Poonam Shodh Rachna (ISSN 2456-5563)
(A Multidisciplinary, Peer Reviewed and Refereed Research Journal)
Vol. 3, Issue.V, May 2024, PSR-2305055

Frozen Embryo Transfer VS Fresh Embryo Transfer - A Review

[1]Mohit Yadav*, [2]Rajwinder Kaur, [3]Dipneet Kaur
1- M.Sc Department of Clinical Embryology and Reproductive Genetics,
Rayat-Bahra University. ymohityadav8989@gmail.com
2- Assistant Professor, Department of Clinical Embryology and Reproductive Genetics,
Rayat-Bahra University
3- Assistant Professor, Department of Clinical Embryology and Reproductive Genetics,
Rayat-Bahra University

ABSTRACT
Embryo transfer plays a pivotal role in vitro fertilization (IVF) procedures. This paper provides a comprehensive review of the assessment of frozen embryo transfer v/s fresh embryo transfer receptivity in IVF cycles, focusing on the emerging role of array analysis techniques. A prospective observational study was undertaken to investigate the frozen embryo transfer v/s fresh embryo transfer. The studies show advantage and disadvantage of Fresh Vs Frozen embryo transfer. Which type of problem can be face after pregnancy. It shows comparison Fresh ET vs Frozen ET. In this study frozen embryo transfer v/s fresh embryo transfer in some area it shows that Frozen ET is Good And In Some Area Its Shows Fresh ET is good. Meanwhile, there is no big difference in pregnancy rate in Frozen Embryo transfer vs Fresh Embryo Transfer. The primary purpose of embryo cryopreservation is to preserve extra embryos for use in future IVF cycles (i.e., to raise the cumulative pregnancy rate per cycle) following a fresh embryo transfer. There are other indicators such as the accumulation of embryos in patients who are not responding well and the cancellation of embryo transfers in order to prevent Ovarian hyper stimulation syndrome (OHSS).
Keywords:*Assisted Reproductive Technology, Embryo Transfer, Ovarian hyper stimulation syndrome, Frozen Embryo Transfer.*

INTRODUCTION

The assisted reproductive technology (ART) known as IVF (In Vitro Fertilization) was first used by Robert Edwards and Patrick Steptoe in the 1970s. (Choe, Shanks, and Archer, 2022). The information that is now available indicates that 186 million people and 48 million couples worldwide are infertile. The WHO Significant advances in the field have led to the development of numerous techniques to increase the likelihood of conception in couples undergoing ART. Experts assess and counsel infertile couples, urging them to select the most suitable assisted reproductive technology.

The World Health Organization (WHO) defines infertility as a disorder of the male or female reproductive system characterized by the inability to conceive after 12 months or longer of consistent, unprotected sexual activity. Experts recommend treating women 35 years of age or older after six months of unprotected sexual relations due to the known decline in a woman's fertility with age. About 10% of couples globally are infertile, and one in six couples will at some point in their reproductive lives experience subfertility ("Assisted reproductive technology in Europe, 2011: results generated from European registers by ESHRE," 2016). Primary infertility refers to the inability to conceive at all, while secondary infertility refers to the inability to conceive after a prior successful conception.

The primary and furthermost frequent reason of infertility, particularly in women but often in men, is advanced age. The likelihood of a woman becoming pregnant decreases with age since there is an inverse relationship between fertility and female age. Furthermore, sperm counts of western men decreased by 50% to 60% between 1973 and 2011, with an average annual decline of 1% to 2%, according to a 2017 study. Consequently, there is also a lower likelihood of becoming pregnant through natural sexual activity. (Carlsen et al., 1992)

In 1972, mouse embryos were successfully cryopreserved for the first time. A year later, the first calf born from a frozen and thawed embryo made headline news. (Whittingham, 1971). After the successful use of frozen embryos to create the first human pregnancy in 1983, freezing and thawing procedures have become commonplace in assisted reproductive technology (ART) and are being utilized more and more.

Cases of infertility preservation (ahead of surgery, chemotherapy, radiotherapy, or other major illnesses), as well as difficulties with sperm collection and donation, warrant sperm cryopreservation.

