

DISTURBANCE OF RENAL MITOCHONDRIAL FUNCTION BY CADMIUM-BASED QUANTUM DOT IN MICE

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Quantum dots (QDs) have been recently applied in biomedical imaging, including cell tracking and photosensing in experimental animals. Because some QDs consist of toxic metals, such as cadmium (Cd), the safety of these QDs in biological systems is of great concern. Mitochondria are the major targets for toxicity of many metals including Cd. Previously, we have reported that QD705, a Cd-based QD, was disintegrated *in vivo* with the release of Cd accumulated in the kidneys of ICR mice after a single intravenous injection for 16 weeks. In this study, we first observed the swollen mitochondria with the loss of cristae structure in proximal tubular epithelial cells of ICR mice at 4th week after injection of 40 pmol QD705. Besides, the mitochondrial DNA (mtDNA) copy number in the kidney was decreased after 40 pmol and 160 pmol of QD705 treatment at the 12th week. Furthermore, QD705 reduced the efficiency of glutamate-malate or succinate-supported mitochondrial respiration, which was accompanied by the decreased respiratory control ratio (RCR) in the kidneys. Mitochondrial respiratory enzyme Complex I+III and Complex IV activities were also dramatically decreased in the kidneys of mice treated with 40 pmol QD705. Although there was no significant change in renal functions at the 12th week after injection, QD705 might cause chronic renal toxicity at later time points. These results suggest that respiratory function of mitochondria could be used as sensitive parameters for the evaluation of toxicity of metal based nanomaterials.

Keyword:

nanoparticles; quantum dots 705; cadmium; mitochondrial dysfunction; mitochondrial Complex activity