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Identification of Biomarkers to Predict Embryo Implantation

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INTRODUCTION

Obesity is now recognized as a high risk factor for reproductive health. Despite remarkable progress in ART and the high quality of transferred embryos, a significant number of infertile and obese women still suffer from repeated implantation failures. Although it has long been known that obesity has a variety of adverse effects on female fertility, the underlying mechanisms, particularly the role of lipid metabolism in endometrial receptivity, remain largely unknown. This summarizes the current evidence on the effects of several key lipids and lipid-derived mediators on the embryonic implantation process. We also describe new methods to assess endometrial receptivity, such as transcriptome analysis and lipidomic analysis

DESCRIPTION

Recent studies have shown that a fatty acid-associated pro-inflammatory response at the embryo-endometrium junction promotes pregnancy through prostaglandin signaling. Phospholipid-derived mediators such as endocannabinoids, lysophosphatidic acid, and sphingosine-1-phosphate are involved in endometrial receptivity, embryonic spacing, and decidualization, based on evidence from animal and human studies. It is believed that Progesterone and estrogen are two cholesterol-derived steroid hormones that synergistically mediate structural and functional changes in the uterus in preparation for blastocyst implantation. endometrial transcriptome analysis has served as a diagnostic tool for WOI dating. A large number of genes controlling lipid homeostasis have been identified, and based on specific changes in the lipidomic signature that are differentially expressed in WOI, lipidomic analysis of endometrial fluid provide insight into lipid changes during WOI.

Key to this process is a complex cascade of molecular mechanisms regulated by endocrine, paracrine, and autocrine regulators of embryonic and maternal origin. However, classical morphological embryo selection and newer strategies integrated into clinical practice, such as embryo genetic analysis, morphological dynamics and ultrasonic endometrial dating, are still insufficient to predict implantation success. Furthermore, there are no widely used techniques to analyze the molecular signals involved in interactions between the embryo and uterus. Improved pregnancy outcomes require more reliable biological markers to predict embryonic and uterine fertility. In recent years, there has been a trend towards 'omics' methods that allow the evaluation of the complete endometrium and embryo molecular profile during implantation. Omics has expanded our knowledge of the transplantation process and identified potential but rarely implemented biomarkers for successful transplantation.

CONCLUSION

Discrepancies between the results of published omics studies, and perhaps the fact that embryonic and endometrial molecular signatures were often not examined together, also prevented firm conclusions from being drawn. Here, we provide a complete overview of the major achievements of the omics approach in human implantation research, highlighting its potential to improve reproductive outcomes while fully elucidating the mechanisms of implantation. Despite the vast amount of biomarker information provided by omics, there is still insufficient evidence linking all omics data to transplant outcome. However, in the near future, minimal or non-invasive application of omics tools and more integrative interpretation of uniformly collected data will help overcome difficulties in clinical implementation of omics tools. Embryonic and endometrial omics testing has been proposed as a diagnostic tool to individually transfer single embryos in the most favorable endometrial environment to avoid the risk of multiple gestations and ensure higher pregnancy rates.

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