

Maria PILARCZYK

**The Effect of Intravenous Loading with Glucose on Inorganic Phosphorus  
and Lipids-Bound Phosphorus Content in the Patients with Transient  
Brain Ischaemia**

Wpływ dożylnego obciążenia glukozą na zawartość fosforu nieorganicznego i fosforu związanego z lipidami u chorych z przemijającym niedokrwieniem mózgu

Nervous tissue is especially rich in phosphorus compounds, mainly represented by phospholipids, cerebrosides, gangliosides and phosphates. Well-known are the elaborations concerning the occurrence of disturbances in carbohydrate metabolism in the patients with different forms of cerebral stroke.

Phosphorus coming from different sources is actively involved in glucose metabolism (4), therefore it is essential to determine the interdependence between what happens to this element in the patients with acute vascular brain injury and transient hyperglycaemia in the course of this disease.

Our own investigations aimed at determining the effect of glucose introduced to the organism of patients with transient circulatory cerebral insufficiency, which is quite often practised for therapeutic reasons, on the concentration of inorganic and lipid phosphorus in the blood of these patients.

**MATERIAL AND METHODS**

The control group consisted of 25 healthy persons, and the group of patients with acute, transient circulatory cerebral insufficiency, of 20 persons.

Determination of inorganic and lipid concentration was performed on an empty stomach as well as in the 4th, 34th, 64th and 124th min from the ending of loading with glucose. 60 ml of 40% glucose solution has been applied intravenously for 4 min. In the control group the glucose loading test as well as all other examinations were carried out only once, whereas in the patients — in the 1st, 3rd, 7th and 14th 24 hrs of the disease.

Determinations of inorganic phosphorus were performed by means of the Fisk-Subarow's method in Śliwińska's modification and, of lipid phosphorus — by means of the Hochmeyer and Fried's method, the results of investigations were subject to the statistical analysis.

## RESULTS OF EXAMINATIONS

Before carrying out the loading with glucose the concentration of inorganic phosphorus in the blood of controlled persons was 3.5 mg% on the average. In the 4th, 34th, 64th and 124th min of the loading test the level of the examined element in the blood lowered and it was random ( $p > 0.05$ ).

The average content of lipid phosphorus in the blood before loading with glucose in the control group was within the scope of values given in the literature as normal. In the 4th, 34th, 64th and 124th min of loading with glucose the average initial concentration decreased successively by: 0.2, 0.4, 0.3, and 0.5 mg% statistically insignificantly ( $p > 0.05$ ).

In order to estimate the effect of intravenous application of glucose on the behaviour of the level of inorganic phosphorus and lipid phosphorus an analysis of correlation was made between the content of phosphorus and concentration of glucose in the blood in the particular stages of the loading test. In the control group the values of the examined correlation coefficient between glucose concentration and the content of inorganic phosphorus in the blood oscillated between 0.09 and 0.12; between glucose concentration and content of lipid phosphorus in the blood — between  $-0.2$  and  $0.2$  and were statistically insignificant ( $p > 0.05$ ).

In the patients with transient brain ischaemia in the 1st 24 hrs before loading with glucose and just after loading, the concentration of inorganic phosphorus and lipid phosphorus in the blood of all the patients were within the scope of control concentrations and differed from them statistically insignificantly ( $p > 0.05$ ), the average levels of lipid phosphorus were, successively: 9.5, 9.7, 10.8, 10.7, 10.6 mg% and differed from respective control concentrations statistically randomly ( $p > 0.05$ ).

The value of the examined correlation coefficient between the concentrations of inorganic phosphorus and the content of glucose on an empty stomach in the 1st 24 hrs of the disease was 0.46; it was proved that the examined correlation occurs statistically significantly ( $p > 0.05$ ).

After introducing the load in all the above-mentioned points of time of the test, the values of the examined coefficient of correlation between the content of glucose and concentration of inorganic phosphorus ranged from  $-0.33$  to  $0.14$ . The statistical analysis has proved that the examined correlations occur statistically insignificantly ( $p > 0.05$ ).

The values of coefficient of correlation between the concentrations of inorganic phosphorus and content of glucose in the blood of this group of patients in the 3rd, 7th and 14th 24 hrs of the clinical observation fluctuated between  $-0.05$  and  $0.14$  statistically insignificantly as regards the statistic aspect ( $p > 0.05$ ).

