

Optimizing Embryo Transfer in IVF Cycles

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Optimizing IVF Outcome
Precongress Course
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Embryo transfer is the rate limiting step in the process of ART



Successful ART

1. Uterine receptivity
2. Embryo quality
3. Embryo transfer

Is Embryo Transfer Procedure Inefficient?

- ❑ Dummy ET using methylene blue (Mansour et al 1994)

The dye was extruded at the external cervical os in 23% to 57% cases

- ❑ First IVF pregnancy was ectopic (Edwards and Steptoe, 1975)

What may go wrong during transfer ?

1. Distruption of endometrium
2. Induction of uterine contractions
3. Deposition of embryos in a suboptimal location
4. Damage of embryos during the process

What is difficult Transfer ?

- Prolonged time to negotiate uterocervical angle
- Tenaculum application
- Blood in or on the catheter
- Stiff embryo transfer catheter



Why is it difficult to transfer ?

- ❑ Cervical stenosis
- ❑ Acute angle of uterocervical portion (anteversion/retroversion)
- ❑ Unexperienced operator



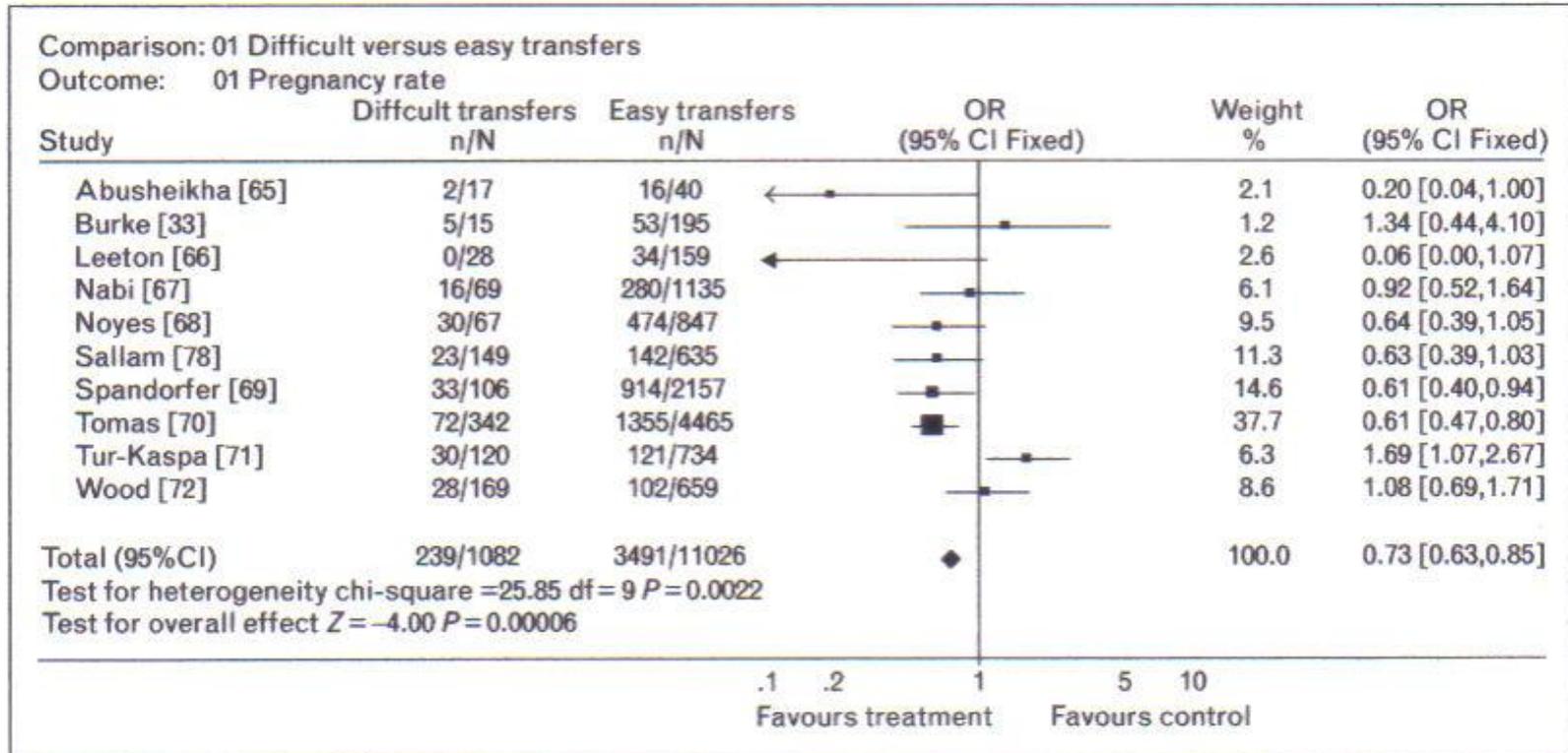
Difficult Embryo transfer: analysis of 6484 transfers