There are many uses for oocyte cryopreservation, including fertility preservation, the treatment of endometriosis and chronic inflammation in women, the preparation of a woman for chemotherapy or radiation, the preparation of a woman for ovarian surgery, and social reasons such as delaying parenthood. (Xu et al., 2015). Additional signs are limitations on embryo freezing imposed by law, ethics, or religion. Furthermore, When the day of oocyte retrieval arrives and no sperm are ground and when oocyte donation occurs, oocyte cryopreservation is carried out.

The primary purpose of embryo cryopreservation is to preserve extra embryos for use in future IVF cycles (i.e., to raise the cumulative pregnancy rate per cycle) following a fresh embryo transfer. In addition, there are other indicators such as the accumulation of embryos in patients who are not responding well and the cancellation of embryo transfers in order to prevent OHSS. Moreover, embryo cryopreservation can prevent PGT cases, oocyte donation cycles, and embryo transfers in less-than-ideal endometrial environments (Bedoschi and Oktay, 2013).

OBJECTIVE:

The objective is to discern the optimal approach—frozen embryo transfer (FET) versus fresh embryo transfer (ET)—in assisted reproductive technology. This involves evaluating efficacy, safety, and patient-centered outcomes to maximize pregnancy success while minimizing risks and healthcare resource utilization. Key aims include determining which method yields higher live birth rates, mitigates ovarian hyperstimulation syndrome risk, and maintains embryo viability post-transfer. Understanding patient preferences and treatment flexibility is crucial for delivering personalized care. By addressing these objectives, clinicians can tailor fertility treatments to individual needs, enhancing overall success rates and patient satisfaction.

STATEMENTOFPROBLEM

The comparative efficacy and safety of frozen embryo transfer (FET) versus fresh embryo transfer (ET) in assisted reproductive technology remain pivotal. While FET offers benefits like reduced ovarian hyper stimulation syndrome risk and improved embryo selection, concerns persist regarding embryo viability and implantation rates. ET presents risks of OHSS and potential suboptimal embryo quality due to timing constraints. Determining the optimal approach hinges on balancing success rates, patient safety, and treatment convenience. Resolving this issue requires comprehensive analysis of pregnancy outcomes, patient preferences, and healthcare resource utilization to guide informed decision-making in fertility treatment.

HYPOTHESIS:

The success rates, measured by live birth rates, will be comparable between frozen embryo transfer (FET) and fresh embryo transfer (fresh ET) in assisted reproductive technology (ART) cycles. The hypothesis is based on emerging evidence suggesting that frozen embryo transfer may offer certain advantages over fresh embryo transfer, such as improved endometrial receptivity and reduced risk of ovarian hyper stimulation syndrome (OHSS). By testing this hypothesis, researchers can contribute to our understanding of the optimal approach for embryo transfer in ART cycles and provide valuable insights for clinical practice.

RESEARCHMETHODOLOGY

Literature was reviewed by conducting a comprehensive search of relevant academic databases, including PubMed, MEDLINE, Embase, Scopus and Google scholar etc. Different key words like frozen embryo transfer, conception techniques, ART, hyper ovarian stimulation , fresh embryo transfer were used to search the relevant research articles.

Impact of Conception Technique on Postpartum Hemorrhage: IVF Comparison there was a difference between pregnancies that were created spontaneously, via "fresh embryo in vitro fertilization," and through "frozen embryo transfer". The influence of conception technique on the incidence of severe postpartum haemorrhage was examined. The research found that the major postpartum haemorrhage prevalence in normally conceived pregnancies was 0.74 percent (n = 1749), in fresh- in vitro fertilization pregnancies it was 1.92 percent (n = 34), and in frozen- in vitro fertilization pregnancies it was 3.30 percent (n = 29). The outcomes showed that frozen in vitro fertilization pregnancies had a greater risk of significant postpartum haemorrhage than either normally conceived pregnancies or fresh in vitro fertilization pregnancies. According to the results, in order to reduce the heightened risk of significant postpartum haemorrhage at birth, frozen-IVF pregnancies should be monitored more closely.