The value of coefficient of correlation between the concentrations of lipid phosphorus and glucose before loading in the 1st 24 hrs of the disease was 0.30,

whereas after loading with glucose in all points of time of the loading test the values of correlation coefficient oscillated from 0.24 to 0.36. It was proved that the examined correlations occur statistically insignificantly ( $p > 0.05$ ).

The values of correlation coefficient between the concentrations of lipid phosphorus and content of glucose in the blood of patients with transient brain ischaemia in the 3rd, 7th and 14th 24 hrs of the clinical observation ranged from  $-0.02$  to  $0.28$ . The statistical analysis proved that only in the 124th min of the loading test in the 7th 24 hrs of the disease was revealed a statistically significant dependence between the concentration of glucose and lipid phosphorus in the blood of the patients. However, in the remaining points of time of determinations in the 3rd, 7th and 14th 24 hrs of the clinical observation the relation between the examined substrates occurred to be random statistically ( $p > 0.05$ ).

## DISCUSSION

The occurrence of hyperglycaemia in response to the stress stimulus is a commonly known and understandable phenomenon. The causes of the occurring changes are perceived in the activation of the sympathetic system and stimulation of adrenal glands.

It was proved throughout the last 30 years that transient hyperglycaemia and glucosuria occur in brain injury of vascular origin. The examination carried out by Abdułłajew (1), Borisenko (2), Kawiak (3), Wenclewski and Wender (5) allowed to a large degree to get acquainted with the essence of disturbances in metabolism of some substrates, specially carbohydrates, in the patients with vascular brain pathology.

The transient brain ischaemia, which most often develops as a result of disturbances in interrelations between vascular resistance, blood pressure and quantity of blood passing through cerebral vessels, is undoubtedly acute pathology, which also leads, especially in the initial part of the disease, to the limited in time disturbances in carbohydrate metabolism.

Although phosphorus, coming from different sources, is actively involved in glucose metabolism, no permanent and significant dependence was found between what happens to this element in the patients with transient brain ischaemia and short-lasting hyperglycaemia occurring under the influence of loading with glucose.

## Conclusions

1. In the patients with transient brain ischaemia the concentration of inorganic and lipid phosphorus in the blood increases statistically insignificantly in single patients.

2. Most of the patients with transient brain ischaemia show a distinct instability of phosphorus metabolism in comparison with healthy persons.

3. The instability of phosphorus metabolism occurring in the patients with transient brain ischaemia can be regarded as metabolic anomaly, as a consequence of central disregulation of the metabolism.

#### REFERENCES

1. Абдуллаев Р. А.: К вопросу об углеводной функции печени при мозговом инсульте. Журн. невропат. псих. 4, 446, 1959.
2. Борисенко Р.: Химические изменения крови при острых нарушениях мозгового кровообращения и их клинические значения. Журн. невропат. псих. 4, 452, 1959.
3. Kawiak W. et al.: Zawartość fosforu lipidowego w surowicy krwi u chorych z udarem mózgu. Neur. Neurochir. Pol. 3, 365, 1972.
4. Michell R. H.: Phospholipids in the Nervous System. Vol. 1: Metabolism, Ed. L. Horrocks et al., Raven Press, New York 1982.
5. Wender M. et al.: Zaburzenia metaboliczne w udarach mózgu. Neur. Neurochir. Psychiatr. Pol. 2, 169, 1961.

Otrzymano 1993.10.25.

#### STRESZCZENIE

Badano wpływ glukozy na zawartość fosforu nieorganicznego i fosforu lipidowego u 20 pacjentów z przemijającym niedokrwieniem mózgu. Uzyskane wyniki porównano z tymi, które stwierdzono w grupie kontrolnej. U chorych z przemijającym niedokrwieniem mózgu występuje wzrost stężenia fosforu nieorganicznego i lipidowego we krwi, ale tylko u pojedynczych pacjentów i w sposób statystycznie nieistotny. Przemijająca hiperglikemia nie wywiera istotnego wpływu na zawartość fosforu nieorganicznego i lipidowego w surowicy krwi chorych z przemijającym niedokrwieniem mózgu.