

# **Electromagnetic fields promote severe and unique vascular calcification in an animal model of ectopic calcification**

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The effects of electromagnetic fields (EMFs) on cardiovascular calcification is unknown. We sought to evaluate the effects of EMF on vascular calcification in normal rats and in rats with chronic kidney disease (CKD) – a condition which promotes calcification. We used four groups of rats: group 1 – exposed to EMF, group 2 – not exposed to EMF, group 3 – rats with CKD exposed to EMF, group 4 – rats with CKD not exposed to EMF. In order to induce CKD, groups 3 and 4 rats were fed with a uremia-inducing diet. Groups 1 and 3 rats were continuously exposed to EMF using a system similar to an electrical transformer, which consists of a primary coil, a ferrite ring, and a secondary coil. The system transmitter emitted a series of exponentially decaying electromagnetic sine waves (continuous exposure with pulsed peaks) in randomly selected frequencies between 150 and 155kHz, with random exposure intensities between 4 and 7mG. Clinical investigations included multislice computed tomography of the aortic roots. Pathological examinations of the aortas included histological characterization, and antigen expression analyses. No calcification was found in either group of rats with normal kidney function. Aortic root calcification was significantly higher in rats exposed to EMF (group 3) compared with group 4 rats – with a mean Agatston score of  $138 \pm 25$  vs.  $80 \pm 20$  respectively ( $p < 0.05$ ). Pathological examination showed massive aortic calcification in group 3 rats. The calcification pattern was unique as it formed circular rings along the length of the aortic media. Although increased calcification was noticed in group 3 rats, antigen expression of osteoblast markers was significantly decreased in group 3 compared with group 4. EMF exposure may have potential harmful effects on the cardiovascular system, as it promotes severe vascular calcification in CKD milieu.