

ABSTRACT

Reactive oxygen species (ROS) is known to play an important role in the female reproductive system. Oxidative stress (OS) in the ovarian follicular fluid (FF) environment is one of the causes for poor *in-vitro* fertilization (IVF) outcome. An upper cut-off ROS level in FF of women undergoing IVF, beyond which good quality embryo formation is unlikely, is established. This level, estimated to be ~107 cps, has been validated in women with endometriosis/ polycystic ovary syndrome (PCOS) undergoing IVF. Presently, limited reports exist on the role of granulosa cells (GC) in ROS generation in pathophysiological conditions such as endometriosis and PCOS and its effect on IVF outcome. Increase in ROS levels, decrease in MMP and significant DNA damage in GC of PCOS women show an adverse effect on IVF outcome. However, despite excessive ROS generation, mitochondrial dysfunction and DNA damage observed in GC of endometriosis, IVF outcome parameters appear to be unaffected. It is well established that the metabolites present in FF are the non-invasive biochemical predictors of oocyte quality. However, there are no studies on metabolomic analysis of FF in women with endometriosis/PCOS undergoing IVF. The differently expressed metabolites identified are expected to help in assessment of oocyte quality and assist in improving IVF success rate. In recent years, antioxidant therapy has proved to be an effective treatment option for various ROS induced pathophysiological diseases. The efficacy of a cerium oxide based nanoparticle, Nanoceria in the management of endometriosis/PCOS induced in mice is explored. OS and increased vascularization observed in both, PCOS and endometriosis were reduced significantly on treatment with Nanoceria. Also, significant improvement in quality and number of oocytes retrieved was observed in mice with endometriosis/PCOS treated with this nanoparticle. It is concluded that Nanoceria therapy reduces OS and inflammatory factors in pathological conditions of female infertility and improves oocyte quality considerably. Taken together, all these findings are expected to assist in clinical practice by improving the IVF outcome.

Keywords: *Follicular fluid, Granulosa cells, Oxidative stress, ROS, Antioxidant, Metabolomics, Endometriosis, PCOS, Oocyte, Embryo, Polscope, IVF, Infertility*