Bone density, bone geometry and bone development in young men

The importance of pubertal timing and fracture history

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I. Darelid A*, Ohlsson C*, Rudäng R, Kindblom JM, Mellström D, Lorentzon M. Trabecular volumetric bone mineral density is associated with previous fracture during childhood and adolescence in males: the GOOD study. The Journal of Bone and Mineral Research, March 2010; 25(3):537-544.

II. Ohlsson C*, Darelid A*, Nilsson M, Melin J, Mellström D, Lorentzon M. Cortical consolidation due to increased mineralization and endosteal contraction in young adult men: a five year longitudinal study. The Journal of Clinical Endocrinology and Metabolism, July 2011; 96(7):2262-2269.

III. Darelid A, Ohlsson C, Nilsson M, Kindblom JM, Mellström D, Lorentzon M. Catch up in bone acquisition in young adult men with late normal puberty. The Journal of Bone and Mineral Research, October 2012; 27(10):2198-2207.

IV. Darelid A, Nilsson M, Kindblom JM, Mellström D, Ohlsson C, Lorentzon M. Bone turnover markers predict bone mass development in young adult men: a five year longitudinal study. The Journal of Clinical Endocrinology and Metabolism, January 2015; epub before print.

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The importance of pubertal timing and fracture history

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ABSTRACT

Background: Peak bone mass, the maximal bone mass attained in young adulthood, is an important factor of the lifetime risk of developing osteoporosis. The aim of this thesis was to study the development of bone mineral density (BMD) and bone geometry around the time of peak bone mass in men, and also to investigate the association between pubertal timing, fracture history, bone turnover markers and BMD and bone geometry in young men.

Methods: The studies included in the thesis were performed within the Gothenburg Osteoporosis and Obesity Determinants (GOOD) study, a well-characterized population-based cohort including 1068 men between 18-20 years of age at baseline. At baseline and follow-up five years later, measurements of bone density, bone mass and bone geometry were assessed with dual energy X-ray absorptiometry (DXA) and peripheral quantitative computed tomography (pQCT). Blood samples were drawn to measure bone turnover markers. A self-administered questionnaire was used to collect information about physical activity, nutritional intake, smoking and previous fracture. Reported fractures were verified in X-ray registers.

Results: Previous fracture was associated with lower BMD at age 19, and especially with reduced trabecular volumetric BMD (vBMD) of the radius. Between 19 and 24 years of age, lumbar spine areal BMD (aBMD) increased while femoral neck aBMD decreased. Radius aBMD increased, due to increased cortical thickness and continuing mineralization. Men with late puberty had larger gains in aBMD, vBMD, and bone size, reflecting a catch up in bone acquisition in young adulthood in men with late puberty. A high level of osteocalcin (a bone turnover marker) was associated with larger gains in aBMD, vBMD, and bone size between 19 and 24 years.

Conclusion: In young adult men between 19 and 24 years, aBMD of the lumbar spine and the radius continued to increase, while aBMD of the femoral neck already started to decrease. Late puberty and high level of osteocalcin were associated with greater increases in aBMD, vBMD and bone size during this period. A previous fracture was a risk factor for low BMD in young men.

Keywords: peak bone mass, bone mineral density, bone development, fracture, young adulthood, men

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