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Editorial

Modern Methods of Assisted Reproductive Technology

Assisted reproductive technology (ART) has evolved considerably over the last decades, incorporating advances in ovarian stimulation, embryology, cryobiology, reproductive genetics, and laboratory medicine. Contemporary ART aims not only to achieve fertilization and embryo implantation but also to optimize cumulative live birth rates while minimizing treatment-related risks.

In vitro fertilization (IVF) remains the cornerstone of ART. Controlled ovarian stimulation using gonadotropins, combined with individualized ovarian response monitoring and GnRH antagonist protocols, allows the retrieval of multiple mature oocytes. Fertilization may be achieved through conventional insemination or intracytoplasmic sperm injection (ICSI). Although ICSI is indispensable in severe male-factor infertility and specific previous fertilization failures, its routine use in non-male-factor infertility remains controversial.

A major advance has been the introduction of vitrification, which has markedly improved oocyte and embryo cryosurvival. The increasing use of elective freeze-all strategies and frozen embryo transfer (FET) enables transfer in a subsequent cycle, potentially reducing the risk of ovarian hyperstimulation syndrome and allowing more physiological endometrial preparation. FET can be performed in natural, modified-natural, or hormone-replacement cycles according to the clinical setting.

Preimplantation genetic testing (PGT) provides an additional tool for selected patients. PGT-M is used for monogenic disorders, PGT-SR for structural chromosomal rearrangements, and PGT-A for the detection of whole-chromosome aneuploidies. However, PGT-A should not be regarded as a universal screening test, and its clinical value depends on maternal age, embryo cohort, laboratory performance, and appropriate patient selection.

Modern ART also incorporates fertility preservation, particularly oocyte cryopreservation, which has become increasingly relevant for both medical and elective indications. Donor oocytes and sperm, embryo donation, and gestational carrier programs provide additional options for patients with specific reproductive indications.

Emerging technologies include time-lapse embryo imaging, artificial intelligence-assisted embryo assessment, non-invasive embryo biomarkers, and increasingly sophisticated genomic approaches. Although these technologies are promising, their clinical utility should be assessed according to robust evidence rather than laboratory performance alone.

Overall, contemporary ART is moving toward increasingly individualized treatment, integrating clinical characteristics, ovarian reserve, embryological parameters, genetic information, and patient preferences. In this special issue, Chondrou et al. provide comprehensive data on the role of hysterosalpingo-foam sonography in the evaluation of female infertility. The future of reproductive medicine will likely depend on combining technological innovation with rigorous evidence-based clinical practice.