Abnormal mitochondrial structure in human unfertilized oocytes and arrested embryos

Au HK, Yeh TS, Kao SH, Tzeng CR, and Hsieh RH

Abstract

Abstract: To clarify the relationship between mitochondria and embryo development, we collected human unfertilized oocytes, early embryos, and arrested embryos. Unfertilized oocytes and poor-quality embryos were collected, and the ultrastructure of mitochondria was determined by transmission electron micrography. Four criteria for determining the mitochondrial state were mitochondrial morphology, cristae shape, location, and number of mitochondria. In mature oocytes, mitochondria were rounded with arched cristae and a dense matrix and were distributed evenly in the ooplasm. In pronuclear zygotes, the size and shape of mitochondria were similar to those in mature oocytes; however, mitochondria appeared to migrate and concentrate around pronuclei. In this study, 67% of examined unfertilized oocytes had fewer mitochondria in the cytoplasm. A decreased number of mitochondria located near the nucleus was also demonstrated in 60% of arrested embryos. Fewer differentiated cristae were determined in all three arrested blastocyst stages of embryos. The relative expressions of oxidative phosphorylation genes in oocytes and embryos were also determined. These data imply that inadequate redistribution of mitochondria, unsuccessful mitochondrial differentiation, or decreased mitochondrial transcription may result in poor oocyte fertilization and compromised embryo development.