Effects of gold nanoparticles on human prostate cancer cells and xenografts and male rat reproductive organs

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Context: Nanomaterials become widely used in medicine. Effects of gold nanoparticles (GNP) on prostate cancer and normal male reproductive tissues are poorly investigated. Objective: This research was carried out to study impact of GNP stabilized by polyvinylpyrrolidone on androgen-sensitive prostate cancer (PCa) cell line, human PC xenografts in mouse model, and reproductive organs of normal male rats. Methods: GNP (20 nm) colloidal solution was s/c injected in a daily dose of 0.64, 1.7 or 6.4 mcg/kg b.w. for 3 days to CBA mice bearing human PC grafts under renal capsule after 3-days free tumor growth, and xenografts weights and histology were studied in comparison with controls. In in vitro experiments, GNP (10 mcg/ml RPMI-1640 medium containing 10% fetal bovine serum) were added to growing LNCaP cells. Mature Wistar male rats were given GNP s/c in a daily dose of 5 mcg/kg b.w. for 10 days followed by counting sperms in epididimis, determination of fructose in coagulating gland and morphological examination of the prostate and testicles. Results: Histological examination revealed dose-dependent cytotoxic influence of GNP on PC xenograft tissues. Presence of GNP in culture medium inhibited LNCaP cell line growth by 50%-60% due to suppression of proliferation without changes in cell morphology. In male rats, GNP treatment decreased seminal vesicles net weights with no impact on weights of other studied organs. Ventral prostate showed modest decrease in epithelium secretory activity. Fructose content, quantity of sperms and testicles histology did not differ of controls. Conclusions: 20 nm sized GNP exert cytotoxic and antiproliferative effects against human PC cells. Their modest impact on reproductive organs of male rats was found.