"Comparing Fresh and Frozen-Thawed Euploid Blastocyst Transfer Protocols for Elderly Mothers: Implications for Implantation and Gestation Rates after Preimplantation Genetic Testing" "fresh and frozen-thawed euploid blastocyst transfer" protocols after preimplantation genetic testing on elderly mothers. The "frozen-thawed" group had a higher number of fertilized eggs, retrieved oocytes, and metaphase II oocytes. In comparison to the fresh group, the "frozen-thawed" group exhibited significantly higher rates of implantation (46.6 versus 62 percent), gestation 50 percent versus, ongoing gestation (38.4 percent versus 53.8 percent), and "live birth percentage" (37.0 versus 53.8 percent). Comparable gestation of euploid embryos (32% and 34.8%, respectively) were gestated in both groups. Abortion rates that were comparable in terms of biochemistry as well clinical features, however, did not differ much. Thus, frozen-thawed single euploid embryo transfer was associated with higher rates of implantation and gestation than fresh single euploid embryo transfer utilizing pre implantation genetic screening.

Age-Stratified Analysis Reveals Improved Outcomes for Women 25-35 Years Old" evaluated the effects of gestation after both "frozen embryo transfer" and "fresh embryo transfer" among females using technology for assisted reproduction. For women under 25, there were no significant changes in the live birth and chemical gestation rates between the two groups. For women between the ages of 25 and 35, however, the "frozen embryo transfer group" demonstrated much higher live birth rates, clinical pregnancies, as well chemical gestation than the fresh embryo transfer group did. The frozen embryo transfer group showed a substantially "higher live birth rate" among women in the 35–40 age range, although the rates of chemical and clinical gestation remained the same. Furthermore, there was a reduced chance of miscarriage within the cohort that had frozen embryo transfers. These findings suggest that the frozen embryo transfer process is useful in raising the likelihood of a successful IVF or intracytoplasmic sperm injection, particularly for women in the 25–35 age range.

Comparing Clinical Outcomes of Fresh vs. Frozen Embryo Transfer examined the clinical results and neonatal results of individuals undergoing "fresh or frozen embryo transfer." The study found that women who were part of the "frozen transfer group" had a higher likelihood of having solo caesarean procedures. There were no other notable distinctions between the two groups discovered by the investigation. Subgroup comparisons, however, revealed notable variations in the incidence of postpartum haemorrhage and gestational hypertension. Interestingly, they found no discernible variations in the offspring results between the two transfer techniques. There was no obvious winner when comparing transfers of fresh and frozen embryos. The research also demonstrated that advanced motherhood has a significant impact on pregnancy problems. According to these results, frozen embryo transfer was still a feasible alternative in certain clinical situations, even if it may not always be the best option.

CONCLUSION

In conclusion, there has been a substantial surge in the utilization of elective frozen embryo transfer (FET) due to advancements in cryopreservation methods. Randomized controlled trials and observational studies

have indicated that the endometrium is not optimally prepared for implantation during stimulated cycles; pregnancy rates have increased and the risk of ovarian hyper stimulation syndrome has decreased; and perinatal outcomes have been found to be less significantly impacted by FET. Nevertheless, the evidence is not conclusive, and recent randomized controlled trials raise doubts regarding the utility of elective FET for the IVF population as a whole. An analysis of pregnancy rates was conducted on a cohort of patients who underwent embryo transfers.

The findings indicated that there were no statistically significant disparities in the biochemical, clinical, continuing clinical pregnancy rates, and miscarriage rates between the equivalent groups of fresh and frozen embryo transfers, despite the fact that each of these rates were greater in the frozen embryo transfer group. The literature provides evidence of decreased endometrial receptivity in cycles involving controlled ovarian stimulation. It also confirms the clinical data that frozen embryo transfer (FET) decreases the likelihood of ovarian hyper stimulation syndrome (OHSS) and improves outcomes for both the mother and baby.

