Postnatal ex vivo rat model for longitudinal bone growth investigations

ABSTRACT

Background: Chondrocytes in the growth plate (GP) undergo increases in volume during different cascades of cell differentiation during longitudinal bone growth. The volume increase is reported to be the most significant variable in understanding the mechanism of long bone growth. Methods: Forty-five postnatal Sprague-Dawley rat pups, 7-15 days old were divided into nine age groups (P7-P15). Five pups were allocated to each group. The rats were sacrificed and tibia and metatarsal bones were harvested. Bone lengths were measured after 0, 24, 48, and 72 hours of ex vivo incubation. Histology of bones was carried out, and GP lengths and chondrocyte densities were determined. Results: There were significant differences in bone length among the age groups after 0 and 72 hours of incubation. Histological sectioning was possible in metatarsal bone from all age groups, and in tibia from 7-to 13-day-old rats. No significant differences in tibia and metatarsal GP lengths were seen among different age groups at 0 and 72 hours of incubation. Significant differences in chondrocyte densities along the epiphyseal GP of the bones between 0 and 72 hours of incubation were observed in most of the age groups. Conclusion: Ex vivo growth of tibia and metatarsal bones of rats aged 7-15 days old is possible, with percentage growth rates of 23.87 ± 0.80% and 40.38 ± 0.95%measured in tibia and metatarsal bone, respectively. Histological sectioning of bones was carried out without the need for decalcification in P7-P13 tibia and P7-P15metatarsal bone. Increases in chondrocyte density along the GP influence overall bone elongation.

Keyword: Bone growth model, Chondrocytes, Endochondral ossification, Growth plate, Sprague-Dawleyra rat