Calcium-dependent upregulation of mitochondrial electron transfer chain gene expressions in human luteinized granulosa cells

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Abstract

To evaluate the transcription and translation ability of mitochondria in terminally differentiated granulosa cells, these cells were incubated with ionic calcium.
Design: Prospective laboratory research. Setting: In vitro fertilization laboratory in a university hospital. Patient(s): Granulosa cells were harvested from 50 female patients undergoing IVF. Intervention(s): Analysis of mitochondrial gene expression by semiquantitative reverse transcription-polymerase chain reaction (RT-PCR) and of mitochondrial-encoded proteins by Western blot.Main Outcome Measure(s): Comparison of the RNA expression levels of genes including cytochrome c oxidase subunit I (COX I), adenosine triphosphate synthase 6 (ATPase 6), flavoprotein, and succinate-ubiquinone oxidoreductase, and protein levels of COX I and flavoprotein in different calcium ion treatment groups. Result(s): There were dose-dependent increases in RNA expressions of the four genes analyzed from granulose cells cultured in a serial concentration of calcium ions. This effect was abolished when cells were preincubated with the extracellular calcium-chelating agent, Ethylene glycol-bis (2-aminoethylether)-N,N,N=,N=-tetraacetic acid (EGTA). The effect of ionic calcium on both the nuclear- and mitochondrial-encoded subunits also was determined. Expression levels of mitochondrial transcription factor A in RNA significantly increased in granulose cells that were exposed for 24 and 48 hours to 0.5 and 1 M A23187. Conclusion(s): The present study is the first report to present calcium-dependent increases in the transcription and translation levels of both nuclear-encoded and mitochondrial-encoded mitochondrial respiratory enzyme subunits and also indicates that mitochondrial transcription factor A is involved in mitochondrial biogenesis. (Fertil Steril 2005;84(Suppl 2):1104–8. ©2005 by American Society for Reproductive Medicine.)