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Editorial Letter

Genetic Printing as a Predictor of Pregnancy Viability

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Dear Editor-in-Chief,

Assisted reproductive treatments (ART), particularly IVF, were one of the major innovations that allowed many infertile couples to become parents. Globally, their use has been steadily increasing. Even though 20% of pregnancies end in miscarriages, there is an increasing demand for more reliable and customized prenatal viability predictors [1]. In this context, Abdulsattar et al. have highlighted the emerging role of non-classical biomarkers, cytokines, and adipokines [2]. The female genetic signature, sometimes referred to as the genetic print, is another element that merits discussion. Despite having a direct bearing on ART success and implantation potential, this area has received little attention. Pregnancy viability genetic predictors offer a consistent internal molecular profile that affects the upstream processes of oocyte maturation (ovum competence, metabolic signaling, and spermatogenesis) as well as uterine receptivity [1,3]. However, the immunometabolic environment in the early stages of pregnancy is reflected in the biomarkers used to predict pregnancy viability, however they are impacted by a variety of circumstances. Environmental, hormonal, and epigenetic influences are a few of them [2]. Important aspects of genetic print have been demonstrated by recent investigations. expression of the Steroidogenic Acute Regulatory (StAR) gene. This plays a role in the rate-limiting phase of steroidogenesis, the transport of cholesterol into mitochondria. These high levels of StAR expressions were related in a positive manner with the quality and numbers of oocytes and embryos, reflecting that high StAR expression may suggest the odds of high IVF success [4]. On the other hand, another genetic marker is IRS-1 rs1801278G>A polymorphism can be involved in insulin receptor signaling in PCOS patients. This can be considered as a key pathogenic axis in women who are affected. In a certain study, it was shown that the mutant AA genotype had an increase of around 20-fold among PCOS cases. In addition, women's reproductive performance had strong correlations with this polymorphism, as did a higher antral follicle count, which is considered a lead parameter in ovulation dysfunction and implantation success. These outcomes underline the prognosis of gene polymorphism screening for infertility risk stratification and expected success of ART [5]. According to Abdulsattar *et al*., the analysis showed that combining AI and cytokines has increased the prediction value for pregnancy viability to more than 90%. The performance of these methods can be further enhanced by using genetic input, particularly among complex infertility patients with phenotypes like PCOS, unexplained infertility, and recurrent implantation failure [6]. An added benefit of genetic printing is the potential to alter gene expression patterns. It has been reported that the administration of myoinositol can lead to a downregulation of StAR expression in cumulus cells, consequently affecting oocyte maturity and the quality of embryos [7]. Enhancing the IVF outcome requires involving both pharmacological and nutritional therapies to alter the genetic printing of females, a new possibility. The clinical significance of genetic printing is crucial, as it facilitates the categorization of patient responses and risks associated with IVF protocols. This, in turn, permits a more individualized approach aimed at minimizing adverse effects such as ovarian hyperstimulation syndrome [6]. The ability to alter patterns of gene expression is another benefit of genetic printing. Myoinositol treatment has been shown to decrease the expression of StAR in cumulus cells, which in turn affects oocyte maturity and embryo quality [7]. Pharmacological and nutritional therapies that alter the female genetic print are a novel way to improve the results of IVF. To avoid undesirable side effects such as ovarian hyperstimulation syndrome, a more individualized approach to therapy is made possible by the ability to stratify patient responses and risks to IVF protocols, which makes the therapeutic implications of genetic printing crucial [6]. Furthermore, they provide a mechanistic perspective for comprehending the differences in hormone profiles and embryonic results between patients with matched age or body mass index, two important factors that can impede the success of IVF [8]. Lastly, a non-fluctuating, cycle-

independent indicator that enhances clinical decision-making is made possible by the stability of genetic markers across time [9]. These genetic markers are infrequently incorporated into routine treatment, however, in spite of all these benefits. Their translation is hampered by several problems. 1) Standardization Gene expression levels, such as those of StAR, are sensitive to the test technique and sample window and differ depending on the tissue source (granulosa cells, cumulus cells, or adipose tissue). Clinical interpretation is still challenging in the absence of established criteria or reference ranges [4]. 2) Regarding phenotype variation, the presence of ovulatory, hyperandrogenic, and metabolic characteristics, specifically in PCOS, makes it more difficult to link genotype to phenotype and calls for validation specific to subgroups [10]. 3) Concerning the outcome, most research correlated genes with diagnosis rather than pregnancy viability or live birth outcomes. such as live birth, fetal heartbeat, or biochemical pregnancy. This is a significant gap in relevancy to the real world [11]. 4) In terms of cost and access, restricted affordability and infrastructure, particularly in ART environments with limited resources. Absence of NGS platforms or PCR-based assay infrastructure [1]. Genetic biomarkers hold promises in reproductive medicine despite these drawbacks since they help us develop more individualized treatment plans. These markers are anticipated to eventually become as commonplace in IVF procedures as AMH testing or ultrasound monitoring. the genetic print of male variables on pregnancy outcome, which is another crucial area for future research [12,13]. In conclusion, the female unique genetic print is still largely neglected, despite its promising and crucial function in evaluating reproductive potential, even though the present focus is on molecular biomarkers in many areas of women's health [1,2,14]. Multicenter validation and AI-integrated models are required to make full use of this possibility. To enable genomic tools as an assessor and guide in therapy protocol and reproductive planning, these tools can close the gap between genetic knowledge and everyday practice.

Keywords: Genetic printing, Predictor, Pregnancy viability.

Conflict of interests

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