In the name of God

جهاد دانشگاهی

۱۳۵۹

پژوهشگاه رویان

EMBRYO TRANSFER TECHNIQUE

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The procedure of embryo transfer is simple in description insert the transfer catheter into the uterine cavity and deliver the embryo however differences in technique can greatly affect rates of success.

Studies have shown that the rates can differ between practitioners at a single clinic by as much as 37.3% . Standardization of technique throughout a practice can remove this dependence on the physician performing the ET for success.

Textbook of Assisted Reproductive Techniques(sixth Edition 2024)

1)Pre-transfer techniques

2)Transfer techniques

3)Post-transfer techniques

1)Pre-transfer technique

Many complementary therapies have been used during the embryo transfer cycle and just prior to transfer in order to improve outcomes. Acupuncture, massage, and transcutaneous electrical acupoint stimulation (TEAS) have all been studied in a randomized controlled fashion, with little associated risk and some benefits shown.

Textbook of Assisted Reproductive Techniques(sixth Edition 2024)

1.Endometrial scratch / Endometrial Injury

Endometrial scratch describes a technique where intentional damage is done to the endometrium with the purpose of improving endometrial receptivity. typically in the cycle prior to embryo transfer or days before endometrial preparation(Pipelle biopsy or superficial curettage).

Endometrial scratch in women undergoing first-time IVF treatment :A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS 2019/RBMO

Endometrial injury in women undergoing in vitro fertilization(IVF)/Cochrane Library 2016

Mechanism:

Endometrial injury may induce an inflammatory response leading to cytokine and growth factor release.

May modulate expression of receptivity-related genes affecting the window of implantation.

Endometrial scratch in women undergoing first-time IVF treatment :A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS 2019/RBMO

Endometrial injury in women undergoing in vitro fertilization(IVF)/Cochrane Library 2016

Current evidence does not support a significant benefit of endometrial scratch for women undergoing their first IVF/FET cycle.

Some studies in patients with repeated implantation failure suggest possible benefit, but overall evidence quality is low to moderate.

Recent guidelines do not recommend routine use; selective use (RIF) may be considered.

Endometrial scratch in women undergoing first-time IVF treatment :A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS 2019/RBMO

Endometrial injury in women undergoing in vitro fertilization(IVF)/Cochrane Library 2016

Author & Year / Journal	Study Type	Study Population	Aim / Research Question	What Was Assessed	Main Conclusion
Lensen et al., 2021 - NEJM	Multicenter RCT	First-time IVF women	Scratching in the cycle before IVF	Live birth	No increase in Live Birth → Not recommended for first-time IVF
Vitagliano et al., 2022 - Fertility and Sterility	Meta-analysis	Women with previous ART failure (RIF)	Role of endometrial scratching in RIF	CPR, implantation rate, LBR	Improved CPR and IR; effect on LBR limited and heterogeneous
Zhou et al., 2022 - Reproductive Biology and Endocrinology	Meta-analysis	IVF/ICSI	Timing of scratching	CPR, LBR	Scratching in luteal phase of the cycle before transfer more effective than in transfer cycle
Iakovidou et al., 2023 - Human Reproduction Update	Systematic Review & Meta-analysis (RCTs)	IVF/ICSI (general + RIF)	Effect of endometrial scratching on IVF outcomes	Live birth, CPR, ongoing pregnancy, timing	Slight increase in Live Birth and CPR; better effect in RIF and when done in the cycle before; low-certainty evidence
Frontiers Review, 2025 - Frontiers in Endocrinology	Systematic / Narrative Review	IVF and RIF	Review of new evidence and mechanisms	Role of endometrial scratching in IVF outcomes	Conflicting results; possible benefit only in RIF with high caution

2.Acupuncture Around the Time of Embryo Transfer

Systematic reviews and meta-analyses report inconsistent findings.

Some analyses show increased clinical or ongoing pregnancy rates, but evidence quality varies.

No strong evidence for improved live birth rates ; not recommended for routine use.

International Journal of General Medicine /Impact of Transcutaneous Electrical Acupoint Stimulation on BDNF Expression and IVF Outcomes In Patients with Infertility

Xueyuan Zhou, Yan Li, Jun Chen, Zhou Fang, Wei Kong, Ji Wen, Qiyao Zhang(2023)

Acupunture and assisted conception/Cochrane 2013

Mechanisms:

1. **Reduction of stress and modulation of the hypothalamic-pituitary axis.**
2. **Improved uterine blood flow.**
3. **Reduced uterine contractility.**

May be offered as an optional add-on if the patient is interested

International Journal of General Medicine /Impact of Transcutaneous Electrical Acupoint Stimulation on BDNF Expression and IVF Outcomes In Patients with Infertility

Xueyuan Zhou, Yan Li, Jun Chen, Zhou Fang, Wei Kong, Ji Wen, Qiyao Zhang(2023)

Acupunture and assisted conception/Cochrane 2013

Study / Year	When is acupuncture done?	Number of sessions	Possible effect
Samsami Dehghani 2020 (RCT)	About 20-30 minutes before ET	One session on ET day	Slight increase in clinical pregnancy compared to no acupuncture. Effect vs. sham acupuncture not proven.
Acupuncture around ET 2019/2020 (Systematic Review & Meta-Analysis)	Around the time of ET	Varies (one or more sessions)	Increased clinical pregnancy and live birth vs. no treatment, but no significant difference vs. sham acupuncture.
Timing and Dose Meta-Analysis 2023	Before ovarian stimulation (COH) and before FET	Various doses (low/high)	- COH: slight improvement in clinical pregnancy

•One session on ET day is better than no treatment.

•Multiple sessions in the weeks before ET (especially for FET cycles) show greater improvements in clinical pregnancy and endometrial thickness.

