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JOURNAL ARTICLE

Involvement of reactive oxygen species in human sperm arcosome reaction induced by A23187, lysophosphatidylcholine, and biological fluid ultrafiltrates

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Although recent evidence indicated that the production of reactive oxygen species (ROS) by human spermatozoa may be involved in the regulation of capacitation, very little is known about the role of ROS in the acrosome reaction. To address this issue, Percoll-washed spermatozoa were incubated in Ham's F-10 medium in the absence (no capacitation) or presence (capacitation) of fetal cord serum ultrafiltrate (FCSu) or progesterone. The effects of the ROS scavengers, superoxide dismutase (SOD), and catalase were then tested on the acrosome reaction induced by lysophosphatidylcholine (LPC), A23187, and ultrafiltrates from follicular fluid (FFu) and FCSu, as well as on the protein tyrosine phosphorylation associated with this process. 2-Methyl-6-(p-methoxyphenyl)-3,7-dihydroimidazo [1,2-a] pyrazin-3-one (MCLA)-amplified chemiluminescence was used to determine the extracellular superoxide (O2.-) production from spermatozoa. The observations that both SOD and catalase reduced (in the case of LPC) or totally prevented (in the other cases) the acrosome reaction of capacitated spermatozoa and that hydrogen peroxide (H2O2) or ROS generated by the combination of xanthine and xanthine oxidase (O2.-, which dismutates to H2O2) triggered the acrosome reaction indicated the involvement of ROS in this process. In fact, capacitated spermatozoa in which the acrosome reaction was induced by LPC, A23187, and FFu produced more O2.- than noncapacitated spermatozoa treated with the same agents. A23187 and LPC had minor effects on protein tyrosine phosphorylation of noncapacitated spermatozoa. However, these inducers caused a decrease in tyrosine phosphorylation of Triton-soluble proteins (mainly those of 37, 42, and 47 kDa) from capacitated spermatozoa, a decrease more pronounced in the presence of SOD. On the other hand, there was a marked increase in tyrosine phosphorylation of few proteins (70 to 105 kDa) from the Triton-insoluble fraction, which was partly reversed by SOD (in the case of LPC and A23187) or catalase (in the case of A23187), or abolished in the presence of the two antioxidants (in the case of A23187). These data indicate that the acrosome reaction is associated with an extracellular O2.- generation by spermatozoa and that both O2.- and H2O2 may be involved in the regulation of this process. The mechanism by which these ROS act is unknown but may involve tyrosine phosphorylation of sperm proteins.

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