Preimplantation Genetic Screening May Improve Embryo Selection

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Research has shown that preimplantation genetic screening (PGS) may improve success of in vitro fertilization (IVF) by allowing physicians to select embryos for implantation that have the greatest potential for success. Preimplantation genetic screening helps women aged 37 or older, or those with recurrent miscarriages, achieve higher implantation rates with lower numbers of spontaneous abortions. This technique does not diagnose specific diseases, however it does reduce unnecessary implantation of multiple embryos by screening them for potential viability and success.

The main concern with IVF is the frequency of multiple pregnancies. Multiple pregnancies are associated with high costs and accompanying health risks for the mother as well as offspring. To reduce the risk of multiple pregnancies, a single embryo transfer (SET) is sometimes preferred. However, this may limit the chance of a successful pregnancy, unless there are better ways of selecting the most appropriate embryo. Combination SET and PGS improves selection efficiency and achieves higher success rates. Making SET viable and attractive to patients may also result in more insurance companies paying for IVF with SET.

PGS for infertility traditionally involves the biopsy of a single blastomere at the cleavage stage during day 3 testing, followed by a limited chromosomal assessment using fluorescent in situ hybridization (FISH). The more recent development of comparative genomic hybridization (CGH), referred to as array-based CGH (aCGH), shows results in 24 hours.

While aCGH can be performed on day 3 embryos, later stage embryos (day 5) are preferred, as embryologists can safely remove more cells from day 5 blastocysts. It is possible to remove eight to 10 cells on day 5 instead of only a single cell on day 3, thus allowing more cells to be screened for viability. Not only does the increased number of available cells provide a robust test showing CGH success rates of approximately 94 percent, but diagnostic issues of chromosomal mosaicism are also reduced.

Recent studies involving day 5 biopsy, cryopreservation and genetic analysis have given encouraging results as far as viability and implantation potential of biopsied blastocysts after thawing. The use of sequential, stage-specific media combined with ultra-stable, low-oxygen culture systems have permitted blastocyst cultures to be accomplished with high efficiency.

Preliminary results indicate that while aCGH and CGH can improve the detection of chromosomal abnormalities by 20 percent, combination aCGH, CGH and blastocyst biopsy can double implantation rates of potentially viable embryos. Moreover, FISH may be substituted in the future by CGH and aCGH, since early results show better
implantation rates with embryos analyzed by CGH than with controls or PGS with FISH.

Combination SET and PGS via CGH analysis of biopsied trophoblast cells (outer layer of cells), along with embryo cryopreservation and transfer in a subsequent cycle will improve selection efficiency and maintain higher success rates. These new techniques can better determine which embryos are healthy and have potential for high pregnancy rates. Instead of transferring all of the embryos and hoping for success, it is possible to implant the one specific embryo that will have the best chance of success. This may reduce the time and number of treatment cycles needed to conceive.

PGS will not improve the chances of conceiving if there are no viable embryos. However, it will reduce the number of unnecessary costly procedures. PGS has increased the cumulative pregnancy rate for fresh and frozen cycles. The freezing of biopsied blastocysts and their transfer in a subsequent cycle could potentially enable a better synchronization between the embryo and the uterus, which will enhance implantation and pregnancy.

For more information, or if you are interested in being an author on a future publication, please contact:
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Mark Perloe, MD received his medical degree from the Pennsylvania State University, Hershey Medical Center. After fulfilling his residency in obstetrics and gynecology at the University of Wisconsin, he completed a fellowship in reproductive endocrinology and infertility at the University of Minnesota. He is currently medical director at Georgia Reproductive Specialists where he specializes in topics, including polycystic ovary syndrome, recurrent pregnancy loss, endometriosis and in vitro fertilization. Dr. Perloe is a member of several professional organizations, and has published numerous works on obstetrical, gynecological and reproductive issues in prestigious medical journals, including Obstetrics & Gynecology, Southern Medical Journal and the International Journal of Obstetrics and Gynecology.
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