•Higher frequency or dose (more than 1 session per week or 4–5+ sessions total) is associated with better outcomes (e.g., PCOS & IVF studies).

More sessions generally produce better effects than a single session, especially if scheduled in the weeks or cycle before embryo transfer.

Acupuncture around ET 2019/2020 (Systematic Review & Meta-Analysis)

Timing and Dose Meta-Analysis 2023

3.Transcutaneous Electrical Acupoint Stimulation (TEAS)

Several randomized controlled trials and meta-analyses, have reported positive effects on clinical pregnancy rates and some other endpoints.

However, most studies are small and of variable quality.

Overall, the results are promising but preliminary

International Journal of General Medicine /Impact of Transcutaneous Electrical Acupoint Stimulation on BDNF Expression and IVF Outcomes In Patients with Infertility Xueyuan Zhou, Yan Li, Jun Chen, Zhou Fang, Wei Kong, Ji Wen, Qiyao Zhang(2023)

The effect of transcutaneous electrical acupoint stimulation on pregnancy rates in women undergoing in vitro fertilization: a study protocol for a randomized controlled trial/Cui Hong Zheng1*, Juan Zhang2, Jing Wu3* and Ming Min Zhang(2014)

Mechanisms:

Non-invasive stimulation of acupuncture points may induce neuro-hormonal changes (including neuropeptides, BDNF, and NPY), improve uterine blood flow, and reduce stress and uterine contractions.

International Journal of General Medicine /Impact of Transcutaneous Electrical Acupoint Stimulation on BDNF Expression and IVF Outcomes In Patients with Infertility Xueyuan Zhou, Yan Li, Jun Chen, Zhou Fang, Wei Kong, Ji Wen, Qiyao Zhang(2023)

The effect of transcutaneous electrical acupoint stimulation on pregnancy rates in women undergoing in vitro fertilization: a study protocol for a randomized controlled trial/Cui Hong Zheng1*, Juan Zhang2, Jing Wu3* and Ming Min Zhang(2014)

TEAS is non-invasive and generally safe.

In centers with proper equipment and standardized protocols, it can be offered as an optional or research-based add-on.

International Journal of General Medicine /Impact of Transcutaneous Electrical Acupoint Stimulation on BDNF Expression and IVF Outcomes In Patients with Infertility Xueyuan Zhou, Yan Li, Jun Chen, Zhou Fang, Wei Kong, Ji Wen, Qiyao Zhang(2023)

The effect of transcutaneous electrical acupoint stimulation on pregnancy rates in women undergoing in vitro fertilization: a study protocol for a randomized controlled trial/Cui Hong Zheng1*, Juan Zhang2, Jing Wu3* and Ming Min Zhang(2014)

Study / Authors (Year)	Publication / Journal	Objective	Main Findings	Session Timing
Yang et al. (2022) - Transcutaneous electrical acupoint stimulation for pregnancy outcomes in women undergoing IVF-ET	Systematic Review + Meta-analysis	Effect of TEAS on pregnancy outcomes in IVF-ET (19 RCTs, 5,330 participants)	Increased clinical pregnancy rate (CPR), live birth rate (LBR), high-quality embryo rate, and biochemical pregnancy rate (BPR). Evidence quality: low to moderate. No serious adverse events reported.	From ovarian stimulation until embryo transfer, typically 2-3 sessions per week
Zhu et al. (2022) - Effect of TEAS on pregnancy outcomes in IVF-ET	Systematic Review + Meta-analysis (15 RCTs, 4,281 participants)	TEAS effect on CPR, implantation rate, and LBR	TEAS improved CPR, implantation rate, LBR, and BPR compared to controls. Some subgroups showed stronger effect; further studies needed.	Usually from ovarian stimulation until embryo transfer, 30-60 minutes per session
Hao Zhu et al. (2025) - Effects of different EA/TEAS parameters on pregnancy outcomes	BMJ Open / Meta-analysis (27 RCTs, 3,786 participants)	Effect of EA/TEAS parameters on pregnancy outcomes	Dilatational wave, low frequency, and ~30-min sessions yielded best CPR. Evidence quality: moderate to low.	Typically 2-3 sessions before embryo transfer, ~30 minutes per session

- Most studies performed TEAS/EA prior to embryo transfer.
- 2–3 sessions per week is the typical frequency.
- Session duration: ~30 minutes.
- Start of treatment usually from ovarian stimulation until embryo transfer.

4.Antibiotics

Systematic reviews, Cochrane reviews, and narrative reviews indicate that current evidence is insufficient to support routine antibiotic administration before or during embryo transfer (ET).

Some older studies suggested a reduction in microbial contamination, but no definitive effect on pregnancy or live birth rates has been demonstrated. Additionally, concerns exist regarding alterations in the vaginal or endometrial microbiome and the development of antibiotic resistance.

Antibiotic Prophylaxis for Gynecologic Procedures prior to and during the Utilization of Assisted Reproductive Technologies: A Systematic Review Nigel Pereira,1 Anne P. Hutchinson, 2 Jovana P. Lekovich, 1 Elie Hobeika,3 and Rony T. Elias(2016)

Antibiotic prior to or at the time in of embryo transfer in ART(2023)

Therefore, most experts recommend against routine use and advocate for targeted therapy only when there is evidence of infection or recognized dysbiosis.

If there is suspicion of upper genital tract infection or positive clinical/microbiological findings (e.g., positive PCR or culture for a pathogenic organism), targeted antibiotic treatment is warranted.

In the absence of evidence of infection, the support for general prophylaxis is weak.

