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

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Abstract

Objective

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 granulosa 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 granulosa cells that were exposed for 24 and 48 hours to 0.5 and 1 μM 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.