Cadmium, kidney and bone

Akademisk avhandling

som för avläggande av medicine doktorsexamen vid Sahlgrenska Akademin, Göteborgs universitet, kommer att offentligen försvaras i sal Tore Ahnoff, Arbets- och miljömedicin, Medicinaregatan 16A, Göteborg, torsdagen den 3 december 2015 kl. 9:00

av

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Avhandlingen baseras på följande arbeten:

I. Barregard L, Fabricius-Lagging E, Lundh T, Mölne J, Wallin M, Olausson M, Modigh C, Sallsten G. Cadmium, mercury, and lead in kidney cortex of living kidney donors: Impact of different exposure sources. *Environmental Research. 2010 Jan;110(1):47-54.*

II. Wallin M, Sallsten G, Fabricius-Lagging E, Öhrn C, Lundh T, Barregard L. Kidney cadmium levels and associations with urinary calcium and bone mineral density: a cross-sectional study in Sweden. *Environmental Health. 2013 Mar 7;12:22.*

III. Wallin M, Sallsten G, Lundh T, Barregard L. Low-level cadmium exposure and effects on kidney function. *Occupational and Environmental Medicine. 2014 Dec;71(12):848-54.*

IV. Wallin M, Barregard L, Sallsten G, Lundh T, Karlsson MK, Lorentzon M, Ohlsson C, Mellström D. Low-level cadmium exposure is associated with decreased bone mineral density and increased risk of incident fractures in elderly men: the MrOS Sweden study. *Submitted manuscript.*

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ABSTRACT

Toxic heavy metals, such as cadmium, mercury and lead, occur in the environment both naturally and as contaminants due to agricultural and industrial activities. The aims of this thesis were to examine the levels of these metals in the kidney in the general population and the association with sources of exposure, and to study the effects of low-level cadmium exposure on kidney and bone. The first three studies were cross-sectional and were conducted on 109 living kidney donors. In the first study, the concentrations of cadmium, mercury and lead in kidney cortex, and the impact of different exposure sources and background factors, were examined. Kidney cadmium levels were relatively low (median 12.9 μg/g wet weight), and increased with age, smoking, and in women with low iron stores. Kidney mercury levels were associated with the number of amalgam surfaces, but not with fish consumption. Kidney lead levels were very low, and not related to any of the background factors. In the second study, the relationships between kidney cadmium, urinary calcium and bone mineral density were investigated. A positive association was found between kidney cadmium and calcium excretion in women, but not in men. Negative correlations were found between kidney cadmium and bone mineral density, but the associations were not significant after adjustment for covariates. In the third study, the relation between kidney cadmium and kidney function was explored, and significant positive associations were found with the excretion of alpha-1-microglobulin, but there was no association with glomerular filtration rate. The fourth study was both cross-sectional and prospective, and was conducted on 936 elderly men. Negative associations were found between urinary cadmium and bone mineral density, and those with high urinary cadmium had an increased risk of incident non-vertebral osteoporosis fractures. In conclusion, the results of this thesis indicate effects of cadmium on kidney and bone also at the low levels found in the general population in Sweden. This provides further support for the importance of reducing the spread of cadmium in the environment.

Keywords: Cadmium, kidney function, bone, urinary calcium, fracture

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