RECOMMENDATION

For optimal outcomes in assisted reproductive technology, consider patient health, embryo viability, and success rates. Frozen embryo transfer (FET) offers advantages such as reduced risk of ovarian hyper stimulation syndrome, optimal embryo selection, and flexibility in timing. Fresh embryo transfer (ET) may suit certain cases, yet carries risks like OHSS and potential embryo quality concerns. Discuss with a fertility specialist to tailor the approach to individual needs, balancing efficacy, safety, and patient preferences.

REFERENCES –

- Assisted reproductive technology in Europe, 2011: results generated from European registers by ESHRE" (2016) Human Reproduction, p. dev319. doi:10.1093/humrep/dev319.
- Al-Khatib A, Sagot P, Cottenet J, Aroun M, Quantin C, Desplanches T. Major postpartum haemorrhage after frozen embryo transfer: A population-based study. BJOG: An International Journal of Obstetrics & Gynaecology. 2024 Feb;131(3):300-8.
- Babakhanzadeh, E. et al. (2020) "Some of the Factors Involved in Male Infertility: A Prospective Review.," International journal of general medicine, 13, pp. 29–41. doi:10.2147/IJGM.S241099.
- Bagheri RB, Bazrafkan M, Sabour A, Ataei M, Badehnoosh B, Mashak B, Khakifirooz B, Moghaddam R. The comparison of pregnancy outcomes in fresh and frozen embryo transfer: A cross-sectional study. International Journal of Reproductive BioMedicine. 2023 Jul;21(7):551.
- Bedoschi, G. and Oktay, K. (2013) "Current approach to fertility preservation by embryo cryopreservation," Fertility and Sterility, 99(6), pp. 1496–1502. doi:10.1016/j. fertnstert.2013.03.020
- Biliangady R, Pandit R, Tudu NK, Kinila P, Maheswari U, Gopal IS, Swamy AG. Is it time to move toward freeze-all strategy? A retrospective study comparing live birth rates between fresh and first frozen blastocyst transfer. Journal of Human Reproductive Sciences. 2019 Oct 1;12(4):321-6.
- Bushaqer NJ, Alkhudhairy NN, Alturaigi ZM, Alhamad RM, Mohawesh WA, Alraka FE, Ayyoub HA, Nawal MD. The effect of fresh IVF cycle characteristics on frozen embryo transfer (FET) outcomes. JBRA assisted reproduction. 2020 Apr;24(2):135.
- Cai Q, Wan F, Huang K, Zhang H. Does the number of oocytes retrieved influence pregnancy after fresh embryo transfer?. PloS one. 2013 Feb 15;8(2):e56189.
- Carlsen, E. et al. (1992) "Evidence for decreasing quality of semen during past 50 years.," BMJ, 305(6854), pp. 609–613. doi:10.1136/bmj.305.6854.609.
- Choe, J., Archer, J.S. and Shanks, A.L. (2022) In Vitro Fertilization.
- Chun S, Seo JE, Rim YJ, Joo JH, Lee YC, Koo YH. Efficacy of hyaluronan-rich transfer medium on implantation and pregnancy rates in fresh and frozen-thawed blastocyst transfers in Korean women with previous implantation failure. Obstetrics & gynecology science. 2016 May;59(3):201.
- Dieamant FC, Petersen CG, Mauri AL, Comar V, Mattila M, Vagnini LD, Renzi A, Petersen B, Nicoletti A, Oliveira JB, Baruffi RL. Fresh embryos versus freeze-all embryos-transfer strategies: nuances of a meta-analysis. JBRA Assisted Reproduction. 2017 Jul;21(3):260.
- Ding Q, Wang Y, Suo L, Niu Y, Zhao D, Yu Y, Wei D. The gestational age-specific difference in birthweight between singletons born after fresh and frozen embryo transfer: A cohort study. Acta Obstetricia et Gynecologica Scandinavica. 2023 Mar;102(3):323-33.

