Translocation of silver nanoparticles in the ex vivo human placenta perfusion model characterized by single particle ICP-MS - DTU Orbit (12/10/2018)

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With the extensive use of silver nanoparticles (AgNPs) in various consumer products their potential toxicity is of great concern especially for highly sensitive population groups such as pregnant women and the developing fetus. To understand if AgNPs are taken up and cross the human placenta, we studied their translocation and accumulation in the human ex vivo placenta perfusion model by single particle ICP-MS (spICP-MS). The impact of different surface modifications on placental transfer was assessed by AgNPs with two different modifications: polyethylene glycol (AgPEG NPs) and sodium carboxylate (AgCOONa NPs). AgNPs and ionic Ag were detected in the fetal circulation in low but not negligible amounts. Slightly higher Ag translocation across the placental barrier for perfusion with AgPEG NPs and higher AgNPs accumulation in placental tissue for perfusion with AgCOONa NPs were observed. Since these AgNPs are soluble in water, we tried to distinguish between the translocation of dissolved and particulate Ag. Perfusion with AgNO3 revealed the formation of Ag containing NPs in both circulations over time, of which the amount and their size in the fetal circulation was comparable to those from perfusion experiments with both AgNP types. Although we were not able to clarify whether intact AgNPs and/or Ag precipitates from dissolved Ag cross the placental barrier, our study highlights that uptake of Ag ions and/or dissolution of AgNPs in the tissue followed by re-precipitation in the fetal circulation needs to be considered as an important pathway in studies of AgNP translocation across biological barriers.

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