Original Paper

Association of Some Components of the Metabolic Syndrome with the Subtype of Mild Cognitive Impairment

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ABSTRACT: In the last 30 years there has been a long way in what concerns the ability to test and diagnose cognitive disorders. On the other hand, it is more and more obvious the necessity to discover new parameters, which can clearly witness the passage from the physiological state of aging to a cognitive impairment in various stages (ranging from mild cognitive impairment to severe dementia). Bringing together all the clinical, paraclinical and neuropsychological data trying to discover the missing link between metabolic disorders, chronic inflammatory changes, progression of atherosclerosis, and the appearance of cognitive disorders, remains an extremely attractive and challenging field of research. By this study, we observed that there is a slight supremacy of the amnestic-MCI in patients with metabolic syndrome, without being able to extract statistically significant data. The interesting data obtained in this study emphasized the connection between the triglycerides/HDL-cholesterol ratio and the presence of the amnestic-MCI subtypes in patients with metabolic syndrome. The data obtained led to the conclusion that an increase in diastolic blood pressure in older people is a prediction factor for cognitive decline.

KEYWORDS: *metabolic syndrome, mild cognitive impairment subtype, triglycerides/HDL-cholesterol ratio*

Introduction

In the last 30 years there has been a long way in what concerns the ability to test and diagnose cognitive disorders. There have been several attempts to find tests that can be used in the process of assessing patients with mild cognitive impairment (MCI), and in 2001 even a consensus of American Academy of Neurology was published, defining some essential parameters for supporting the diagnosis [1].

There were ranged some subcategories of cognitive affection according to certain cognitive domains [2].

At the same time, there appeared and developed the idea according to which some risk factors of cardiovascular diseases are also involved in the development of this type of pathology [3].

There are now some theories that try to prove that there is a connection between the progression of atherosclerosis and the occurrence of cognitive disorders [4].

On the other hand, the necessity to discover new parameters is more and more obvious, which can clearly witness the passage from the physiological state of aging to a cognitive impairment in various stages (ranging from mild cognitive impairment to severe dementia) [5].

Bringing together all the clinical, paraclinical and neuropsychological data trying to discover the missing link between metabolic disorders, chronic inflammatory changes, progression of atherosclerosis, and the appearance of cognitive disorders, remains an extremely attractive and challenging field of research.

Material and Method

The purpose of this study is to assess the correlations between some components of the metabolic syndrome and the subtypes of mild cognitive impairment. There were included in the study 40 patients with metabolic syndrome (21 men and 19 women) with ages between 61 and 81 years old. We obtained the written consent of patients and caregivers for tests. The metabolic syndrome diagnosis was established according to criteria defined by the 2009 Consensus of International Diabetes Federation Task Force on Epidemiology and Prevention, National Heart, Lung and Blood Institute, American Heart Association, World Heart Federation, International Atherosclerosis Society and International Association for the Study of Obesity [6]. According to this definition, the presence of at least 3 criteria out of 5 is necessary without abdominal obesity representing a mandatory criterion.

Table 1. Criteria for Clinical Diagnosis of the Metabolic Syndrome

Measure	Categorical Cut Points
Elevated waist circumference	>94cm men >80cm women
Elevated triglycerides (drug treatment for elevated triglycerides is an alternate indicator	>150mg/dL (1.7mmol/L)
Reduced HDL-C (drug treatment for reduced HDL-C is an alternate indicator	<40mg/dL (1.0mmol/L) in males; <50mg/dL (1.3mmol/L) in females
Elevated blood pressure (antihypertensive drug treatment in a patient with a history of hypertension is an alternate indicator)	Systolic >130 and/or Diastolic >85mm Hg
Elevated fasting glucose (drug treatment of elevated glucose is an alternate indicator)	>100mg/dL (5.6mmol/L)

The cognitive assessment of the patients was performed by using the Montreal Cognitive Assessment Test (MoCA) [7]. The results after the cognitive assessment of the patients were analysed using four cognitive domains: memory, attention, language, and the executive function.

Thus, the maximum score of 30 points of MoCA test was divided between four areas, as such: memory-9 points, attention-8 points, language-6 points and the executive function-7 points. Then we proceeded to classify cognitive deficits in two major categories: amnestic-MCI and non-amnestic-MCI. Each of the two categories was then subdivided according to the alteration of one cognitive domain, respectively, affecting several cognitive domains, thus resulting four different entities. The results were:

Type I: amnestic-MCI with unique affected domain (memory)

Type II: amnestic-MCI with multiple affected domains (memory plus at least one of the other three)

Type III: non-amnestic-MCI with one affected domain (any of three less memory)

Type IV: non-amnestic-MCI with multiple affected domains (any combination of three cognitive domains, apart from memory).

The statistic analysis was possible using the software dedicated to scientific statistical calculations Epi Info2000 and SPSS.

We calculated and statistically proceded using Fisher's exact test for assessing the significance of differences in contingency tables, Pearson correlation coefficient, chi-square test (χ^2); p-values up to 0.05 were considered statistically significant.

Even if the results of this study are not of a high value, the practical value of the findings must not be ignored. Thus, the results can be statistically significant, significant in the practical perspective, more precisely in the clinical perspective.

Results

Regarding the results obtained in case of the patients with metabolic syndrome, we noticed that most of them experienced cognitive impairment of the amnestic type with multiple affected domains, followed by those that had amnestic-MCI with unique affected domain, then by those experiencing non-amnestic-MCI with multiple affected domains. The last category showed the patients with non-amnestic-MCI with one affected domain.

