Title *

TRANSLOCATION AND FATE OF INHALED GOLD NANOPARTICLES IN MICE AND MAN

Abstract *

Background: Inhaled combustion-derived nanoparticles are associated with cardiovascular disease. The pathways linking pulmonary exposure and cardiovascular effects remain unclear. A fundamental questions remains: Do inhaled nanoparticles translocate from the lung to the blood in man? Here we use complimentary human and animal studies to investigate whether gold nanoparticles can translocate from the lung into the blood and accumulate at sites of vascular lesion development.

Methods & Results: Healthy volunteers were exposed to gold nanoparticles by inhalation. Gold was detected in the blood and urine by ICPMS, and was still present 3-months after exposure. Levels were greater following inhalation of 5nm particles compared to 30nm particles. Studies in mice demonstrated accumulation in the blood and liver following pulmonary exposure to a broader size range of gold nanoparticles (2−200nm), with translocation greater for particles <10nm diameter. In high-fat-fed apolipoprotein-E deficient mice gold nanoparticles were detected in higher concentrations in areas of the vasculature associated with lesion development. Additionally gold was detected using Raman spectroscopy in carotid lesions excised from endarterectomy patients that had inhaled gold nanoparticles 24h prior to surgery.

Conclusions: Translocation of inhaled nanoparticles and accumulation at sites of vascular inflammation provides a direct mechanism that could explain the link between environmental nanoparticles and cardiovascular disease. A greater understanding of how nanoparticles translocate and accumulate at sites of disease is of paramount importance for the risk assessment of both environmental and engineered nanoparticles.

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