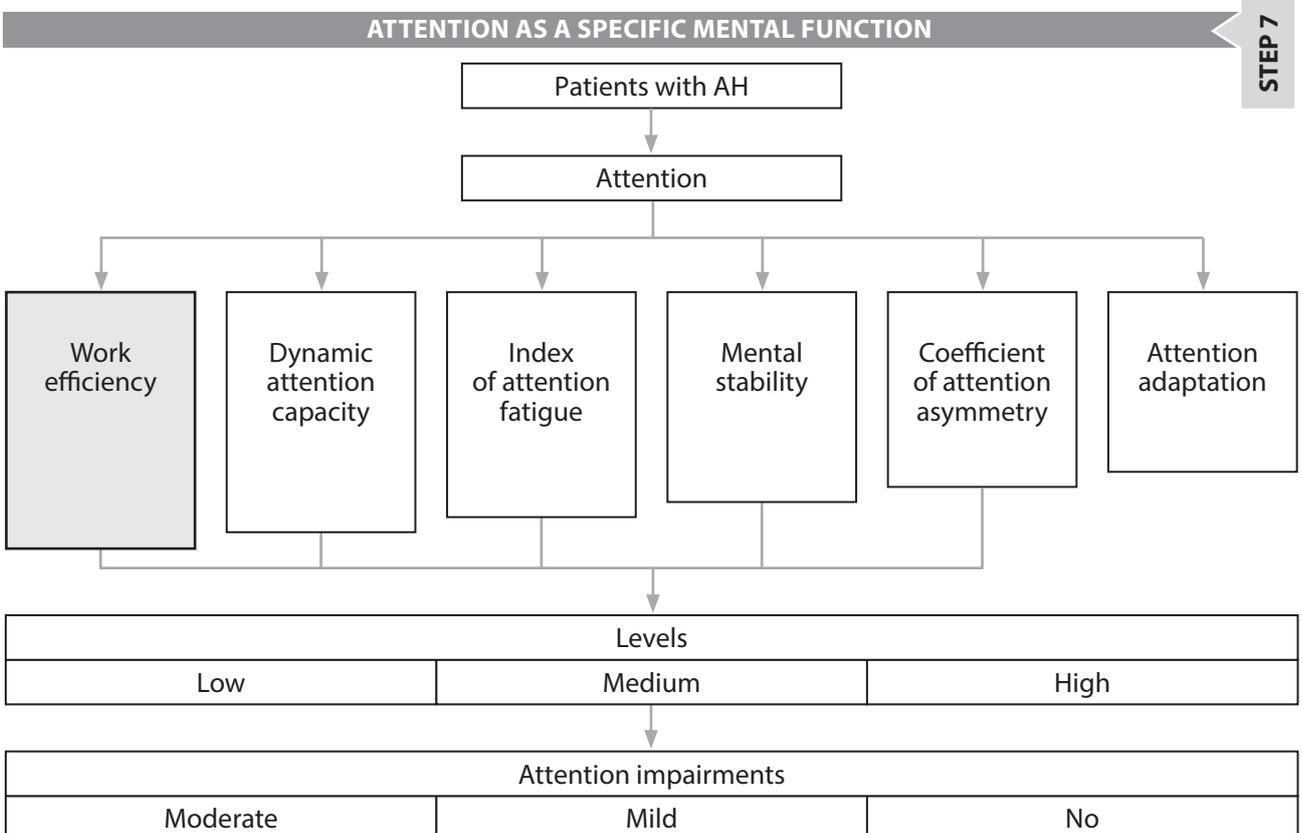
**Fig. 4.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH



**Fig. 5.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH



**Fig. 6.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH



**Fig. 7.** Diagnostic algorithm for detecting nature and stage of cognitive dysfunction in patients with AH

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