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Effects of propranolol on the development of glucocorticoid-induced osteoporosis in male rats

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Abstract:
Glucocorticoid-induced osteoporosis is the most frequently occurring type of secondary osteoporosis. Antagonists of β-adrenergic receptors are now considered to be potential drugs under investigation for osteoporosis. The aim of the present study was to investigate the effects of propranolol, a nonselective β-receptor antagonist, on the skeletal system of mature male rats and on the development of bone changes induced by glucocorticoid (prednisolone) administration. The experiments were performed on 24-week-old male Wistar rats. The effects of prednisolone 21-hemisuccinate sodium salt (7 mg/kg, *sc* daily) or/and propranolol hydrochloride (10 mg/kg, *ip* daily) administered for 4 weeks on the skeletal system were studied. Bone and bone mineral mass in the tibia, femur and L-4 vertebra, length and diameter of the long bones, mechanical properties of tibial metaphysis, femoral diaphysis and femoral neck, bone histomorphometric parameters and turnover markers in serum were determined. Prednisolone-induced unfavorable skeletal changes led to disorders in bone mechanical properties. Propranolol not only did not improve bone parameters, but even caused deleterious effects on the skeletal system. Concurrent administration of propranolol with prednisolone did not counteract the changes induced by prednisolone. The results of this study may help to understand the equivocal results of human studies on the effects of β-blockers on the skeletal system. It is possible that the drugs exert biphasic effects on the skeletal system, both favorable and deleterious, depending on the dose or individual susceptibility.

Key words:
propranolol, prednisolone, bone histomorphometry, bone mechanical properties, bone mineralization