

# Cortical Porosity – Its regulation and association with fracture

Akademisk avhandling

som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet, kommer att offentligen försvaras i Mölndalsaulan, V-huset Sahlgrenska Universitetssjukhuset/Mölndal, den 5 maj 2017, klockan 09.00

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## Avhandlingen baseras på följande delarbeten

- I. Sundh D\*, Mellström D\*, Nilsson M, Karlsson M, Ohlsson C, and Lorentzon M. Increased Cortical Porosity in Older Men With Fracture. *Journal of Bone and Mineral Research*, 2015; 30(9): 1692-700. \*contributed equally
- II. Sundh D, Nilsson AG, Nilsson M, Johansson L, Mellström D, and Lorentzon M. Increased Cortical Porosity in Women With Hip Fracture. *Journal of Internal Medicine*, 2017; epub before print.
- III. Sundh D, Rudäng R, Zoulakis M, Nilsson AG, Darelid A, and Lorentzon M. A High Amount of Local Adipose Tissue Is Associated With High Cortical Porosity and Low Bone Material Strength in Older Women. *Journal of Bone and Mineral Research*, 2016; 31(4): 749-57.
- IV. Sundh D\*, Mellström D\*, Ljunggren Ö, Karlsson MK, Ohlsson C, Nilsson M, Nilsson AG, and Lorentzon M. Low Serum Vitamin D Is Associated With Higher Cortical Porosity in Older Men. *Journal of Internal Medicine*, 2016; 280(5): 496-508. \*contributed equally

**SAHLGRENKA AKADEMIN  
INSTITUTIONEN FÖR MEDICIN**



# Cortical Porosity – Its regulation and association with fracture

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## Abstract

**Objective:** Osteoporosis is a disease characterized by low bone mineral density and deteriorated bone microstructure. This thesis aimed to determine whether cortical porosity is associated with previous fracture and increase the knowledge regarding the regulation of this bone trait.

**Methods:** The studies included in this thesis were based on two well-defined cohorts. The first was a sub-sample from the Swedish part of the Osteoporotic fractures in men (MrOS) study. This cohort comprised of 456 older men (mean age 80.2 years). The second cohort was the Sahlgrenska University hospital Prospective Evaluation of Risk of Bone fractures – **SUPERB** study, which is based on 3030 elderly women (75-80 years). Two sub-populations were used selected either on an X-ray verified hip fracture or available measurements of bone material properties. Bone mineral density was assessed with dual-energy X-ray absorptiometry. Bone geometry and microstructure were measured at the tibia with high-resolution peripheral quantitative computed tomography. Microindentation was performed with the hand-held Osteoprobe to assess bone material strength.

**Results:** Cortical porosity was associated with prevalent fracture in older men and prevalent hip fracture in older women independently of areal bone mineral density and clinical risk factors. Serum levels of 25-hydroxyvitamin D were inversely associated with cortical porosity independently of parathyroid hormone, indicating that vitamin D might directly regulate this bone trait. A high amount of adipose tissue was associated with higher cortical porosity and lower bone material strength.

**Conclusions:** Cortical porosity is higher in individuals with a prevalent fracture, low vitamin D levels, or large amount of adipose tissue. These results indicate that cortical porosity is important for bone strength and has a role in the etiology of bone fractures.

**Keywords:** Cortical porosity, fracture, osteoporosis, adipose tissue, vitamin D, high-resolution peripheral quantitative computed tomography