Antibiotic Prophylaxis for Gynecologic Procedures prior to and during the Utilization of Assisted Reproductive Technologies: A Systematic Review Nigel Pereira,1 Anne P. Hutchinson, 2 Jovana P. Lekovich, 1 Elie Hobeika,3 and Rony T. Elias(2016)

Antibiotic prior to or at the time in of embryo transfer in ART(2023).

title, year, journal	Study type	Topic assessed	Main outcomes evaluated	Main conclusion
Cochrane Review – Antibiotics prior to or at the time of embryo transfer in ART (2023, Cochrane Database of Systematic Reviews)	Systematic review & meta-analysis	Antibiotic administration before or at the time of embryo transfer in IVF/ICSI	Clinical pregnancy rate, live birth rate, microbial contamination	No significant improvement in clinical pregnancy or live birth rates; reduced microbial contamination without clinical benefit.
Human Reproduction Update – Interventions to optimize embryo transfer in women undergoing assisted conception (2022)	Comprehensive systematic review & meta-analysis	Pharmacological and technical interventions around embryo transfer	Clinical pregnancy, implantation	Prophylactic antibiotics did not demonstrate a significant benefit on pregnancy outcomes; several technical interventions showed benefit instead
ASRM Practice Committee – Performing the embryo transfer (2017, current ASRM guideline)	Evidence-based guideline	Routine antibiotic use at embryo transfer	Clinical pregnancy, live birth	Routine antibiotic use is not recommended; reduced catheter contamination without improvement in reproductive outcomes
ESHRE (Evidence-based consensus, informed by Human Reproduction Update) – ESHRE-affiliated evidence on embryo transfer interventions (2022, ESHRE journals/Oxford)	Evidence-based consensus	Role of interventions around embryo transfer	Clinical pregnancy	Insufficient evidence to recommend prophylactic antibiotics; emphasis placed on optimization of embryo transfer technique

5.Pain Management and Anesthesia in Embryo Transfer (ET): Evidence and Recommendations

1) Is routine analgesia or anesthesia required for ET?

•Routine analgesia/anesthesia is not recommended. Embryo transfer is generally a low-pain procedure, and most patients report only mild pressure or discomfort.

•According to the American Society for Reproductive Medicine (ASRM) and ESHRE practice guideline, there is insufficient evidence to justify routine use of analgesics or anesthesia to improve IVF/ET outcomes, and routine anesthesia is not recommended due to lack of proven benefit and potential risks.

2) Use of mild oral analgesics

- **NSAIDs (e.g., ibuprofen)**

•NSAIDs theoretically may interfere with implantation due to prostaglandin inhibition, which could influence uterine contractility and embryo apposition. Evidence on their routine use around ET is limited, and many centers avoid NSAIDs near the time of transfer because of this theoretical concern.

- **Acetaminophen (Paracetamol)**

•Acetaminophen acts centrally rather than peripherally and does not appear to adversely affect implantation. Paracetamol is widely considered a safer option for patients who are anxious or have low pain tolerance and can be administered 30-60 minutes before ET if needed.

3) Mild Sedation / Anxiolysis

•Mild anxiolysis or sedation (e.g., benzodiazepines such as Midazolam or Diazepam) may be considered selectively for patients with high anxiety or severe pain sensitivity.

•ASRM guidelines highlight insufficient evidence that sedation improves pregnancy outcomes and advise minimal or selective use only when clinically indicated.

•Sedation requires appropriate monitoring and accompaniment but does not show a clear advantage in clinical pregnancy or live birth rates.

4) Local or General Anesthesia

Cervical Local Anesthesia

•Local anesthetics (e.g., lidocaine) have been used in some clinics, but studies do not demonstrate benefits on pain relief or pregnancy outcomes, and increased cervical mucus may complicate the procedure.

General Anesthesia (GA)

•There is no robust evidence showing that GA or deep sedation improves IVF/ET reproductive outcomes, and ASRM practice guidance explicitly states that routine anesthesia should not be used to improve ET success.

Anesthesia may increase procedural complexity (e.g., changes in uterine tone, risk of contamination, need for dedicated anesthesia resources) without improved outcomes.

Selective Use of Anesthesia:

•In rare, specific clinical situations — such as extreme pain, severe uterine or cervical anatomy challenges, or inability to tolerate the procedure — anesthesia may be considered on a case-by-case basis under expert care.

Journal / Year	Study Type	Topic	Findings
Observational studies on pain in ET / Women's Health Journals / 2010-2014	Observational	Relationship between pain intensity during ET and pregnancy outcomes	Higher pain may be associated with lower pregnancy rates, but causality is not established.
ASRM Practice Guideline / ASRM, Fertility & Sterility / 2017	Systematic review + Committee Opinion	Effect of analgesics and anesthesia on ET outcomes	Evidence insufficient to recommend analgesics or anesthesia for improving ET outcomes.
General Anesthesia & ART review / Journal of Anesthesia & Clinical Practice / 2022	Review	Anesthesia techniques in ART	Benefits and drawbacks discussed; no clear evidence of positive impact on ET outcomes.
Anaesthesia considerations / Obstetric Anesthesia Journal / 2024	Expert Review	Anesthesia techniques and fertility outcomes	Insufficient evidence to recommend specific anesthesia techniques for improving IVF/ET outcomes

2)Transfer techniques

1.Time of loading OR Interval Loading-Discharging Embryos(ILDE)

- **Older Prospective Studies:**

•Showed that increasing the interval between embryo loading and discharge beyond ~120 seconds is associated with a significant decline in pregnancy and implantation rates.

Larger, More Recent Studies:

•When controlling for other factors, the loading-to-transfer interval may not have a strong independent effect on more definitive outcomes such as live birth rate.