- Ding X, Yang J, Li L, Yang N, Lan L, Huang G, Ye H. Fertility outcomes in women after controlled ovarian stimulation with gonadotropin releasing hormone agonist long protocol: fresh versus frozen embryo transfer. BMC Pregnancy and Childbirth. 2021 Dec;21:1-8.
- Ernstad EG, Wennerholm UB, Khatibi A, Petzold M, Bergh C. Neonatal and maternal outcome after frozen embryo transfer: increased risks in programmed cycles. American journal of obstetrics and gynecology. 2019 Aug 1;221(2):126-e1.
- Fan L, Tang N, Yao C, Wei X, Tang Y, Li J, Huang W. Association between fresh embryo transfers and frozen–thawed embryo transfers regarding live birth rates among women undergoing long gonadotropin-releasing hormone antagonist protocols. Frontiers in Cell and Developmental Biology. 2022 Apr 28;10:884677.
- Ginström Ernstad, E. et al. (2019) "Neonatal and maternal outcome after frozen embryo transfer: Increased risks in programmed cycles," American Journal of Obstetrics and Gynecology, 221(2), pp. 126.e1-126.e18. doi:10.1016/j.ajog.2019.03.010.
- Glujovsky, D. et al. (2014) "Vitrification versus slow freezing for women undergoing oocyte cryopreservation," Cochrane Database of Systematic Reviews [Preprint]. doi:10.1002/14651858.CD010047.
- Goto, S. et al. (2011) "Prediction of pregnancy rate by blastocyst morphological score and age, based on 1,488 single frozen-thawed blastocyst transfer cycles.," Fertility and sterility, 95(3), pp. 948–52. doi:10.1016/j.fertnstert.2010.06.067.
- Greenfeld, D. A. (2015). Effects and outcomes of third-party reproduction: parents. Fertility and sterility, 104(3), 520-524.
- Groenewoud, E.R. et al. (no date) "What is the optimal means of preparing the endometrium in frozen-thawed embryo transfer cycles? A systematic review and metaanalysis.," Human reproduction update, 19(5), pp. 458–70. doi:10.1093/humupd/dmt030
- He QH, Wang L, Liang LL, Zhang HL, Zhang CL, Li HS, Cui SH. Clinical outcomes of frozen-thawed single blastocyst transfer in patients requiring whole embryo freezing. Systems biology in reproductive medicine. 2016 Mar 3;62(2):133-8.
- He Y, Zheng H, Du H, Liu J, Li L, Liu H, Cao M, Chen S. Delayed frozen embryo transfer failed to improve live birth rate and neonatal outcomes in patients requiring whole embryo freezing. Reproductive Biology and Endocrinology. 2020 Dec;18:1-7.
- Jimenez PT, Schon SB, Odem RR, Ratts VS, Jungheim ES. A retrospective cross-sectional study: fresh cycle endometrial thickness is a sensitive predictor of inadequate endometrial thickness in frozen embryo transfer cycles. Reproductive biology and endocrinology. 2013 Dec;11:1-5.
- Le TM, Ong PT, Nguyen QA, Roque M. Fresh versus elective frozen embryo transfer: Cumulative live birth rates of 7,236 IVF cycles. JBRA Assisted Reproduction. 2022 Jul;26(3):450.