Table 2. Distribution of patients according to the cognitive impairment subtypes

	amnestic-MCI		non-amnestic-MCI		Total	
	No.	**%**	No.	**%**	No.	**%**
unique affected domain	10	25%	5	12.5%	15	*37.5%*
multiple affected domains	18	45%	7	17.5%	25	*62.5%*
Total	**28**	*70%*	**12**	*30%*	**40**	*100%*

Regarding the four cognitive domains studied, the results showed that the most affected area is the memory, followed, with relatively close relative values, by the other three areas: attention, execution and language, these data being represented in Fig.1.

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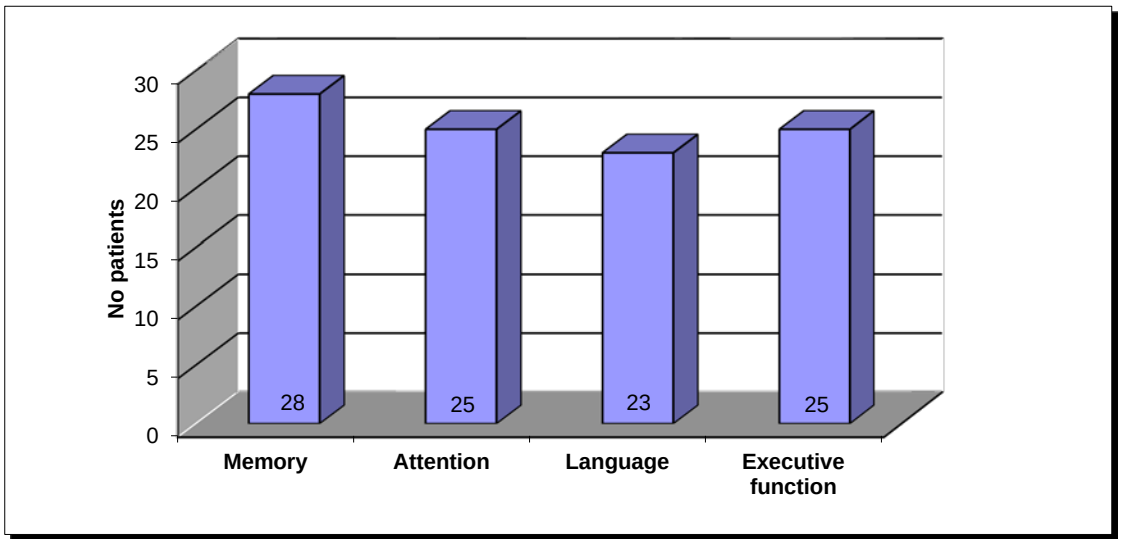

Fig.1. Distribution of patients according to the cognitive domains

In type I cognitive impairment we noticed a good correlation between the increase of triglycerides and high blood pressure, which resulted in memory impairment. (r=0.49).

Among the individual components of the metabolic syndrome, the decrease HDL-cholesterol and the increase of glycemia were correlated with type II (amnestic-MCI with multiple affected domains) (r=0,40).

Also, the high diastolic blood pressure, the increase of triglycerides and the increase of glycemia were associated to the type III cognitive impairment (non-amnestic-MCI with single affected domain) (r=0,61).

Concerning type IV (non-amnestic-MCI with multiple affected domains) there was a strong correlation with the increasing of the abdominal circumference and high diastolic blood pressure.

Analyzing the association between the triglyceride/HDL-cholesterol ratio and the type of cognitive impairment using the chi-square test, as shown in Table 3, we obtained results with statistical significance between the two MCI subtypes ($p < 0.05$).

Table 3. Association between ratio TG/HDL and cognitive impairment subtypes

	ratio TG/HDL < 4,5	ratio TG/HDL > 4.5
Type I + Type II (a-MCI)	10	18
Type III + Type IV (na-MCI)	9	3
chi-square: 5.19 ($p<0.05$)		

Discussions

Throughout this study we noticed that there is a slight supremacy of the amnestic-MCI in patients with metabolic syndrome, without being able to extract any statistically significant data.

In literature, there are data confirming an association between the components of the metabolic syndrome and certain subtypes of mild cognitive impairment [8,9].

The interesting data obtained in this study emphasized the connection between the triglycerides/HDL-cholesterol ratio and the presence of the amnestic-MCI subtype in patients with metabolic syndrome.

In a study published in 2016 there is a description of the correlation between cognitive profiles with high blood pressure [10].

Likewise, there were reported data, which suggest a significant relationship between the cumulative effect of metabolic disorders and the impairment of certain cognitive functions [11,12].

According to the four cognitive domains studied, the results showed that in patients with metabolic syndrome the most affected area is the memory but the other cognitive domains were affected in almost the same way. Among the types of MCI, type II (amnestic-MCI with multiple affected domains) is the most frequently met.

There have been described the connection between cardiovascular diseases and the stroke with the non-amnestic-MCI type II, while neurodegenerative diseases were connected to amnestic-MCI type II [13,14].

Conclusions

1. Apart from the five classic parameters of the metabolic syndrome, we tried to use a composed parameter (triglycerides/HDL cholesterol ratio) in order to see if there is a better association of this one to the subtypes of cognitive impairment.

2. The data obtained led to the conclusion that an increase in diastolic blood pressure in older people is a prediction factor for cognitive decline.

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