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Changes in Intracellular Concentration of Amino Acids and Polyamines during the Apoptosis of HL-60 Cells

Hiroshi Sakagami , Ei-ichi Fujiwara ( 藤原栄一 ) , Yoshiko Yokote, Kiso Akahane, Kazuhito Asano, Mutsuyuki Kochi,Ei-ichi Hara and Akira Shirahata (白幡 晶)

Possible changes in the intracellular concentrations of amino acids and polyamines were investigated during the apoptosis of human promyelocytic leukemic HL-60 cells. Treatment of HL-60 cells with sodium 5,6-benzylidene-L-ascorbate (SBA) or sodium ascorbate induced apoptotic cell death characterized by chromatin condensation, nuclear fragmentation, loss of microvilli, and production of numerous vacuoles and apoptotic bodies. The apoptosis was accompanied by a significant intracellular concentration of almost all neutral and basic amino acids (regardless of their polarity). On the other hand, the concentration of glutamic acids, the most abundant amino acids in the cell, was significantly reduced. These data suggest the reduced amino acid utilization and possible membrane impairment, especially in SBA-treated cells. Among three major polyamines, the intracellular concentration of putrescine rapidly declined, whereas that of spermidine and spermine was almost unchanged during apoptosis. Conversely, the concentration of putrescine, but not that of spermidine and spermine, was significantly increased during the chemically-induced carcinogenesis of mouse liver tissue. The present study demonstrates that the putrescine level is the most sensitive to the proliferation capability of the cells, among three polyamines, and provides an early marker for apoptosis and proliferation.