

Katedra i Klinika Neurologii. Akademia Medyczna w Lublinie
Kierownik: prof. dr hab. n. med. Wiesław Kawiak

Wiesław KAWIAK, Maria PILARCZYK,
Barbara CHMIELEWSKA, Adela GIERACZ-NAZAR

The Effect of Piracetam on the Content of Glucose in the Blood of Patients with Cerebral Infarction at the Very Early Stage of the Illness

Wpływ piracetamu na zachowanie się glukozy we krwi chorych z zawałem mózgu
w najwcześniejszym okresie choroby

Piracetam as a medicine was studied in 1963 in the Pharmaceutical Laboratories UCB (Brussels) and it is registered under the code number UCB 6215. Piracetam is known under the trade name Nootropil.

The curative value of the specimen was evaluated on the basis of a considerable number of clinical tests. The efficacy of the discussed specimen is connected with the activation of the energetic potential of the brain, achieved by the improvement of the metabolism of the nerve cell, mainly by means of intensive utilization of circulating glucose and accelerated synthesis of ATP. In consequence of the improvement of the metabolic process, Nootropil activates brain cells, protecting them from the results of anoxaemia by the utilization of oxygen and glucose (1, 2).

The cerebral infarction can change the activity of the central vegetative neurons and induce generalized disturbances of the mechanism of metabolism.

It is known that in the sick with cerebral infarction with serious or semi-serious evolution of the illness the instability of carbohydrate economy occurs, and one can also observe a fundamental increase of the glucose content in blood (5).

The aim of the present paper was to estimate the influence of Nootropil on the content of glucose in the blood of patients with cerebral infarction.

MATERIAL AND METHODS

Examinations were carried out on 20 patients with cerebral infarction aged from 58 to 82 years (average age 69). Diagnosis was based on widely accepted criteria.

The control group consisted of 20 persons with radicular syndroms in the period of remission. Their age ranged from 56 to 85 years (average age 66). The age of the control grup was similar to that of patients examined.

Blood samples for determination of glucose were taken from the ulnar vein with the patient on an empty stomach and on the 1st, 2nd, 3rd and 4th hr after intravenous applying of Nootropil. The examinations were made on the 1st, 3rd, 7th and 14th day of illness.

The concentration of glucose in the blood serum was estimated by means of the standard sets of Bio-La-Test made by Lachema. Extinction values were read on the Specol type spectrophotometer at the wave length of 630 m μ . The results of the determinations were compared with those obtained in the control group.

RESULTS

The determination of the content of glucose in the blood of the control group was made to test the methods under laboratory conditions and to exclude any deviation due to the physiology of advanced age. Both the dispersion of the control values and that of the average content of glucose in the blood serum of the control group proved to be in agreement with the values considered to be correct in the literature.

One hour after applying Nootropil the average concentration of glucose in blood of the control people increased by 4 mg%. This difference was statistically insignificant ($p > 0.05$). After the 2nd, 3rd and 4th hr, the concentration of glucose increased respectively by: 5.0, 8.0 and 8.0 mg% in the statistically significant way ($p < 0.05$).

In 15 patients with cerebral infarction, on the 1st day of illness on an empty stomach, the concentration of glucose in blood exceeded the biggest control concentration and this increase was statistically significant ($p < 0.001$).

After the application of Nootropil, on the 1st day of illness, beginning with the 1st hr of the examination, one could observe systematic increase of average glucose concentrations in the blood of patients ill from cerebral infarction. In the 4th hr of the test the increase of glucose concentration was 44.0 mg% and appeared to be statistically significant ($p < 0.0001$). During the 3rd and 7th day of illness on an empty stomach in 12 patients with cerebral infarction the concentration of glucose in blood exceeded the biggest control concentration. During the 14th day of illness, before the application of the medicine, 2 patients had the glucose concentration corresponding to the smallest control concentration. The average concentration of glucose in the blood of patients on the 3rd and, 7th day of illness was bigger than corresponding to them average control concentration, respectively, by: 23.0, 15.0 and 16.0 mg%. All the differences were statistically significant ($p < 0.05$).