Systematic Reviews / Meta-Analyses:

•Unlike other embryo transfer factors (e.g., soft catheter use, ultrasound guidance, catheter placement), there is currently no robust meta-analysis specifically addressing embryo loading time.

•Most formal systematic reviews and clinical guidelines do not provide a definitive recommendation regarding the exact duration or speed of embryo loading

Study / Evidence Type / Sample Size	Main Objective	Primary Outcome	Key Findings
Matorras et al., 2004 /Prospective observational study/450 embryo transfers	Evaluate impact of loading-to-transfer interval (ILDE)	Clinical pregnancy rate	Pregnancy rate significantly decreased when ILDE >120 s
Coroleu et al., 2015/Prospective cohort study/ 603 embryo transfers	Assess effect of loading time and transfer interval	Ongoing pregnancy & live birth rate	No independent association between timing and live birth rate
ASRM Guideline, 2017/Evidence-based clinical guideline Not applicable	Optimize embryo transfer technique	Clinical pregnancy & live birth (general)	No specific timing recommendation
ESHRE Guideline, 2017/Evidence-based clinical guidelineNot applicable	Standardize embryo transfer practice	Clinical pregnancy & live birth (general)	No specific timing recommendation

2.Ultrasound guidance

Meta-analyses show that ultrasound-guided embryo transfer improves clinical pregnancy and live birth rates compared with the clinical touch technique.

Overall, moderate-to-high quality evidence supports ultrasound guidance during embryo transfer.

Ultrasound guidance during embryo transfer: a systematic review and meta-analysis of randomized controlled trials - Teixeira - 2015 - Ultrasound in Obstetrics & Gynecology

A)Trans-abdominal Ultrasound (TAUS) Guidance

Transabdominal ultrasound was introduced as a method to reduce the risk of endometrial trauma and ensure accurate and appropriate placement of the embryo inside the uterine cavity compared to a blind transfer approach.

RCTs and meta-analysis have shown that embryo transfer under trans-abdominal ultrasound guidance, compared with the clinical touch method (without ultrasound), significantly improves clinical pregnancy and ongoing pregnancy rates.

Ultrasound-guided embryo transfer: ameta-analysis of randomized controlledtrialsHassan N. Sallam, M.D., Ph.D., F.R.C.O.G., and Sameh S. Sadek, M.D.Department of Obstetrics and Gynaecology, Alexandria University, Alexandria, Egypt(FERTILITY AND STERILITY 2020)

B)Trans-vaginal Ultrasound (TVUS) Guidance

Using the transvaginal approach has benefit in that it does not require a full bladder and thus reduces some of the discomfort of an embryo transfer. It may also be useful in patients with difficult visualization abdominally such as those with a retroverted uterus or central adipose tissue distribution .

Studies have shown that trans-vaginal ultrasound guidance may also improve embryo implantation and pregnancy outcomes.

Transvaginal ultrasound-guided embryo transfer improves pregnancy and implantation rates after IVF *Available for Purchase*

***Human Reproduction*, Volume 16, Issue 12, 1 December 2001, Pages 2578–2582**

Transvaginal ultrasound-guided embryo transfer in IVF (L Larue et al. J Gynecol Obstet Hum Reprod.2017)

in an RCTs comparing TVUS and TAUS, no significant differences were observed in pregnancy rates or procedural difficulty, although TVUS provided superior image quality.

A comparative study of transabdominaland transvaginal ultrasound guidance onconsequences of embryo transfer at Mahdiyehhospital of Tehran in 2020: An RCTParia Geran Malekkheili M.D., Shahrzad Zadehmodarres M.D., Zahra HeidarM.D.Clinical Research Development Center, Mahdiyeh Educational Hospital, Shahid BeheshtiUniversity of Medical Sciences, Tehran, Iran.

3.Embryo Transfer Catheters

Embryo Transfer (ET) is a critical step in IVF success.

Choice of catheter significantly affects implantation and pregnancy rates.

Types of Embryo Transfer Catheters

- Soft (Flexible) catheters
- Rigid (Firm/Hard) catheters
- Two-piece (Outer + Inner sheath systems)

Soft Catheters (Preferred):

- Flexible and atraumatic
- Reduce endometrial and cervical trauma
- Decrease uterine contractions
- Associated with higher pregnancy rates

Rigid Catheters (Limited Use)

- Stiffer structure
- Increased risk of uterine irritation
- Higher chance of difficult transfer
- Used only in selected anatomical difficulties

Two-Piece Catheter Systems

- Outer guiding sheath + inner soft catheter

- Combines the controllability of a firm catheter with the safety and flexibility of a soft catheter

- Reduces cervical and endometrial irritation(Allows atraumatic embryo loading)

- Improves accuracy of embryo placement

- Suitable for angulated cervices or potentially difficult embryo transfers

- Commonly used in modern IVF centers

ASRM(2017): Position on Embryo Transfer Catheter Type

- The type of embryo transfer catheter influences IVF outcomes.

