Role of lipid peroxidation and total antioxidant capacity in follicular fluid and pregnancy outcome of women undergoing assisted reproduction

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Objectives: Assisted reproductive procedures involve ovarian hyperstimulation to retrieve larger number of oocytes. Healthy metabolically active oocytes may result in healthy embryos and successful pregnancies. Our objective was to evaluate the relationship between the lipid peroxidation (LPO) and total antioxidant capacity (TAC) in the follicular fluid (FF) of women undergoing assisted reproduction with fertilization rate, embryo quality, and pregnancy outcome.

Design: Prospective study in which follicular fluid LPO and TAC levels were compared between patients who became pregnant with those who did not.

Material and Methods: Following ovarian stimulation, macroscopically clear FF specimens were obtained at the time of oocyte retrieval from 36 patients undergoing assisted reproductive procedure. Eleven patients underwent intracytoplasmic sperm injection and the remaining 25 underwent conventional in vitro fertilization. Levels of lipid peroxidation in the FF were determined by malonaldehyde assay and reported as µmol MDA/mL. Total antioxidant capacity was measured by an enhanced chemiluminescence reaction and expressed as molar Trolox equivalents. The embryo quality index was determined using a ratio of cumulative embryo score and the total number of embryos in culture.

Results: Mean female age was significantly lower in patients who became pregnant (30.09 years ± 0.83) than in patients who did not (34.16 years ± 0.89) (p = 0.01). The mean number of oocytes recovered (13.91 ± 1.32 vs 11.96 ± 1.05) and percentage of oocytes fertilized (77.17 ± 8.82 vs 70.35 ±4.78) were comparable in both groups of patients. After adjusting for age, non-pregnant patients demonstrated depressed LPO levels in the FF compared to patients who achieved pregnancy (0.80 µmol/mL ± 0.12 vs 1.48 µmol/mL ± 0.17, p = 0.02). There was no difference in the TAC levels between non-pregnant patients and those who achieved pregnancy (816.09 ± 105 vs 933.67 ± 101.49, p = 0.67). The embryo quality was significantly higher in pregnant than in non-pregnant patients (33.45 ± 1.67 27.51 ± 1.41, p = 0.009). LPO and TAC levels in FF showed no correlation with the embryo quality or fertilization rates.

Conclusion: High levels of LPO in the follicular fluid of pregnant women and a positive correlation of LPO with pregnancy may reflect more intense oxidative metabolism of healthy developing follicles which may be responsible for successful pregnancy. This finding may reflect a functional buffering system for oocyte metabolic activity. The lack of association between embryo quality and LPO and TAC levels in the FF found in our study could be due to the fact that the embryo is an interaction of sperm and oocyte therefore the LPO and TAC levels in sperm may play a critical role in the embryo quality.