

A Moderate Increase of Reactive Oxygen Species in Ovary Associates with Meiotic Resumption from Diplotene Arrest in Rat Follicular Oocytes

Meenakshi Tiwari¹ and Shail K. Chaube²

^{1,2}Cell Physiology Laboratory, Biochemistry Unit, Department of Zoology,
Banaras Hindu University, Varanasi-221005, India
E-mail: ²shailchaubey@gmail.com

Abstract—Oocyte quality directly affects assisted reproductive technologies (ARTs) outcome in mammals. Oocyte quality is determined by meiotic cell cycle progression from diplotene arrest and extrusion of first polar body (PBI). The mammalian ovary generates reactive oxygen species (ROS) on an extraordinary scale but their roles during meiotic cell cycle progression inside the follicular microenvironment remains poorly understood. We propose that a moderate increase of ROS level could be associated with meiotic cell cycle progression from diplotene stage in follicular oocytes. The present study was aimed to find out whether a moderate increase of ROS level in ovary is beneficial for meiotic resumption from diplotene arrest in rat follicular oocytes. Our results suggest that human chorionic gonadotropin (hCG) induced meiotic resumption from diplotene arrest and extrusion of PBI in cumulus oocyte complexes (COCs) collected from ovary and cultured in plain medium for 3 h in vitro. Meiotic cell cycle progression from diplotene was associated with increased ROS and hydrogen peroxide (H₂O₂) levels. Increased ROS level correlates with the decreased levels of adenosine 3', 5'-cyclic monophosphate (cAMP) as well as guanosine 3', 5'-cyclic monophosphate (cGMP). The reduced cyclic nucleotides level decreased Thr-161 phosphorylated Cdk1 as well as cyclin B1 level and increased Thr-14/Tyr-15 phosphorylated cyclin dependent kinase 1 (Cdk1) level leading to destabilization of maturation promoting factor (MPF). The destabilized MPF resulted in the meiotic resumption from diplotene arrest in follicular oocytes. Taken together these findings suggest that a moderate increase of ROS in the ovary is beneficial for meiotic resumption from diplotene arrest and extrusion of PBI in follicular oocytes, required to enhance oocyte quality and thereby ARTs outcome.

Keywords: ROS, Cumulus oocyte complexes, Signal molecules, MPF, ART.