

Silica nanoparticles induce acute pulmonary toxicity in mice

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Abstract:

Silica nanoparticles (SiO₂-NPs) are the one of most widely used and important nanomaterials in nanotechnology engineering. Lung tissue is one of the main routes of entry nanoparticles, which may cause severe pulmonary toxicity. However, the toxicological effects and the precise mechanisms of SiO₂-NPs on lung are still unclear. Here, we attempted to investigate the toxic injuries and the definite mechanism of SiO₂-NPs on the acute pulmonary toxicity. The adult male ICR mice were exposed to intratracheal signal dose of 50 mg/kg SiO₂-NPs and lung tissue were collected after 7 days. Our results found that SiO₂-NPs increased 40% mortality rate and significantly

induced pulmonary morphological and histological changes with neutrophils, macrophage and fibroblast cells from the terminal bronchial. The lung tissue weight/body weight ratio (LW/BW) increased 2-fold suggested that SiO₂-NPs may trigger pulmonary edema. Meanwhile, the malondialdehyde (MDA) levels in the treated lung tissue were increased. Moreover, SiO₂-NPs ~~also~~ caused ~~mitochondrial-dependent~~ apoptosis-related signals, including up-regulation of Bax and down-regulation of Bcl-2 and activations of caspase cascades mRNA expression, which accompanied with ~~Moreover, exposed to SiO₂-NPs resulted in~~ triggered the endoplasmic reticulum (ER) stress identified through several key molecules, such as activating the ~~protein expression of~~ C/EBP homologous protein (CHOP), X-box binding protein 1(XBP-1), caspase-12, and increasing the glucose-regulated protein 78/94 (GRP-78/-94) mRNA expression. These results suggest that SiO₂-NPs induced an oxidative stress, and cause acute pulmonary toxicity through mitochondria and endoplasmic reticulum pathways.

Keyword: Silica nanoparticle; Pulmonary toxicity; Oxidative stress/ER-stress