

Bone Mass and Fractures at Young Age

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ABOUT THE STUDY

Bone mass accounts for most of the variance in the bone strength. As a result, low bone mass has been considered the main risk factor for sustaining a fracture due to minor trauma (bone fragility fracture). Most of the studies on fracture epidemiology are limited to adults and deal with risk factors associated with bone remodeling and bone loss. The studies of fracture in children during the period of bone modeling and bone accretion have attracted very little attention, presumably due to low morbidity and the lack of mortality associated with it. Although the literature describing accidents in children is abundant, only few studies provided data about fracture epidemiology in children [1].

Distal forearm fractures caused by minimal to moderate type of trauma are the most common bone fragility fractures in children. The incidence of this type of fracture shows a bimodal distribution for age at event, with one peak occurring during early adolescence and the other one in postmenopausal women. The sex (female/male) ratio of this type of fracture in children is 1:1 while among adults is 5:1. Forearm fractures at young age are, therefore, equally common in both boys and girls while this type of fracture dominates only in postmenopausal women, representing type I osteoporosis [1].

It has been suggested that a high level of physical activity is the key factor in the increased incidence of fractures in children. However, one third of fractures could not be related to a specific activity or environment leading us to the research on bone quantity in children with bone fragility fracture [2,3]. A more recent study found a significant bone mass deficiency at multiple Skeletal Regions of Interest (SROI) in adolescents with bone fragility fracture, but not in young children. This has been confirmed by either Dual energy X-ray Absorptiometry (DXA), Peripheral Quantitative Computerized Tomography (pQCT) measurements, or metacarpal radiogrammetry [4]. DXA provides a bone mineral areal density measurement expressed in g/cm^2 that is a size dependent bone mineral density parameter, however the pQCT measurement provides a true volumetric bone mineral

density parameter expressed in g/cm^3 and does not depend on bone size. This is of particular importance when we deal with bone mineral density measurements in children with different rate of growth and bone development.

The results of this study confirm the presence of osteopenia of growth during rapid skeletal development and bone modeling of adolescence [4]. About 40% of the total bone mass is accumulated between the pubertal stages 2 to 4 [5]. This rapid skeletal change along the longitudinal axis (growth in height) and the horizontal axis (periosteal bone expansion) results in a slower rate of endosteal bone apposition leading to bone thinning, changes at the endosteal envelope lacking behind. This is the time of profound skeletal activity reflected in the highest levels of bone turnover biomarkers; bone formation biomarker (alkaline phosphatase, osteocalcin) and bone resorption biomarker. During this period the calcium requirements are the highest of all the lifespan, reflected in a mild hypocalcemia, secondary hyperparathyroidism, high serum concentration of 1,25-dihydroxyvitamin D, and hypocalciuria, indicating a high level of calcium conservation in the body and the need for the highest positive calcium balance (calcium retention) to satisfy skeletal development [6-9].

CONCLUSION

Adequate calcium intake, therefore, may improve endosteal mineral apposition and reduce the fracture rate during this time of rapid bone modeling of adolescence, however, the definitive studies of this kind with the fracture as an outcome are still lacking. This may be of importance due to an expected rise in the number of children and teenagers in the forthcoming decades in this country as well as World-wide with concomitant expected increase in the number of bone fragility fractures in this segment of the population. The rising incidence of the forearm fractures in children has been reported for the State of Minnesota, USA, while the opposite trend was recently recorded in Sweden. Continued monitoring of the fracture rate in children should, therefore, be mandatory.

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