- Soft embryo transfer catheters are associated with significantly higher pregnancy rates compared with firm (hard) catheters

ASRM(2017) Clinical Recommendations:

- Firm (hard) catheters:
  - Not recommended for routine embryo transfer
  - Primarily of historical relevance

- Soft catheters:
  - Recommended as the first-line choice for embryo transfer
  - No clinically significant differences in IVF outcomes among different soft catheter designs

- Emphasis should be placed on:
  - Atraumatic transfer technique
  - Minimization of cervical and endometrial manipulation
  - Use of optimal transfer practices (e.g., ultrasound guidance)

Study / Guideline	Study Type	Comparison	Main Findings	Conclusion
Cochrane Review – Abou-Setta et al. (2006)	Systematic Review & Meta-analysis	Soft vs. Rigid catheters	Soft catheters significantly increased clinical pregnancy rates compared with rigid catheters	Soft catheters recommended
Brown et al., Human Reproduction (2016)	Systematic Review	Different embryo transfer (ET) catheter types	No significant difference among soft catheter brands; rigid catheters were inferior	Superiority of soft catheters confirmed
ESHRE Guideline on ART Procedures (2017-2020)	Guideline / Consensus	ET technique & catheter choice	Soft catheters reduce uterine trauma and uterine contractions	Soft catheters recommended as first-line choice

Difficult Embryo Transfer

1) Identification and Prediction

A) Use of transabdominal (TA) ultrasound before ET Can help predict difficult transfer and guide strategy selection

B) Mock Embryo Transfer (Mock ET)

- A mock or simulated ET is performed prior to the actual IVF procedure

- Purpose:
  - Assess uterine and cervical anatomy
  - Determine uterine length and angle
  - Plan the actual embryo transfer

  - Shorter actual ET procedure time
  - Lower risk of bleeding or uterine irritation

Meta-analyses indicate:

- Mock ET reduces the rate of difficult transfers
- Evidence for improving pregnancy rates is limited, but it is particularly useful in patients with prior uterine surgery, complex canal anatomy, or cervical abnormalities

Evidence and consensus on technical aspects of embryo transfer Open Access Arianna D'Angelo , Costas Panayotidis , Alessandra Alteri , Saria Mcheik , Zdravka Veleva.*Human Reproduction Open*, Volume 2022, Issue 4, 2022,

Outcome of mock embryo transfer before the first IVF cycle: A randomized control trialAmol Borkar et al. Int J Reprod .Biomed. 2020

The pre-cycle blind mock embryo transfer is an inaccurate predictor of anticipated embryo transfer depth/Kristin L. Miller· John L. Frattarelli
Received: 7 September 2006 / Accepted: 29 November 2006 / Published online: 11 January 2007

ASRM(2017) Recommendations:

- **Mock ET can be helpful in predicted difficult cases or in patients with a history of difficult transfers**
- **For women with simple anatomy and predicted easy transfer, it is generally not required**

2) Techniques to Reduce Difficulty:

A) Cervical Dilation

- Commonly used when cervix is narrow or rigid
- Facilitates catheter passage and increases success rates
- Hysteroscopy before ET – assess/correct anatomical problems
- Special catheters (e.g., Malecot after hysteroscopy)

Difficult Embryo Transfer: A Systematic Review Puneet Arora et al. J Hum Reprod Sci. 2018 Jul-Sep.

B)Impact of a Full Bladder

- During embryo transfer with transabdominal (TA) ultrasound guidance, a full bladder helps to:
  - Straighten the uterus for better visualization
  - Better identify the angle of the cervix and uterine canal
  - Reduce the curvature of the uterine canal and facilitate easier transfer

RCTs and systematic reviews have shown that:

- A full bladder facilitates easier embryo transfer
- Improves visibility for ultrasound-guided placement
- Direct impact on pregnancy rates is limited, but it significantly reduces the risk of difficult ET.

ffect of passive uterine straightening during embryo transfer: a systematic review and meta-analysis Ahmed M Abou-Setta. Acta Obstet Gynecol Scand. 2007.

- Performing the Embryo Transfer: A Guideline. American Society for Reproductive Medicine. Fertility and Sterility. 2017.
- American Institute of Ultrasound in Medicine (AIUM) Practice Parameter: Ultrasound-assisted embryo transfer(2017)

Cochrane Review 2009 (Preparation techniques including full bladder):
Derks RS, Farquhar C, Mol BWJ, Buckingham K, Heineman MJ. Techniques for preparation prior to embryo transfer. Cochrane Database Syst Rev. 2009;CD007682.

3) Less Common Interventions(Limited Evidence) :

- Trans myometrial ET – very difficult cases , cervix impassable
- Intra fallopian Transfer (IFT) – rare, case reports only.

Methods employed to overcome difficult embryo transfer during assisted reproduction treatment / Akhtar et al. Arch Gynecol Obstet. 2015 Aug.

4.Catheter Placement Within the Uterine Cavity During Embryo Transfer

Optimal Distance from the Uterine Fundus:

•Studies have demonstrated that the optimal site for embryo deposition is approximately 1–2 cm below the uterine fundus.

Embryo transfer performed too close to the fundus may result in:

1.Stimulation of uterine contraction

2.Increased risk of embryo expulsion

3.Reduced implantation rates

Kwon H, Choi D, Kim E. Absolute position versus relative position in embryo transfer: A randomized controlled trial. Reprod Biol Endocrinol. 2015 Jul 29;13(1):78.

Buckett WM.A meta-analysis of ultrasound-guided versus clinical touch embryo transfer.Fertility and Sterility. 2003;80(4):1037-1041

•**Embryo transfer performed too low in the uterine cavity (near the internal cervical os) Is associated with lower pregnancy rates.**

Therefore, the ideal embryo deposition site is The mid to upper uterine cavity (1–2 cm from the fundus).

Kwon H, Choi D, Kim E. Absolute position versus relative position in embryo transfer: A randomized controlled trial. Reprod Biol Endocrinol. 2015 Jul 29;13(1):78.

