Biodistribution of gold nanoparticles following intratracheal instillation in mouse lung - DTU Orbit (14/01/2019)

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Background The fate of gold nanoparticles, 2, 40 and 100 nm, administered intratracheally to adult female mice was examined. The nanoparticles were traced by autometallography (AMG) at both ultrastructural and light microscopic levels. Also, the gold content was quantified by inductively coupled plasma mass spectrometry (ICP-MS) and neutron activation analysis (NAA). The liver is the major site of deposition of circulating gold nanoparticles. Therefore the degree of translocation was determined by the hepatic deposition of gold. Mice were instilled with 5 intratracheal doses of gold nanoparticles distributed over a period of 3 weeks and were killed 24 h after the last dose. One group of mice were given a single intratracheal dose and were killed after 1 h. Results The instilled nanoparticles were found in lung macrophages already 1 h after a single instillation. In mice instilled treated repeatedly during 3 weeks, the load was substantial. Ultrastructurally, AMG silver enhanced gold nanoparticles were found in lysosome-/endosome-like organelles of the macrophages and analysis with AMG, ICP-MS and NAA of the liver revealed an almost total lack of translocation of nanoparticles. In mice given repeated instillations of 2 nm gold nanoparticles, 1.4‰ (by ICP-MS) to 1.9‰ (by NAA) of the instilled gold was detected in the liver. With the 40 nm gold, no gold was detected in the liver (detection level 2 ng, 0.1‰) except for one mouse in which 3‰ of the instilled gold was found in the liver. No gold was detected in any liver of mice instilled with 100 nm gold (detection level 2 ng, 0.1‰) except in a single animal with 0.39‰ of the dose in the liver. Conclusion We found that that: (1) inert gold nanoparticles, administered intratracheally are phagocytosed by lung macrophages; (2) only a tiny fraction of the gold particles is translocated into systemic circulation. (3) The translocation rate was greatest with the 2 nm gold particles.

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