Listijono et al, 2013

	N (%)	CPR/ET (%)
Easy	5976 (92.2)	30.7
Medium/Difficult	408 (7.8)	24.6

Effect of difficult ET

Meta-analysis of controlled trials



Difficult embryo transfers are associated with a significant reduction in pregnancy rate.

Umut IVF Center

01/2013-12/2013

	Non-difficult (n=1316)	Difficult (n=28)
CPR	46.8 %	32.1%

Required sedation or tenaculum application with stiff Wallace catheter.
Blood was seen in catheters

Assessment of endocervical and endometrial damage inflicted by embryo transfer trial: a hysteroscopic evaluation

Table 1. Difficulty of embryo transfer trial and degree of endocervical and endometrial damage. Values are numbers with percentages in parentheses.

<i>Difficulty of embryo transfer</i>	<i>Degree of endocervical damage</i>			<i>Total</i>
	<i>None</i>	<i>Minor</i>	<i>Moderate</i>	
Easy	24 (78)	6 (19)	1 (3)	31 (100)
Moderate	15 (56)	7 (26)	5 (18)	27 (100)
Difficult	7 (41)	6 (35)	4 (24)	17 (100)
<i>Difficulty of embryo transfer</i>	<i>Degree of endometrial damage</i>			<i>Total</i>
	<i>None</i>	<i>Minor</i>	<i>Moderate</i>	
Easy	20 (65)	10 (32)	1 (3)	31 (100)
Moderate	8 (30)	16 (59)	3 (11)	27 (100)
Difficult	5 (29)	7 (42)	5 (29)	17 (100)

Tenaculum placement

- ❑ Tenaculum placement during ET increases oxytocin concentration and “junctional zone” contractions

Dorn C et al, 1999
Lesny P et al, 1999

- ❑ Frequency of uterine contractions is negatively correlated to IR & PR

Fanchin R et al. 1998

The presence of blood in the transfer catheter negatively influences outcome at embryo transfer*

R.Alvero^{1,4}, R.M.Hearns-Stokes^{2,3}, W.H.Catherino^{2,3}, M.P.Leondires² and J.H.Segars³

Table IV. Strength of the association between CPR (dependent variable) and blood on or in transfer catheter, retained embryos at transfer, difficulty of transfer, mucus on or in transfer catheter, need for a sham transfer prior to actual procedure or aborted initial attempt at transfer, using logistic regression

Parameter	<i>P</i>
Blood on/in catheter	0.01
Retained embryos at transfer	0.49 (NS)
Difficulty of transfer	0.80 (NS)
Mucus in catheter	0.18 (NS)
Sham at transfer	0.32 (NS)
Aborted transfer	0.94 (NS)

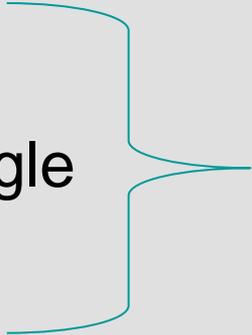


Mock embryo transfer

- ❑ Reduces the risk of difficult transfer, increases IR and PR
Mansour et al, 1990
- ❑ Uterus at mock embryo transfer will often change position at real embryo transfer (Retroversion to anteversion)
Henne and Milki 2004

Steps during ET

1. Room conditions
2. Ultrasonography
3. Operator
4. Assistant and Embriologist
5. Preparation of cervix
6. Loading of catheter
7. Passing uterocervical angle
8. Deposition of embryos
9. Withdrawal of catheter
10. Patient instructions after ET