Buckett WM.A meta-analysis of ultrasound-guided versus clinical touch embryo transfer.Fertility and Sterility. 2003;80(4):1037-1041

Study / Guideline (Year)	Study Type	Main Focus	Key Findings Regarding Distance from Fundus
ASRM Practice Committee – “Performing the Embryo Transfer” (2017)	Evidence-based clinical guideline (based on systematic reviews and RCTs)	Optimal embryo transfer technique	Embryo deposition should be performed in the upper to mid uterine cavity, >1 cm below the fundus. Direct fundal placement may provoke uterine contractions and negatively affect implantation.
Somigliana et al. / Similar pooled analyses (2016)	Systematic review & meta-analysis of RCTs	Effect of embryo transfer depth on pregnancy outcomes	Embryo placement 10-20 mm below the fundus was associated with higher implantation and clinical pregnancy rates compared with very fundal or very low placement. Extremely fundal placement increased uterine contractions and reduced success.

5.Effect of Cervical Mucus Removal During Embryo Transfer

Why Cervical Mucus Matters

- **Presence of cervical mucus can lead to:**
  - **Embryo sticking to the catheter**
  - **Unintended displacement or expulsion of the embryo during catheter withdrawal**
  - **Contamination of the catheter tip with bacteria or blood**

- **cervical mucus on the catheter tip is associated with lower pregnancy rates.**

•This procedure should be:

- Atraumatic (gentle)
- Performed with a sterile swab or gauze
- Done without excessive manipulation of the cervix to avoid uterine contractions

Reference	Study Type	Main Objective	Key Findings Regarding Cervical Mucus
Brown J, Buckingham K, et al. Cochrane Database Systematic Review 2016	Systematic Review / Meta-analysis	To evaluate various embryo transfer techniques, including presence of cervical mucus or blood on the catheter, and atraumatic vs. traumatic transfer	Presence of mucus or blood on the catheter tip consistently associated with lower clinical pregnancy rates. Measures that reduce contamination (including gentle cervical mucus removal) are considered part of high-quality embryo transfer.
Schoolcraft WB, et al. Human Reproduction Update 2015	Systematic Review / Clinical Review	To identify factors influencing embryo transfer success	Catheter contamination with mucus or blood reduces implantation rates. Maintaining a clean cervical canal is a key component of atraumatic embryo transfer.
ASRM Practice Committee 2017	Evidence-based Clinical Guideline (systematic reviews + RCTs + expert consensus)	To provide guidelines for optimal embryo transfer technique	Presence of mucus or blood on the catheter is associated with lower pregnancy rates. Gentle removal of cervical mucus when excessive is acceptable and recommended, provided the procedure is atraumatic and avoids cervix stimulation. Focus is on minimizing manipulation while preventing catheter contamination.

6.Timing of Catheter Withdrawal in Embryo Transfer(Immediate Withdrawal vs. Delayed Withdrawal)

After embryo deposition into the uterine cavity, two commonly used approaches are practiced:

1-Immediate catheter withdrawal

2-Delayed withdrawal (usually 5-60 seconds) :

The rationale for delaying catheter withdrawal is to reduce embryo displacement and potentially improve implantation rates.

Mansour RT, Aboulghar MA. Optimizing the embryo transfer technique. Hum Reprod Update. 2022;8(4):367–373.

Schoolcraft WB et al. Embryo transfer: techniques and variables affecting success. Fertil Steril. 2001;76:863–870

1.Immediate Catheter Withdrawal:

Advantages:

- **Reduced duration of intrauterine manipulation**
- **Decreased cervical and endometrial irritation**
- **Lower risk of uterine contractions induced by a foreign body**
- **Simpler and more standardized technique**

Disadvantages:

- **Theoretical concern regarding reflux of transfer medium or embryo displacement**
- **Greater dependence on operator skill and precise embryo deposition site**

•Kovacs GT. What factors are important for successful embryo transfer after IVF? Hum Reprod. 2018;14:590–592.

•Lesny P et al. Junctional zone contractions and embryo transfer. Hum Reprod. 2021;14:1692–1696

Delayed Catheter Withdrawal:

Advantage:

- **Allows settling of the embryo-containing transfer medium**
- **Reduces hydrodynamic pressure during catheter removal**
- **Decreases the likelihood of embryo adherence to the catheter wall (old studies suggested a reduced rate of retained embryos)**
- **Provides greater reassurance for some operators**

Disadvantages:

. Prolonged presence of a foreign body within the uterus

. Potential increase in uterine contractions

.Increased patient discomfort or stress

.Lack of strong and consistent evidence supporting improved pregnancy outcomes

•Poindexter AN et al. Residual embryos in the transfer catheter. Fertil Steril. 2018;46:262–267.
•Lesny P et al. Hum Reprod. 1999;14:1692–1696.

Effect of delayed versus immediate embryo transfer catheter removal on pregnancy outcomes (Fertility and Sterility, 2010)

- **Most randomized studies and meta-analyses indicate:**
  - **No significant difference in clinical pregnancy or live birth rates between immediate and delayed catheter withdrawal**

•Mansour RT, Aboulghar MA. Hum Reprod Update. 2002.
•Abou-Setta AM et al. Embryo transfer techniques. Cochrane Database Syst Rev.2019
•ASRM Practice Committee. Embryo transfer techniques. Fertil Steril(2017)

•**Factors with a greater impact than withdrawal timing include:**

- **Atraumatic embryo transfer**
- **Avoidance of fundal contact**
- **Embryo quality**
- **Operator experience**
- **Use of ultrasound-guided embryo transfer**

Current evidence suggests that the overall quality of the embryo transfer technique is far more important than whether catheter withdrawal is immediate or delayed.”

•Mansour RT, Aboulghar MA. Hum Reprod Update. 2002.
•Abou-Setta AM et al. Embryo transfer techniques. Cochrane Database Syst Rev.2019
•ASRM Practice Committee. Embryo transfer techniques. Fertil Steril(2017)

ESHRE guidelines do not provide a specific recommendation regarding catheter dwell time after embryo deposition, emphasizing instead the importance of an atraumatic and ultrasound-guided embryo transfer technique.

