Evaluating the Plasma Levels of Poly(ADP-Ribose) Polymerase-2 in Women with Repeated Implantation Failure and in Fertile Women

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Citation:
Pourakbar N, Pashapour M, Seyedgholamisharabyani S, Naseri A, Yousefi M. Evaluating the Plasma Levels of Poly(ADP-Ribose) Polymerase-2 in Women with Repeated Implantation Failure and in Fertile Women. *Iranian biomedical journal*. Supplementary (12-2024): 27.

ABSTRACT

Introduction: Successful embryo implantation requires favorable endometrial receptivity and a high-quality embryo. Recurrent implantation failure (RIF) refers to the implantation failure of at least three healthy embryos following in vitro fertilization (IVF) in a woman under the age of 40 years. The inadequacy of the maternal immune system is convicted for implantation failure in RIF patients. During the implantation window, the high division rate of undifferentiated stem cells of epiblast exposes them to DNA damage. Poly(ADP-ribosyl)ation (PARylation) prevents blastocyst apoptosis through autophagy induction. Poly(ADP-ribose) polymerase-2 (PARP-2), the primary enzyme responsible for PARylation, plays an essential role in DNA repair pathways during early post-implantation development. Animal studies have approved its upregulation throughout the endometrial receptivity stages at basal levels of the endometrium. This study evaluated PARP-2 levels in RIF patients compared to fertile women.

Methods and Materials: In this case-control study, we investigated the expression levels of PARP-2 in peripheral blood samples of RIF patients compared to healthy pregnant women. A total of 24 RIF patients, whose husbands had regular semen analysis and DNA fragmentation test results, were enrolled. Also, 24 individuals, as a control group, from the Gynecology Department of Tabriz Valiasr Hospital participated in the study. A 10 ml blood sample was collected from individuals at the follicular phase of their menstrual cycle, and the serum levels of PARP-2 were assessed by a human PARP2 ELISA kit. To determine the distribution of potential confounding variables (age, BMI, cigarette, and alcohol addiction), the Shapiro-Will test was performed, and it showed a normal distribution. The mean level of PARP-2 and standard deviation were reported. An independent sample t-test was conducted to compare the mean level between the groups using SPSS Statistics version 23.0.

Results: The mean age of the RIF patients was 33.64 ± 3.0, and that of the control group was 32.62 ± 4.01 (p = 0.98). A significant reduction was observed in PARP-2 serum levels in RIF patients (7.72 ± 4.41 ng/ml) compared to controls (11.06 ± 5.41 ng/ml), with p = 0.023.

Conclusion and Discussion: Our findings suggest that PARP-2 could play a role in the cellular events of implantation in the human uterine, as explored in animal studies, influencing endometrial receptivity, embryo development, and blastocyst attachment. Further research is needed to gain a more comprehensive understanding of its underlying mechanisms and to establish it as a biomarker of uterine receptivity and stromal cell decidualization.

Keywords: Embryo implantation, Infertility, PARP-2

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[DOI: 10.61186/ibj.25th-11th-IACRTIMSS]