

Diagnosis Of Endothelial Dysfunction In Children With Neurocirculatory Dystonia: Test With Reactive Hyperemia

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Abstract. The article examines the role of nitric oxide in the regulation of peripheral vascular tone in children with neurocirculatory dystonia. When using a functional test with reactive hyperemia, its high diagnostic significance was revealed; a decrease in the formation of nitric oxide in the vascular endothelium (endothelial dysfunction) was established in children with neurocirculatory dystonia ($p < 0.001$).

Keywords: nitric oxide, neurocirculatory dystonia, endothelial dysfunction, reactive hyperemia, children, functional test.

Introduction

Over the past decade, ideas about the biological role of the endothelium in the body have been radically revised. The understanding of the vasoactive properties of the endothelium has undergone particularly significant changes in connection with the discovery of the pronounced vasodilatory properties of nitric oxide (NO), formed in endotheliocytes. A new term is firmly introduced into clinical practice – endothelial dysfunction. It is understood as short-term or persistent potentially reversible disturbances in the phenotypic properties of the endothelium [1]. Most often, the term is used in the narrow sense of the word to describe NO synthase deficiency of the vascular endothelium, which is clinically manifested by symptoms of vasoconstriction [2].

Materials And Methods

Data from modern fundamental and clinical medicine indicate that in neurocirculatory dystonia, one of the most likely places of damage to the body is the endothelium of the vascular wall. It has been established that endothelial dysfunction is formed both in the vessels of the heart and in systemic vessels [2] with active and passive smoking, hypercholesterolemia, stress, physical inactivity, atherosclerosis, coronary heart disease, hypertension [3]. It has long been undisputed that the origins of atherosclerosis and coronary heart disease in adults should be sought in childhood, and the study of this severe pathology should become a pediatric problem [4]. In the structure of morbidity among children in recent years, the share of cardiovascular diseases of non-rheumatic origin has increased significantly. According to mass surveys, arterial hypertension was detected in 2.4-18% of children and adolescents [1], and various types of dyslipidemia, as a risk factor for coronary artery disease, were found in 19-27% of children and adolescents [4]. Neurocirculatory dystonia is widespread in all age groups. During screening examinations, neurocirculatory dystonia is found in 20-30% of children, 31% of students, 15-25% of patients in polyclinics, 17-35% of patients in cardiological consultation centers and 32-50% of cases in general. structure of cardiovascular diseases [5].

In 53 healthy children and 111 children with neurocirculatory dystonia of both sexes aged 8-15 years, endothelium-dependent dilatation of forearm vessels was studied by studying the increase in pulse blood flow in the forearm in the first 2 minutes after a 4-minute occlusion of arterial blood - shoulder current. In all children, the preservation of the endothelium of the independent myogenic mechanism of vasodilation was monitored. For this purpose, the increase in pulse blood flow in the forearm was studied under initial conditions and at 3 and 6 minutes after taking nitroglycerin (0.1 mg/kg sublingually). Pulse blood flow in the forearm was assessed rheographically using a rheoanalyzer RA5-01. An increase in pulse blood flow in the forearm after reocclusion of the arterial blood flow of the shoulder by 10% and after taking nitroglycerin by 19% or more was considered normal [2]. The results obtained were processed statistically using Student's t-test.

Results And Discussion

As a result of the studies, it was established that in healthy children, endothelium-dependent vascular dilatation was preserved both in the first (increase in pulse blood flow in the forearm - $27.8 \pm 2.81\%$, $P < 0.001$)

and in the second minutes of reocclusion of the arterial blood flow of the shoulder (increase in pulse blood flow in the forearm - $33.4 \pm 3.13\%$, $P < 0.001$).

In children with neurocirculatory dystonia, the increase in pulse blood flow in the forearm after reocclusion of the arterial blood flow of the shoulder at 1 minute was lower than the normative values, but was higher than the initial data by $8.7 \pm 2.23\%$ ($P < 0.001$), while At 2 minutes it was within the physiological norm ($17.4 \pm 3.28\%$) and was also higher than the initial data ($P < 0.001$). At 1 and 2 minutes, pulse blood flow in the forearm after reocclusion of the arterial blood flow of the shoulder in healthy children was higher than in children with neurocirculatory dystonia ($P < 0.001$).

In healthy children, pulse blood flow in the forearm in response to nitroglycerin compared to the initial data at 3 minutes and 6 minutes increased, respectively, by $60.7 \pm 4.05\%$ and $56.9 \pm 4.19\%$ ($P < 0.001$). The increase in pulse blood flow in the forearm in children with neurocirculatory dystonia at 3 minutes and 6 minutes after taking nitroglycerin, respectively, was $45.1 \pm 4.13\%$ and $61.2 \pm 5.01\%$ ($P < 0.001$). At 3 minutes, the increase in pulse blood flow in the forearm after taking nitroglycerin in healthy children was higher (Table 2) than in the group of children with neurocirculatory dystonia ($P < 0.05$).

It should be noted that in both groups of subjects, an increase in pulse blood flow in the forearm in response to taking nitroglycerin was found to be higher than 19%, which indicates the preservation of endothelium-independent vascular dilatation in them.

Based on the data obtained, it was established that endothelium-dependent vascular dilatation in response to reocclusion was preserved completely in the early (up to 1 minute) and late (up to 2 minutes) periods in the group of healthy children and partially (only at 2 minutes) in children with neurocirculatory disorders. dystonia.

Considering the fact that the increase in pulse blood flow in the forearm in children with neurocirculatory dystonia in response to reocclusion of the arterial blood flow of the shoulder was lower than in healthy children, we carried out a thorough individual analysis of its dynamics in group II of children [5]. In 45% of children with neurocirculatory dystonia, pulse blood flow in the forearm at 1 and 2 minutes after reocclusion of the arterial blood flow of the shoulder increased by 10% or less, compared with the initial data ($p > 0.05$). We interpreted this fact as a sign of NO-dependent endothelial dysfunction, since the vascular reaction in children in response to taking nitroglycerin indicated the preservation of the endothelium-independent mechanism of vasodilation. Thus, the vascular response we identified to post-ischemic hypoxia in this subgroup of children with neurocirculatory dystonia was considered pathological with a predominance of vasoconstriction processes. In 55% of children with neurocirculatory dystonia, a physiologically adequate vascular response to occlusion was observed.

Considering its general availability and non-invasiveness, the brachial artery occlusion test in combination with rheographic assessment of blood flow in the forearm has become widespread as a screening method for diagnosing endothelial dysfunction in clinical practice and allows for an objective assessment of NO synthase activity of the vascular endothelium in children [6].

Conclusion

1. The results of the test with post-occlusive reactive hyperemia and the test with nitroglycerin indicate that in the group of healthy children we examined, endothelium-dependent dilation of systemic vessels corresponds to the physiological norm. In the group of children with neurocirculatory dystonia, endothelium-dependent dilatation of systemic vessels was below the normative values only at 1 minute and lower than in the group of healthy children at 1 and 2 minutes after reocclusion of the arterial blood flow of the shoulder.

2. Endothelial dysfunction was diagnosed in 45.0% of children with neurocirculatory dystonia. It is assumed that a transient deficiency of NO synthesis precursors and/or a transient inhibition of endothelial NO synthase activity may be important in its genesis. The data obtained indicate the high diagnostic significance of the test with post-occlusion reactive hyperemia in the diagnosis of endothelial dysfunction in children with neurocirculatory dystonia.

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