Decrease in the Number of Cultured Vascular Endothelial Cells by Cadmium

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Introduction

Cardiovascular diseases such as atherosclerosis, hypertension and thrombosis are public problems which have a strong interrelationship. The role of vascular endothelial cells in the prevention of these vascular disorders has recently attracted a great deal of attention. Endothelial cells cover the surface of the blood vessel wall by the monolayer, and this monolayer is thought to prevent cardiovascular diseases which are induced by the direct contact of blood cells and plasma with underlying tissue. In the present study, we investigated the effect of cadmium on the number of cultured endothelial cells to clarify the toxicity of the metal on the maintenance of the endothelial cell monolayer.

Methods

Endothelial cells from bovine aorta were cultured until confluent in Dulbecco's modified Eagle's medium supplemented with 10% fetal bovine serum. The monolayer was then incubated at 37°C for 24 or 72 h in serum-free ASF 301 medium in the presence of cadmium chloride. After incubation, a histological observation and a measurement of the cell number was performed. To evaluate the cell detachment, the percentage of [³H]thymidine-labeled endothelial cells detached from the prelabeled monolayer was calculated. The cell proliferation was assessed by the number and the incorporation of [³H]thymidine into the acid-insoluble fraction of endothelial cells which were growing in serum-free ASF 301 medium.

Results

Cadmium significantly decreased the number of confluent endothelial cells at 2.0 or 0.5 μM and above after a 24 and 72 h incubation, respectively. The number of growing endothelial cells and the incorporation of [³H]thymidine into the acid-insoluble fraction of the cells were significantly decreased by cadmium. On the other hand, the detachment of [³H]thymidine-labeled endothelial cells from the monolayer was significantly increased by cadmium at 2.0 μM or more after a 24 and 72 h incubation. The activity of lactate dehydrogenase leaked into the medium from the cells was also significantly increased by cadmium at 2.0 μM or more after a 24 and 72 h incubation. Histologically, the occurrence of deendothelialized space with a decrease in the cell number was observed.

Discussion

It was histologically shown that cadmium impaired the monolayer of cultured endothelial cells with a decrease in the cell number. Our findings suggest that the cadmium-induced decrease in the endothelial cells was primarily due to an increase in the cell detachment caused by the cytotoxic effect of cadmium. Cadmium-induced inhibition of the cell proliferation was postulated to retard the repair of the deendothelialized space. Cadmium may thus be a risk factor in the maintenance of vascular endothelial cell monolayer.