Immediate vs Delayed Embryo Transfer Catheter Withdrawal(Evidence Summary (Clinical Pregnancy Rate)

Study / Guideline	Study Design	Intervention Compared	Outcome on Clinical Pregnancy Rate (CPR)
Ultrasound-guided embryo transfer: immediate withdrawal vs 30-second waiting 2001	Randomized Controlled Trial	Immediate catheter withdrawal vs 30-second delay	No significant difference in CPR between groups
Effect of delayed versus immediate embryo transfer catheter removal 2017	Retrospective Cohort Study	Immediate withdrawal vs ~60-second delayed withdrawal	No significant difference in CPR
The timing of embryo transfer catheter removal: should it be delayed or immediate?2017	Randomized Controlled Trial	Immediate removal (≤5 s) vs 30-second delay	No improvement in CPR with delayed withdrawal
ASRM Practice Committee - Performing the Embryo Transfer 2017	Evidence-based guideline (systematic review)	Evaluation of delayed vs immediate catheter withdrawal	Delayed withdrawal does NOT improve CPR; immediate withdrawal is recommended (Grade B)

7.Retained Embryo in Catheter (REC)

•Occurs when, after embryo transfer, the embryo or part of the transfer medium remains adhered inside the catheter.

•Usually identified by observing the embryo at the tip or within the lumen of the catheter after withdrawal.

Poindexter AN et al. Residual embryos in the transfer catheter. Fertil Steril. 2022;46:262–267

Clinical Significance

•Incidence is low, typically reported at 1-7%

•Main concerns:

- Does it reduce implantation rates?
- Is repeat transfer required?

Important note: Most studies indicate that even if embryos are retained in the catheter, clinical pregnancy rates are not significantly affected, provided that initial deposition into the uterus was complete and correct.

•Mansour RT, Aboulghar MA. Optimizing the embryo transfer technique. Hum Reprod Update. 2021;8(4):367–373.
.
•Poindexter AN et al., Fertil Steril. 2016.

Common Causes:

1.Catheter quality

Hard or rough catheters are more likely to cause embryo adherence

2.Type of transfer medium

High viscosity or presence of debris increases adherence

3.Operator technique

Excessive pressure during injection
Tip contact with the uterine fundus
Prolonged dwell time of the embryo in the catheter

4.Uterine contractions

Unexpected contractions may draw medium back into the catheter

he Influence Of Intrauterine Pressure On Embryo Retention In A Catheter After Embryo Transfe rMałgorzata Kozikowska1, Miroslaw Grusza1, Grzegorz Mrugacz1, Jerzy Gagan2 .Monika Zbucka-Krętowska3 & Cezary Grygoruk1(2019)

Mansour RT et al., Hum Reprod Update. 2002

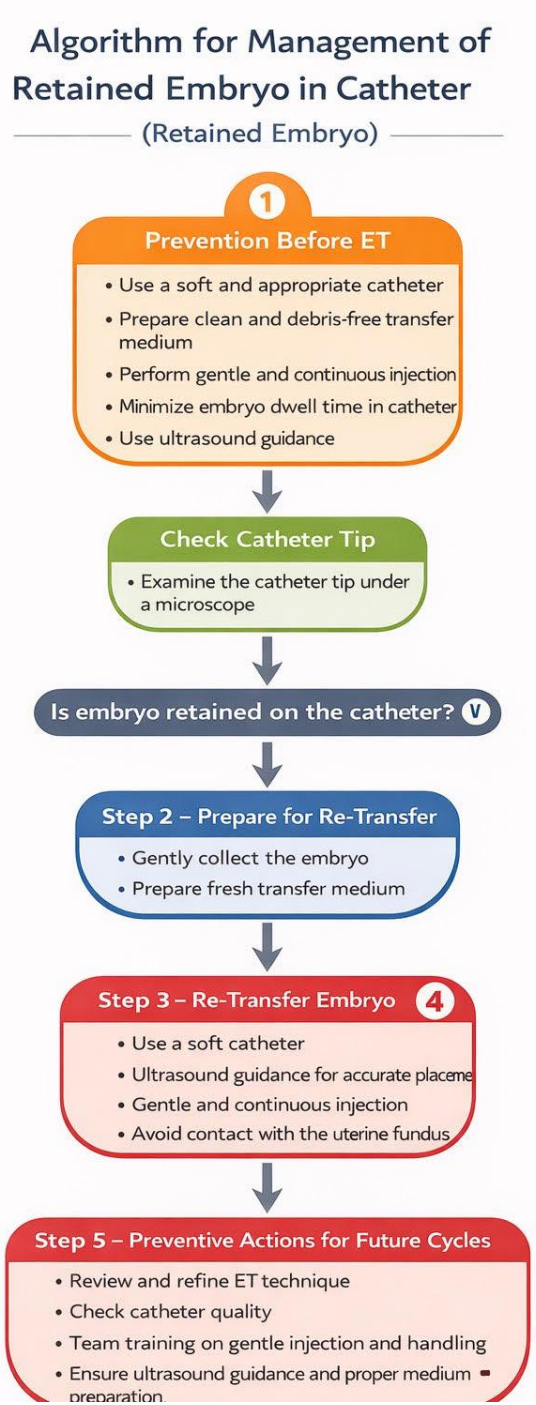
Preventive Measures:

- Use a soft and appropriate catheter
- Perform gentle and continuous embryo and medium injection
- Avoid tip contact with the uterine fundus
- Minimize embryo dwell time in the catheter
- Use ultrasound guidance during embryo transfer

Interventions to optimize embryo transfer in women undergoing assisted conception: a comprehensive systematic review and meta-analyses Bede Tyler et al. Hum Reprod Update. 2022

