Abstract

Title: Cytotoxicity of titanium and magnesium particles to human osteoblast cells

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Abstract:

Metal particles or debris can be generated by corrosion or daily wear and tear from bone implants. Some researches showed nanoparticles could enhance osteogenic differentiation and other positive influence. However, controversial results were also reported that the nanoparticles or debris can circulate in blood and trigger inflammation, aseptic loosening, and other complications. The exact mechanism of these phenomena remains unclear. This research is to investigate the toxicity of titanium (Ti) and magnesium (Mg) in bone implants due to these two are the most commonly used biomaterials due to their excellent biocompatibility, low elastic modulus, and good mechanical strength.

During the direct cytotoxicity test, the metal particles were directly added to the cell culture petri dish. Ti particles showed toxic to osteoblast at different dosages and time, while Mg particles can reduce the Ti induced metal toxicity to the cells and boost cell proliferation. Mg particles can be toxic to osteoblast at a higher dosage as well. To better understand this phenomenon, human osteoblast cell line SAOS2 were exposed to different concentration of Ti particles, Mg particles, and Ti mixed with Mg particles, and the cell proliferation was measured at 48/72/120 hours. The flow cytometry analysis results showed that Ti induced cell toxicity was through an increase in Reactive Oxygen Species (ROS) production and induced cell apoptosis and necrosis. Fluorescence microscopy was implemented to observe the cell damage in mitochondria. Quantitative real-time PCR analysis for relative mRNA expression of SAOS2 cells was studied to understand the process better.

Through this study, a proper protocol can be established to measure the cytotoxicity of metal particles. However, how to quantify the metal debris from corrosion or wear and tear inside the human body, as well as the exact mechanism of cellular interaction between cells and particles still require more investigation.

Biography:

Niyou is currently a Ph.D. candidate and research engineer at the National University of Singapore. He is working on a collaboration project between Mechanical Engineering and Anatomy. He has a rich mechanical background, strong biological knowledge, and hands-on experience. He has two papers under review in reputable journals, and one is pending submission.

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