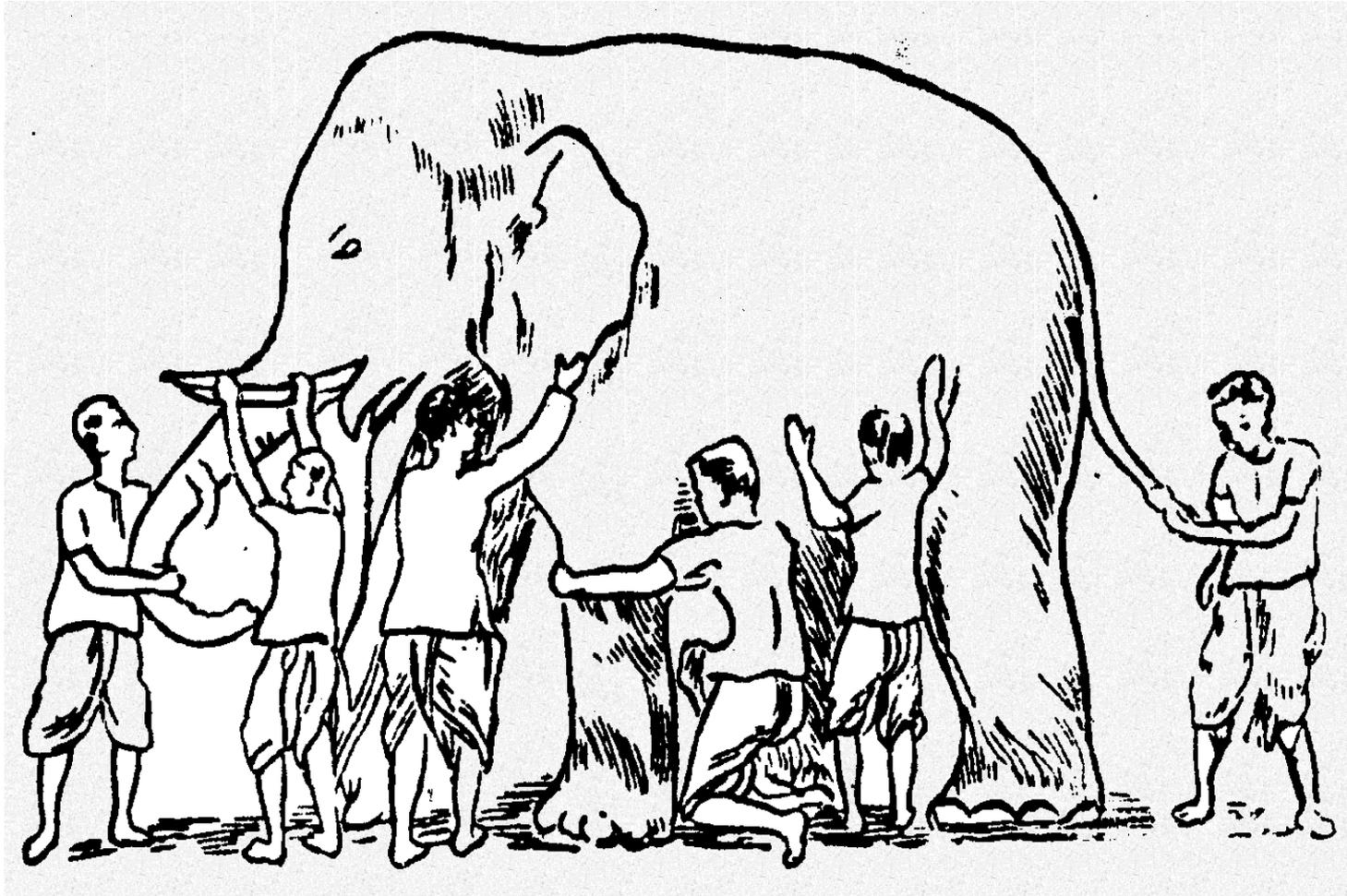


TIME

Room Conditions

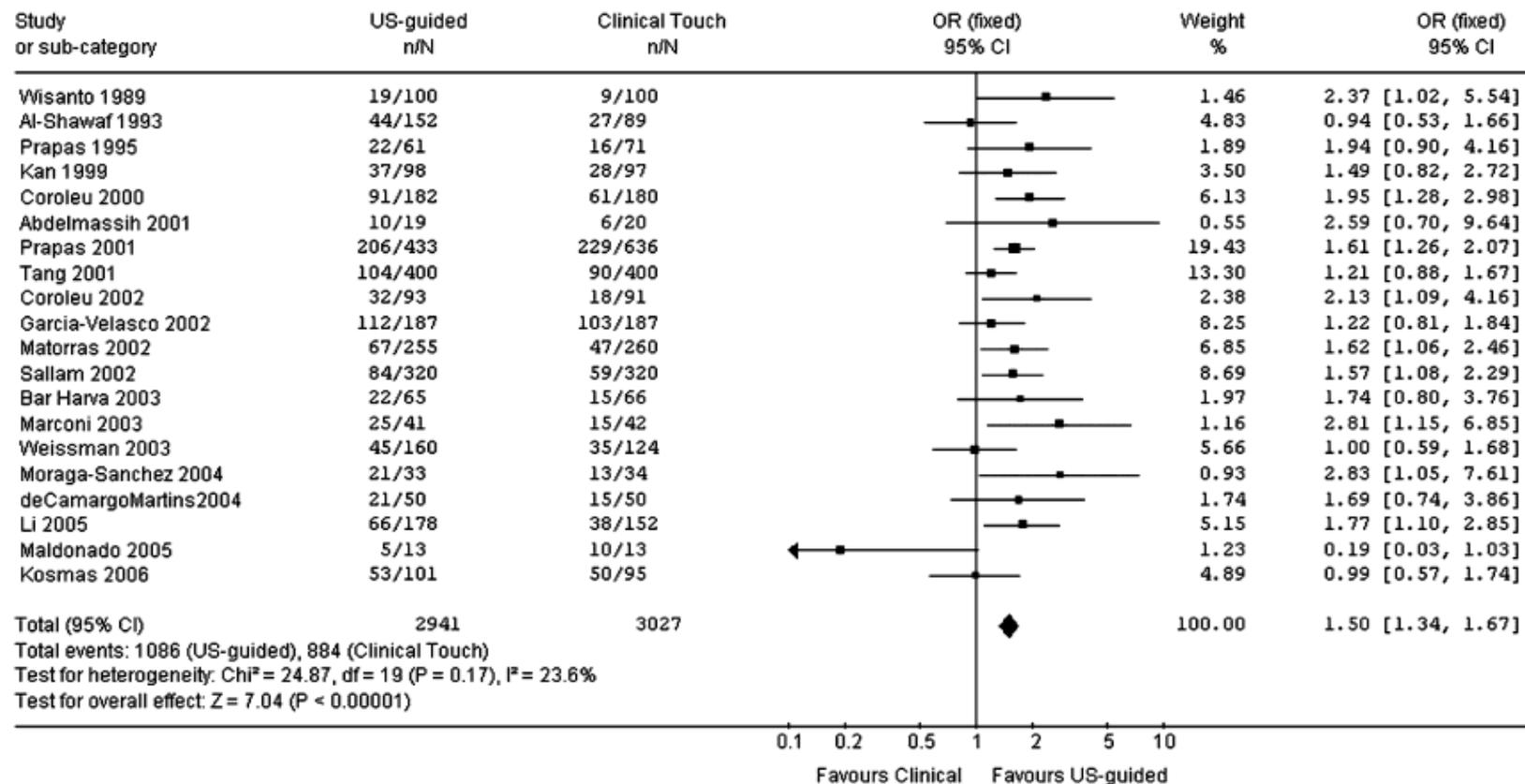
1. Adjacent to IVF Lab
2. Operating room
3. Silent
4. Climate
5. Psychologic support

Seeing is Believing



ET and Ultrasonographic guidance

Meta-analysis forest plots showing clinical pregnancy rate following ultrasound-guided versus clinical touch ET. US = ultrasound.



Embryo transfer—can we learn anything new from the observation of junctional zone contractions?

- Lesny et al, 1998
- 30 μ l Echovist injection
- 45 min serial transvaginal sonograms

Location	No Touch	Twice Touch
No change	7	1
Changed	-	6

Advantages of ultrasonographic guidance:

- ❑ Less difficult transfers
- ❑ Detection of catheter load inside uterine cavity
- ❑ Better position
- ❑ Full bladder facilitates correction of acute uterocervical angle

Sonography assistant is of importance:

1. Anatomical variations of genital tract complicates to visualize sagittal section of cervical canal and endometrial lining.
2. Furthermore stimulated ovaries hamper proper image



Physician experience in performing embryo transfers may affect outcome

Cycle characteristics and pregnancy rate per physician.

