Abstract

The process of sperm capacitation and acrosome reaction (AR) are highly dynamic processes essential for the fertilization, including cytoskeleton proteins in the sperm head. The study of the distribution of actin, spectrin and α-tubulin in the head of representative mammalian sperm indicates that before and after the AR there were changes in the distribution of the cytoskeleton structures in the sperm head of all representatives, mainly in the apical part of the acrosome, but also in the equatorial and postacrosome part of the sperm head. The particularly well-studied actin cytoskeleton plays an important role during the capacitation and before and after the AR. Environmental estrogens can interfere with the function of endogenous hormones in very low concentrations. They can interact with specific receptors affecting several signalling pathways leading to sperm capacitation and AR. The effect of 17β-estradiol, estrone, estriol and synthetic 17α-ethynylestradiol was evaluated by the ratio of tyrosine phosphorylation and the state of the acrosome during *in vitro* capacitation in the sperm head. This study has provided the evidence that estrogens significantly stimulate capacitation progress in a concentration-dependent manner. Estrogens decrease number of sperm after the induced AR too. The raising concentration of estrogens in the environment may represent a potential risk in altering certain mechanisms contributing to the fertilizing capability of sperm. The effect of estrogen effect was subsequently studied *in vivo*. Mice were exposed to 17β-estradiol at the concentration of 20ng/ml. The exposition of sperm to 17β-estradiol caused premature mouse sperm capacitation with a potential negative impact on the sperm reproductive fitness in the female reproductive tract. This effect is mainly caused by hyperphosphorylation of sperm proteins and premature calcium influx.

It has been recently shown in mice that sperm undergo AR by passing through cumulus cells and sperm after AR have the ability to bind to *zona pellucida*, and consequently fertilize the egg. The question was whether the relocation of Izumo happens during spontaneous AR as in sperm with induced AR. Results show that during spontaneous AR there is a clear Izumo relocation from the acrosomal membrane to the equatorial (sperm-egg fusion region) and post-acrosomal segment. This relocation is consistent with the dynamics of Izumo during induced AR. Therefore it can be concluded that mouse spontaneously acrosome reacted sperm have same fertilizing potential as those after induced AR. Moreover, this may represent a unique mechanism how to accelerate the fertilizing process in a highly promiscuous environment under selective pressure of intra-specific sperm competition of specific rodents.