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Changes of resistance parameters of femoral bone in adult female rats after application of zoladex and vincristin

Bone is an important element of the static-dynamic system of man, which determines adequate motor activity of the body. Resistance properties of bone tissue are connected with correct course of processes regulating mineral metabolism, particularly calcium-phosphorus metabolism. Appropriate functioning of gonads is very important in this regulation, particularly in women. The aim of the presented study was to test the selected resistance parameters of bone after application of zoladex-LHRH synthetic analogue, a hormone used in treatment of carcinoma prostate, breast tumour, endometrium hypertrophy inhibiting functioning of ovaries and after application of vincristin cytostatic used in cancer therapy.

MATERIAL AND METHODS

The experiments were carried out on 45 adult albino female Wistar rats weighing 280-300 g, which were divided into three experimental groups. The group I animals were receiving zoladex subcutaneously injected in doses of 0.036 mg twice at 28 days' interval; the group II animals were receiving vincristin dissolved in physiological saline in doses of 0.25 ml per each 100 g of body weight in three portions and administered every 144 hours according to the period of drug activity. Every day the control group animals were receiving physiological saline in doses of 0.25 ml per 100 g of body weight. After 28 days of experiment the animals were decapitated and their femoral bones were prepared. The resistance tests were carried out with INSTRON 4302 apparatus equipped with breaking head adjusted to operation range 0-1 kN as well as register X-t for recording (registering) the force-deformation relationship. The bone preparations positioned crosswise on two support points at most stable position were influenced by a definite force once until reaching the breaking point. The values of the force needed for breaking were read on

the register and they denoted the resistance of the tested bone. The type of fracture of long bones was also defined. The results were statistically analysed. Each measurement result was characterised by M – arithmetic mean, SD – standard deviation, SE – mean error of arithmetic mean and V – variability coefficient.

RESULTS

The studies carried out on adult female rats allowed us to evaluate mechanical resistance of femoral bone base under static loads after application of such preparations as vincristin and zoladex. The experiment proved that in the studied group of animals treated with zoladex and vincristin there was noticed a considerable decrease of bone resistance manifested by smaller force needed to cause the fracture as compared to the control group. In the group of animals receiving zoladex the values of breaking force were in the range of 175 N–179.7 N and this means the decrease of resistance as compared to control group by 14.3%, and in the group receiving vincristin the values were within 191.2 N–198.5 N – the decrease of resistance as compared to control group was smaller by 6.4% and in the control group the values were approximately 204.8 N–210 N (Fig.1). The differences in resistance in both experimental groups are statistically significant. No substantial differences in types of fractures in individually tested groups were noticed. Totally in 45 cases of fractures, 26 fractures were oblique fractures, 11 – transverse and 8 – multiple.

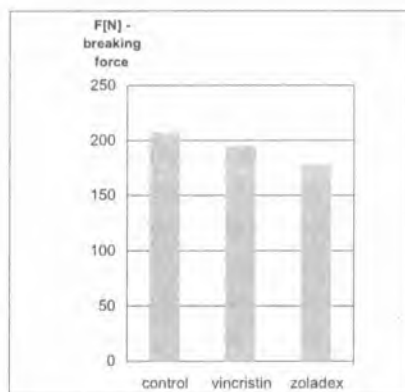


Fig. 1. Average breaking force in three experimental groups

DISCUSSION

The resistance tests of bones are very important due to the function of the type of osseous tissue in the body. Throughout the individual life the bone is exposed to various

loads which should not lead to fractures in some ranges of operation. All of the factors influencing directly or indirectly the metabolism of osseous tissue change significantly its biochemical parameters, including resistance to fracture under the influence of variable breaking force (2, 3) and module of elasticity (1, 4). Many authors (6, 7, 11, 13) emphasise the relationship between the bone microscopic structure and its mechanical resistance (strength). Wie et al. (9, 14) studied the influence of cyclophosphamide, metotrexate, adriamycine applied in cancer therapy on the mechanical properties of bones. Hatano and Suzuki et al. (4, 12) proved in their works that application of synthetic analogues LHRH in the treatment of carcinoma prostate (10) causes a significant increase of the risk of iatrogenic osteoporosis and increase of bone breaking in patients treated with the preparations. Paoletti (8) carried out densitometric studies in women treated with zoladex due to endometriosis and proved evident osteoporosis of lumbar vertebrae bases after 6-month therapy. Leather (5) indicates that application of both zoladex and estradiol reduces negative influence of zoladex on bone tissue.

CONCLUSIONS

The results of our studies on application of vincristin and zoladex indicate a negative influence of applied preparations on the mechanical resistance (strength) of femur bones in rats. The bone is a tissue undergoing continuous changes during which bone-losing reactions are balanced with bone-formation processes. Cytostatics, like vincristin, cause disorder of this balance leading to weakening of mechanical resistance of bones. Zoladex causes weakening of biomechanical properties due to pharmacological castration effect. Prolonged lowering of sexual hormones concentration resulting from elimination of gonades function in reaction to total inhibition of synthesis and release of gonadotropins leads to reduction of bone mineral saturation. The result is osteoporosis due to bone demineralisation. Simultaneous application of treatment improving the mineral metabolism in the bone tissue during treatment of basic disease with zoladex or vincristin reduces the risk of pathologic fractures occurrence.

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SUMMARY

The study consisted in testing the influence of vincristin and zoladex on mechanical resistance of the femur bone in adult female rats. Vincristin was administered intraperitoneally and zoladex – subcutaneously. The experiments imply that in the group of animals receiving vincristin the bone resistance decreased by 6.4 % as compared to the control group, and in the group of animals receiving zoladex – by 14.3%.

Zmiany parametrów wytrzymałościowych kości udowej u dorosłych samic szczurów
po zastosowaniu zoladexu i winkrystyny

W pracy badano wpływ winkrystyny i zoladexu na wytrzymałość mechaniczną kości udowej u dorosłych samic szczurów. Winkrystynę podawano dootrzewnowo, a zoladex podskórnice. Z przeprowadzonych doświadczeń wynika, że w grupie zwierząt, którym podawano winkrystynę, wytrzymałość spadła o 6,4% w porównaniu z grupą kontrolną, a w grupie zwierząt, którym podawano zoladex – o 14,3%.