- Li X, Guo P, Blockeel C, Li X, Deng L, Yang J, Li C, Lin M, Wu H, Cai G, Hu Y. Storage duration of vitrified embryos does not affect pregnancy and neonatal outcomes after frozen-thawed embryo transfer. Frontiers in Endocrinology. 2023 Mar 14;14:1148411.
- Liu C, Li Y, Jiang H, Liu Y, Song X. The clinical outcomes of fresh versus frozen embryos transfer in women≥ 40 years with poor ovarian response. Obstetrics & Gynecology Science. 2021 May;64(3):284.
- Matthiesen, S. M. S., Frederiksen, Y., Ingerslev, H. J., & Zachariae, R. (2011). Stress, distress and outcome of assisted reproductive technology (ART): a meta-analysis. Human reproduction, 26(10), 2763-2776.
- Naredi N, Singh S, Gurmeet P, Kumar P, Sharma R. Fresh versus frozen embryo transfer after an in vitro fertilization cycle: Is there a difference in the ectopic pregnancy rate?. medical journal armed forces india. 2021 Apr 1;77(2):175-80.
- Ozdemir F, Oner G, Kahraman S, Sahin Y, Yelke H. Preferred strategy for euploid single embryo transfer in advanced maternal age: Fresh versus frozen. Clinical and experimental reproductive medicine. 2024.
- Ozgur, K. et al. (2018) "Frozen embryo transfer can be performed in the cycle immediately following the freeze-all cycle," Journal of Assisted Reproduction and Genetics, 35(1), pp. 135–142. doi:10.1007/s10815-017-1048-6.
- Park CW, Choi MH, Yang KM, Song IO. Pregnancy rate in women with adenomyosis undergoing fresh or frozen embryo transfer cycles following gonadotropin-releasing hormone agonist treatment. Clinical and experimental reproductive medicine. 2016 Sep;43(3):169.
- Practice Committee of the American Society for Reproductive Medicine. (2012). Evaluation and treatment of recurrent pregnancy loss: a committee opinion. Fertility and sterility, 98(5), 1103-1111.
- Quaas, A. and Dokras, A. (2008) "Diagnosis and treatment of unexplained infertility.," Reviews in obstetrics & gynecology, 1(2), pp. 69–76.
- Rezazadeh Valojerdi, M. et al. (2009b) "Vitrification versus slow freezing gives excellent survival, post warming embryo morphology and pregnancy outcomes for human cleaved embryos," Journal of Assisted Reproduction and Genetics, 26(6), pp. 347–354. doi:10.1007/s10815-009-9318-6.
- Rienzi, L., Gracia, C., Maggiulli, R., LaBarbera, A. R., Kaser, D. J., Ubaldi, F. M., ... & Racowsky, C. (2017). Oocyte, embryo and blastocyst cryopreservation in ART: systematic review and meta-analysis comparing slow-freezing versus vitrification to produce evidence for the development of global guidance. Human reproduction update, 23(2), 139-155.
- Roque M, Valle M, Sampaio M, Geber S. Obstetric outcomes after fresh versus frozen-thawed embryo transfers: a systematic review and meta-analysis. JBRA assisted reproduction. 2018 Jul;22(3):253.

