Regional variation in oophorectomy induced trabecular bone osteopenia in the distal femur of the rat.

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Abstract

Postmenopausal osteoporosis is a condition resulting from altered bone turnover, producing excessive bone loss following the menopause. Characteristically atraumatic fractures are particularly evident in regions of trabecular bone. The oophorectomised rat has been established as an accepted model of this condition. The use of this model has revealed heterogeneity in response to ovarian hormone deficiency in trabecular bone.

This thesis examines regional variations in trabecular bone remodelling and bone loss following oophorectomy in the distal femur of the rat. The primary focus is the comparison of the weight bearing epiphyseal region to the less mechanically loaded diaphyseal and metaphyseal regions. This is performed using both static and dynamic histomorphometric techniques. Studies characterize the short term and long term response to oophorectomy in adult rats. The effects of oestradiol supplementation, dietary calcium restriction and prepubertal oophorectomy are also been investigated.

In the diaphysis and metaphysis, oophorectomy results in a rapid and permanent loss of trabecular bone, with no loss in the epiphysis, despite increased bone turnover. This epiphyseal immunity to osteopenia is consistent with the weight bearing activity within this region and the greater thickness of trabeculae.

The supplementation of oophorectomised animals with 17β-oestradiol (E₂) reduced bone turnover, thickening trabecuale. This increase in thickness is proposed as a factor in the antifracture efficacy of antiresorptive therapies, such as oestradiol.

The epiphysis was shown to be resistant to osteopenia resulting from calcium restriction. Dietary calcium restriction and oophorectomy produced extensive bone loss in the metaphysis and the epiphysis, highlighting the additive effects of calcium and ovarian hormone deficiency. Prepubertal oophorectomy stopped development of trabecular bone in the diaphysis. In the metaphysis and epiphysis, the accretion of bone was not affected, with Tb.Th similar between operative groups. The production of trabecuale was viretually. Tb.Th was correlated with body weight in the metaphysis and epiphysis, suggesting that ovarian hormones are not obligatory for development of bone in weight bearing regions.

The studies of this thesis reveal a complex interaction between weight bearing and ovarian hormone deficiency, and show that physiological signals exist which can negate all adverse effects of postmenopausal osteoporosis.