During the 3rd and 7th of illness after application of Nootropil in the 4th hr of the examination, 2 patients ill from cerebral infarction had the glucose concentration smaller than corresponding to them control concentration. During the 14th day of illness such a situation could be observed with 4 patients, during the 3rd day of illness 14 patients ill from cerebral infarction had the

concentration of glucose in blood exceeding the biggest control concentration, during the 7th and 14th day — 10 patients. The average glucose concentration during the 3rd, 7th and 14th day of illness, 4 hr after applying Nootropil was, respectively: 106.0, 98.0 and 94.0 mg%, and its values were bigger than corresponding to them values of control concentration respectively by: 30.0, 22.0 and 22.0 mg%. All the differences were statistically significant ($p < 0.05$).

Comparing the average content of glucose in blood of the ill from the cerebral infarction, on an empty stomach and in the 4th hr after application of Nootropil, during particular days of illness, it occurred that during the 1st day the difference of the average results was 14.0 mg%, during the 3rd day — 15.0 mg%, during the 7th day — 15.0 mg%, and during 14th day — 10.0 mg%. All the differences were statistically significant ($p < 0.05$).

DISCUSSION

Specific studies proved that single application of 2 g of piracetam caused in healthy people the increase of glycaemia, not exceeding the range of average physiological values and appearing 2 hrs after the medicine application.

In the ill from cerebral infarction in whom initially hyperglycaemia was found the greater the earlier stage of the illness was, the application of piracetam made it intensify immediately after the application. The biggest differences were found in the patients at the initial (3rd day) and a little advanced (7th day) stage of infarct.

There is news proving that application of piracetam in the therapy of strokes decreases the risk of death and shortens the period of coma in severe cases (3).

The mechanism of the influence of piracetam on the nerve cells is multidirectional. In pathological cases resulting from ischaemia particularly important seems to be the activity of piracetam as a regulator of cells metabolism. The medicine facilitates assimilation of glucose and synthesis of ATP in the nerve cell (2), which leads to the improvement of a function, lessens the risk of damage of neurons in harmful circumstances and facilitates the restoration of lost activity. The observations carried out in the patients with severe brain damages caused by ischaemia or anoxaemia proved the described properties of piracetam (6).

Interpreting the results of specific studies, according to the assignments referring to the way piracetam acts, one should assume that observed hyperglycaemia of the circular blood is the answer to an increased, under the influence of the medicine, vanishing of glucose from the blood providing neurons OUN. This increased local loss of glucose may initiate reactions responsible for the maintenance of the appropriate level of carbohydrate economy.

The acting of the medicine revealed in the control people is consistent with the observation that an increased derivation of glucose by neurons happens not only

in the states of metabolic disregulation but also in the situations demanding their greater activity (1, 4, 6). Stress connected with vein infusion can be an activating factor. Explicitly greater reaction of hyperglycaemia of blood circular in the group of the ill with cerebral infarctum may be treated as the answer to proportionally greater derivation of glucose by damaged neurons of the infarct centre. It was found that the more strongly piracetam increases the use of glucose, the bigger is the loss of energetic nerve cells (1). It was estimated in the specific studies that the influence of piracetam on glycaemia in the patients at their initial period of brain infarct appeared to be most distinct when the clinical state of the examined was more severe because of the brain swelling accompanying the disturbance of blood supply.

Conclusions

1. Nootropil causes a statistically significant increase of glucose content in blood serum of healthy people and with brain infarct in the earliest period of illness.
2. Hyperglycaemic action of Nootropil of patients with brain infarct appeared to be more effective at the beginning of the 1st week of an illness than at the end of the second week of disease.

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Otrzymano 1992.10.30.

STRESZCZENIE

Badano wpływ piracetamu u 20 pacjentów z zawałem mózgu na zawartość glukozy we krwi. Uzyskane wyniki porównano z tymi, które stwierdzono w grupie kontrolnej. Piracetam powoduje istotne statystycznie zwiększenie zawartości glukozy w surowicy krwi osób zdrowych oraz chorych z zawałem mózgu w najwcześniejszym okresie choroby. Hiperglikemizujące działanie piracetamu u chorych z zawałem mózgu okazało się skuteczniejsze na początku pierwszego tygodnia niż na końcu drugiego tygodnia schorzenia.