- Roque, M. et al. (2019a) "Fresh versus elective frozen embryo transfer in IVF/ICSI cycles: a systematic review and meta-analysis of reproductive outcomes," Human Reproduction Update, 25(1), pp. 2–14. doi:10.1093/humupd/dmy033Roque, M., Lattes, K., Serra, S., Sola, I., Geber, S., Carreras, R.,& Checa, M. A. (2013). Fresh embryo transfer versus frozen embryo transfer in in vitro fertilization cycles: a systematic review and meta-analysis. Fertility and sterility, 99(1), 156-162.
- Sahin G, Acet F, Calimlioglu N, Meseri R, Goker EN, Tavmergen E. Live birth after frozen–thawed embryo transfer: which endometrial preparation protocol is better?. Journal of Gynecology Obstetrics and Human Reproduction. 2020 Oct 1;49(8):101782.
- Sauer, M. V. (2015). Reproduction at an advanced maternal age and maternal health. Fertility and sterility, 103(5), 1136-1143.
- Seyedoshohadaei F, Rahmani K, Allahveisi A, Rezaei M, Rezaie MJ, Zandvakili F, Soufizadeh N, Honarbakhsh Y. Fresh or frozen embryo transfer in the antagonist in vitro fertilization cycles: a retrospective cohort study. International journal of fertility & sterility. 2022 Oct;16(4):256.
- Seyedoshohadaei F, Rezaei M, Allahveisi A, Rahmani K, Amirkhani Z. Effect of fresh and frozen embryo transfer method on fertility success in assisted reproduction: a comparative study. Journal of Postgraduate Medical Institute. 2019 Oct 10;33(2).
- Shah J, Huang C, Vigil A, Barr C, Nurudeen SK, Wei-Hua W, Abdallah M. Fresh vs frozen embryo transfer in frozen donor egg IVF and preimplantation genetic screening cycles. Fertility and Sterility. 2016 Sep 1;106(3):e136.
- Shih, W. et al. (2008) "Factors affecting low birthweight after assisted reproduction technology: difference between transfer of fresh and cryopreserved embryos suggests an adverse effect of oocyte collection," Human Reproduction, 23(7), pp. 1644–1653. doi:10.1093/humrep/den150.
- Sik A, Oral S, Aba YA, Ozolcay O, Koc M, Sismanoglu A. Pregnancy results after fresh embryo transfer and selective frozen-thawed embryo transfer: Single-center experience. Journal of Gynecology Obstetrics and Human Reproduction. 2020 Apr 1;49(4):101707.
- Spijkers S, Lens JW, Schats R, Lambalk CB. Fresh and frozen-thawed embryo transfer compared to natural conception: differences in perinatal outcome. Gynecologic and obstetric investigation. 2017 May 13;82(6):538-46.
- Stammler, A., Hau, T., Bhushan, S., Meinhardt, A., Jonigk, D., Lippmann, T., ... & Middendorff, R. (2015). Epididymitis: ascending infection restricted by segmental boundaries. Human reproduction, 30(7), 1557-1565.
- Tarlatzi T, Venetis C, Sassi A, Devreker F, Englert Y, Delbaere A. Higher estradiol levels are associated with lower neonatal birthweight after fresh and frozen embryo transfers. A cohort study of 3631 singleton IVF pregnancies. Gynecological Endocrinology. 2021 Jul 3;37(7):618-23.
- Van der Gaast, M. H., Eijkemans, M. J. C., Van der Net, J. B., De Boer, E. J., Burger, C. W., Van Leeuwen, F. E., ... & Macklon, N. S. (2006). Optimum number of oocytes for a successful first IVF treatment cycle. Reproductive biomedicine online, 13(4), 476-480.
- Wang B, Zhu Q, Wang Y. Pregnancy outcomes after different cycle regimens for frozen-thawed embryo transfer: a retrospective study using propensity score matching. Frontiers in Medicine. 2020 Jul 28;7:327.
- Wang, Z. et al. (2020) "Increased Risk of Pre-eclampsia After Frozen-Thawed Embryo Transfer in Programming Cycles," Frontiers in Medicine, 7. doi:10.3389/fmed.2020.00104.
- WHITTINGHAM, D.G. (1971) "Survival of Mouse Embryos after Freezing and Thawing," Nature, 233(5315), pp. 125–126. doi:10.1038/233125a0.
- Xu, B. et al. (2015) "Oocyte quality is decreased in women with minimal or mild endometriosis.," Scientific reports, 5, p. 10779. doi:10.1038/srep10779.
- Yang M, Lin L, Sha C, Li T, Gao W, Chen L, Wu Y, Ma Y, Zhu X. Which is better for mothers and babies: fresh or frozen-thawed blastocyst transfer?. BMC Pregnancy and Childbirth. 2020 Dec;20:1-20.
- Yu H, Zhang Y, Han M. Comparison of Clinical Pregnancy Outcomes after Fresh and Frozen Embryo Transfer. Computational and Mathematical Methods in Medicine. 2022 Oct 3;2022.
- Zhang J, Du M, Li Z, Wang L, Hu J, Zhao B, Feng Y, Chen X, Sun L. Fresh versus frozen embryo transfer for full-term singleton birth: a retrospective cohort study. Journal of ovarian research. 2018 Dec;11:1-8.
- Zhang X, Ma C, Wu Z, Tao L, Li R, Liu P, Qiao J. Frozen–Thawed Embryo Transfer Cycles Have a Lower Incidence of Ectopic Pregnancy Compared With Fresh Embryo Transfer Cycles. Reproductive Sciences. 2018 Sep;25(9):1431-5.
- Zhu Y, Zhang F, Chen H, Sun X, Jiang F. The use of frozen embryos and frozen sperm have complementary IVF outcomes: a retrospective analysis in couples experiencing IVF/Donor and IVF/Husband. BMC Pregnancy and Childbirth. 2022 Oct 18;22(1):776.