Embryonic arrest in vitro is enhanced by free oxygen radicals in ICSI cycles

Author Block: M. A. Bedaiwy, T. Falcone, J. M. Goldberg, M. Attaran, A. Agarwal; Mount Sinai Hospital, Toronto, ON, Canada, Cleveland Clinic, Cleveland, OH

Objective: Reactive oxygen species (ROS) are produced in the course of oxidative phosphorylation reactions in the mitochondria. There is growing evidence denoting various roles of ROS in different reproductive processes. The objective of this study is to examine the relationship of day 1 culture media ROS (D-1 ROS) levels and subsequent evolution of embryos in ICSI cycles.

Design: A prospective study.

Materials and Methods: Oocytes (n =1451) were denuded in preparation for ICSI by hyalourindase exposure and gentle aspiration in graduated pipettes. ICSI was performed in M-2 oocytes (n = 1120) approximately 42 hours post HCG administration. Fertilization and early culture were performed in HTF with 5% serum substitute supplement. D-1 ROS levels in the central well (sample) and the outer well (control) of each embryo culture dish were measured after overnight incubation by enhanced chemiluminescence assay using luminol as the probe. Average levels of ROS were calculated per cycle. Pregnancy and implantation were determined after transfer of embryos selected solely on the basis of embryo quality (cell number and fragmentation). Fertilization rate, day 3 and day 5 embryo quality parameters, and pregnancy were recorded for each cycle.

Results: Normal fertilization was achieved in 708/1120 oocytes (fertilization rate 63.2%). After controlling for all demographic and clinical variables, D-1 ROS levels were negatively correlated with fertilization rate at day 1, % embryo fragmentation at day 3, and with clinical pregnancy rate (Table). The relationship between ROS and embryonic arrest in vitro is shown in figure 1.

Conclusion: ROS are produced in day 1 culture media after ICSI. The antioxidant capacity of the culture system used could scavenge different amounts of ROS which appears to be variable among the cycles. Increasing levels of ROS in the culture system have a negative impact on the in vitro development of embryos, as well as pregnancy rates in ICSI cycles.

Financial Support: None.

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<thead>
<tr>
<th>Measure</th>
<th>r</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Fertilization rate</td>
<td>-0.294</td>
<td>0.002</td>
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<tr>
<td>Average cell no. at day 3</td>
<td>-0.054</td>
<td>0.584</td>
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<tr>
<td>Embryo fragmentation at day 3</td>
<td>-0.264</td>
<td>0.008</td>
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<tr>
<td>Blastocyst rate at days 5/6</td>
<td>-0.189</td>
<td>0.059</td>
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Clinical pregnancy $-0.348 < 0.001$

Author Disclosure Block: M.A. Bedaiwy, None; T. Falcone, None; J.M. Goldberg, None; M. Attaran, None; A. Agarwal, None.

Category (Complete): Outcome Predictors-Clinical: ART (SART)
Topic (Complete):
  Topic: Assisted reproductive technology

Additional Information (Complete):
  Poster Only: True
  Presenting Author Fellow: No
  In-Training Awards for Research: True
  ACCME Disclosure: I will not be discussing non-FDA approved products
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Status: Complete
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