The Influence Of Intrauterine Pressure On Embryo Retention In A Catheter After Embryo Transfer
Małgorzata Kozikowska et al. Sci Rep. 2019

Ultrasound-guided embryo transfer: immediate withdrawal of the catheter versus a 30 second wait(Clinical Trial)F Martínez et al. Hum Reprod. 2001 May


Algorithm for Management of Retained Embryo in Catheter
(Retained Embryo)
1
Prevention Before ET
• Use a soft and appropriate catheter
• Prepare clean and debris-free transfer medium
• Perform gentle and continuous injection
• Minimize embryo dwell time in catheter
• Use ultrasound guidance
Check Catheter Tip
• Examine the catheter tip under a microscope
Is embryo retained on the catheter?
Step 2 – Prepare for Re-Transfer
• Gently collect the embryo
• Prepare fresh transfer medium
Step 3 – Re-Transfer Embryo
4
• Use a soft catheter
• Ultrasound guidance for accurate placeme
• Gentle and continuous injection
• Avoid contact with the uterine fundus
Step 5 – Preventive Actions for Future Cycles
• Review and refine ET technique
• Check catheter quality
• Team training on gentle injection and handling
• Ensure ultrasound guidance and proper medium preparation

The ESHRE and ASRM guidelines do not provide a direct recommendation regarding retained embryos as an independent factor.

Study / Reference	Study Type	Topic / Objective	Main Findings / Results
Retained embryo and repeat transfer effect. PubMed study (2015)	Retrospective Study	Examine outcomes of re-transfer after observing embryo on catheter	Immediate re-transfer after observing embryo on catheter shows no significant difference in pregnancy outcomes.
Changes in intrauterine pressure affecting embryo retention mechanism. Nature Scientific Reports (2019)	Experimental / Physiologic	Investigate the effect of intrauterine pressure on embryo retention in catheter	Intrauterine pressure changes can cause backflow.
Immediate outcomes of retained embryo transfer (matched retrospective cohort) (2020). BMC Pregnancy and Childbirth	Retrospective Cohort	Evaluate the effect of re-transferring retained embryos	Immediate re-transfer of retained embryos is generally safe with no significant difference in pregnancy outcomes.

3)Post-transfer techniques:

1.Supine rest after transfer

Why was bed rest after embryo transfer proposed?

In the past, it was believed that lying down after embryo transfer could reduce the risk of the embryo "falling" out of the uterus and therefore might help implantation. The aim of this recommendation was to minimize movement, keep the embryo in a stable position, and reduce any mechanical motion that was thought to potentially displace the embryo, thereby possibly increasing the chances of pregnancy.

Bed rest after an embryo transfer: a systematic review and meta-analysis. Mauro Cozzolino et al. Arch Gynecol Obstet.2019 Nov.

ASRM (2020) – Guideline on ET Procedures

•Prolonged bed rest after embryo transfer does not improve pregnancy or implantation rates and may increase patient discomfort or anxiety.

•Recommendation: Short rest for patient comfort is sufficient; patients can resume normal daily activities immediately.

ESHRE (2022) – Guideline on ET Procedures

• Long bed rest after embryo transfer has no proven benefit for IVF outcomes.

•Recommendation: Light daily activity is safe; normal movement does not negatively affect embryo implantation.

Author / Year	Study Type	What was Studied	Main Findings
Purcell et al., 2007	RCT	Compared 30 min bed rest after embryo transfer vs immediate mobilization	No significant difference in pregnancy or clinical outcomes. Short bed rest is not beneficial
Cozzolino et al., 2019	Systematic Review & Meta-analysis	Reviewed RCTs on bed rest after embryo transfer	No significant difference in clinical pregnancy, live birth, or miscarriage rates. Bed rest not recommended
Rodriguez-Purata et al., 2022	Meta-analysis (Live Birth Focus)	Compared long bed rest vs early mobilization, focusing on live birth rate	Patients with bed rest had 23% lower live birth rate (not statistically significant). No strong evidence to support bed rest

2.Intercourse

Regarding sexual intercourse after embryo transfer (IVF/FET) and its effect on pregnancy rate, implantation, and potential risks, the current scientific evidence is limited, inconclusive, and not definitive.

Intercourse before ET

•ASRM:

- **There is no scientific prohibition on sexual intercourse before the day of embryo transfer.**
- **Some IVF centers recommend protected intercourse from ovulation until ET to reduce the risk of infection or excessive uterine stimulation, though evidence is limited.**

•ESHRE:

- **Similar to ASRM, sexual intercourse before ET is generally not problematic, except in cases of bleeding, pain, or infection.**

Authors / Year	Study Topic / Published In	Study Design / What Was Investigated	Key Findings / Discussion
Song J-Y, Zhang S-Z, et al. (2023)	Impact of sexual intercourse one night before frozen-thawed embryo transfer (FET); Contraception and Reproductive Medicine (BMC)	RCT: Effect of sexual intercourse (with barrier) vs. abstinence on pregnancy outcomes	Intercourse group had higher clinical pregnancy rate (51.7% vs. 37.1%) and implantation rate (38.3% vs. 24.8%); spontaneous abortion not significantly different. Authors suggest intercourse may improve outcomes, but mechanisms unclear; larger studies needed.
Tremellen K, et al. (2000)	Effect of intercourse around embryo transfer on pregnancy rates; Human Reproduction (Oxford Academic)	Multicenter prospective randomized study: Intercourse around transfer (fresh/frozen) vs. abstinence	No significant difference in overall pregnancy rates; higher embryo viability at 6-8 weeks in intercourse group. Suggests exposure to semen may enhance early implantation/development


Thanks for your attention