Analysis of macrophages derived from bone marrow on osteolytic potential after phagocytosis of titanium particles

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INTRODUCTION: In periprosthetic osteolysis of total hip joints, macrophages have been reported to play a major role in wear-particle induced foreign body granuloma. This study was designed to establish in-vitro macrophage system and to evaluate the cellular and molecular mechanism of periprosthetic osteolysis.

METHODS: The adherent cell fraction was obtained by synthetic fiber filtration of rat bone marrow cells and harvesting in the presence of M-CSF. Immunocytochemistry and phagocytic activity analyses were performed to identify macrophagic property. mRNA of osteolytic cytokines and proteinases was quantitatively analyzed. Bone resorbing potential was verified by osteoclast activity assay substrate plate coating carbonated calcium phosphate.

RESULTS: Immunoreactivity to CD68 and phagocytic activity of carbon were over 99% after cultivation up to 72 hours without reactivity to tartrate resistant acid phosphatase. Production of IL 1 beta, -6, TNF-alpha, M-CSF, cathepsin K and MMP-9, -12, -13, -14 in mRNA level increased after phagocytosis of titanium particles. Resorption area of substrate plate was significantly increased in the presence of titanium particles.

DISCUSSION: Possible role of direct bone resorption by macrophages in fragile periprosthetic bone in loose total hip joints has been suggested in-vivo. Present data suggested macrophages derived from bone marrow can, not only enhance osteoclastic activation and connective tissue weakening by osteolytic cytokines and proteinases, but also resorb mineralized substance after stimulation of wear particles from implants.