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The influence of cisplatinum and goserelinum on the magnesium and calcium level in rat serum

Cisplatinum and goserelinum (synthetic analogue of LHRH hormone) are used in the therapy of neoplasms. They are especially effective in the treatment of cancer of breast, ovary, testicle and uterine myoma. Therapeutic activity of cytostatics consists in degradation of neoplastic cells. Anti-teratogenic activity is accompanied by side effects of cytotoxic character that may impair functioning of other organs and tissues. (1, 4, 9). These may include disorders in protein synthesis, enzyme levels or the metabolism of electrolytes. (1, 2, 4, 5).

With such a wide spectrum of effects of cytostatics it seemed purposeful to carry out observations on their influence on magnesium-calcium metabolism. The calcium and magnesium ions take part in the normal course of many processes such as enzymatic reactions, bone mineralisation, lipids metabolism and transmission of active states in the nervous system.

The aim of the study was to define the influence of cisplatinum and goserelinum on the magnesium and calcium level in rats.

MATERIAL AND METHODS

The experiments were carried out on 40 Wistar rats with body weight 250-300g. The animals were divided into 2 experimental groups (15 rats in each) and 1 control group (10 rats). The rats from the first experimental group were administered intraperitoneally cisplatinum dissolved in physiological saline in doses of 0.1 ml/square meter of the body surface. The experiments were carried out in three cycles, each lasting five days. There was a 24-hour break in drug administration between individual stages. The second experimental group was administered goserelinum in doses 3.8 mg (depot form) subcutaneously into the anterior abdominal once during 28 days. The control animals were given physiological saline intraperitoneally in the doses of 0.1 ml/square meter of the body surface.

After completing the experiments, the rats were killed by decapitation and tissues were taken for further examinations. The following parameters were determined: magnesium concentration (mEq/l), calcium concentration (mEq/l). The serum concentrations of magnesium and calcium were determined photometrically.

Statistical analyses were performed by t-Student test with $p<0.05$ as statistical limit.

RESULTS

The experiments indicate that in the experimental group of animals that were administered cisplatinum and gorselinum the calcium and magnesium levels were decreased. As it is seen in Figure 1 cisplatinum administered intraperitoneally caused the decrease of magnesium level from 2.5 (mEq/l) to 1.7 (mEq/l). Calcium level was decreased from 5.4 (mEq/l) to 3.4 (mEq/l). As compared to control group this decrease was, respectively, for magnesium 70% and for calcium 63%.

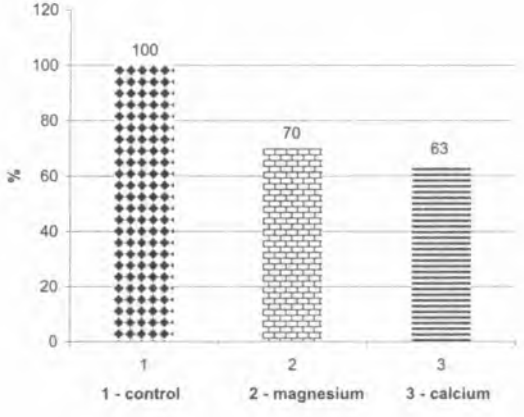

Fig. 1. Magnesium and calcium concentration in control and cisplatinum supplemented rats

Goserelinum activity was similar to cisplatinum activity and was leading to the decrease of magnesium level up to 60% (2.5 mEq/l – 1.5 mEq/l). Also calcium level was decreased to 44% (5.4mEq/l – 2.4 mEq/l) – Fig. 2.

The obtained results were statistically significant.

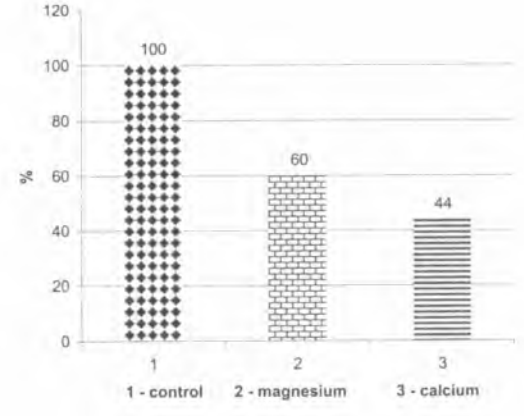

Fig. 2. Magnesium and calcium concentration in control and goserelinum supplemented rats

DISCUSSION

The experiments indicate that the rats that were exposed to cisplatinum and goserelinum displayed the symptoms of hypomagnesemia and hypocalcemia. The results of our research are similar to the studies of other authors (1, 2, 5). Mavichak et al. proved that in rats that had been administered cisplatinum every day for three weeks, hypomagnesemia was noticed (6). Other authors indicated that in perfused heart of the frog cisplatinum caused a negative inotropic effect being the result of disorders in magnesium transportation under the influence of this cytostatic. (7). Grau et al. indicated that patients treated with cisplatinum demonstrated occurrence of ototoxic symptoms with accompanying decrease of total and ionised level of calcium (3). Clinical tests confirm that patients treated with cisplatinum and goserelinum develop hypomagnesemia and hypocalcemia with accompanying weakening of osseous system, which is the effect of reduced mineralisation of bones. These symptoms were particularly acute in women (3, 8, 9). However, after some break in application of cytostatics there may occur reconstruction of bones and this may considerably improve patient's motor functions.

In this research the decrease of the serum magnesium and calcium levels was present with application of both cisplatinum and goserelinum. We can assume that hypomagnesemia and hypocalcemia result from the influence of cytostatics on the mechanisms responsible for transport of magnesium and calcium ions.

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SUMMARY

The infuence of cisplatinum and goserelinum on the magnesium and calcium concentration in rat serum has been studied. The cisplatinum induces decrease in serum magnesium concentration (to 70%), and calcium concentration (to 63%). Goserelinum activity was similar to cisplatinum activity. The magnesium concentration decreased to 60%, and calcium to 44%.

In condition of cisplatinum and goserelinum activity the hypomagnesemia and hypocalcemia were noted.

Wpływ cisplatyny i gosereliny na poziom magnezu i wapnia w surowicy szczura

W pracy badano wpływ cisplatyny i gosereliny (syntetyczny analog enzymu LHRH) na poziom magnezu i wapnia w surowicy krwi u szczura. Cisplatynę podawano dootrzewnowo, a goserelin podskórnie w przednią ścianę brzucha. Z przeprowadzonych doświadczeń wynika, że cisplatyna powodowała obniżenie poziomu magnezu do 70%, a wapnia do 63%. Pod wpływem gosereliny poziom magnezu obniżył się do 60%, a wapnia do 44%.