Physician ID	No. ET cycles	Age of women, (y) ^a	FSH amount ^b	Peak E ₂ ^c	No. of embryos	Mean no. of embryos per cycle ^d	Mean grade of embryos per cycle ^e	Pregnancy rate (%) ^f
1	633	34.4 ± 5.2	3,432 ± 1678	1,962 ± 1158	1,750	2.8 ± 0.9	1.7 ± 0.6	43.1 (273/633)
2	608	34.2 ± 5.6	3,267 ± 1725	2,026 ± 1232	1,742	2.9 ± 0.9	1.7 ± 0.6	45.6 (277/608)
3	233	34.2 ± 5.6	3,525 ± 1627	2,101 ± 1277	667	2.9 ± 1.0	1.7 ± 0.6	41.6 (97/233)
4	317	33.4 ± 5.5	2,632 ± 1939	2,408 ± 1298	912	2.9 ± 0.8	1.5 ± 0.6	46.1 (146/317)
5	173	33.9 ± 5.7	3,763 ± 1710	1,967 ± 1113	488	2.8 ± 0.9	1.8 ± 0.7	38.7 (67/173)
6	248	33.7 ± 5.7	3,807 ± 1717	2,184 ± 1339	662	2.7 ± 0.9	1.7 ± 0.7	49.2 (122/248)

Note: Continuous values are in the form of mean ± standard deviation.

^a Mean age of women are not statistically significantly different among physicians.

^b Mean follicle-stimulating hormone (FSH) values are statistically significantly different among physicians.

^c Mean estradiol (E₂) values are statistically significantly different; however, if physician 4 is excluded, E₂ values did not differ.

^d Mean number of embryos transferred (ET) per cycle are statistically significantly different among physicians.

^e Mean grade of embryos per cycle are statistically significantly different; however, if physician 4 is excluded, embryo grades did not differ.

^f Pregnancy rates are statistically significantly different only between physician 5 and physician 6 (*P* = .03).

Uyar. Correspondence. *Fertil Steril* 2011.

The efficacy of the embryo transfer catheter in IVF and ICSI is operator-dependent: a randomized clinical trial

Zhan Yao¹, Stijn Vansteelandt², Josiane Van der Elst^{1,3},
Tom Coetsier¹, Marc Dhont¹, and Petra De Sutter^{1,4}

Factors	Coefficient estimate	P-value	Odds ratio	95% CI for OR	
				Low	High
Operator A (Cook versus Frydman)	0.1991	0.2588	1.22	0.86	1.72
Operator B (Cook versus Frydman)	0.7107	0.0036	2.04	1.26	3.28
Operator C (Cook versus Frydman)	0.3721	0.0403	0.69	0.48	0.98
Age of female	0.488	0.0003	0.95	0.93	0.98
Primary versus secondary infertility	0.3102	0.0121	0.73	0.58	0.93
Embryo score	0.2762	0.0075	1.32	1.08	1.61

Experience of operator

Learning curve:

- ❑ ET trainees can reach an acceptable PR after the first 25-30 ETs.
- ❑ Clinical pregnancy rates of fellows-in-training were indistinguishable statistically from those of experienced staff by 50 transfers.
(45.5% v 47.3%)

Papageorgiou et al 20

Who will perform embryo transfer?

Human Reproduction vol.11 no.1 pp.105-108, 1996

Nurses performing embryo transfer: successful outcome of in-vitro fertilization

Human Reproduction vol 13 no 3 pp 699-702, 1998

Nurses performing embryo transfer: the development and results of the Birmingham experience

	Preg/embryo transfer	%
Total	270/771	35.0
A Nurse	246/679	36.2
B Doctor	20/68	29.4
Both	4/24	16.7

	Nurses	Doctors	Statistical difference
Embryo transfers	371	151	
Pregnancies	149	62	
Clinical pregnancies	109	48	
Pregnancy rate/embryo transfer	40.2%	41%	NS ^a
Clinical pregnancy rate/embryo transfer	29.4%	31.8%	NS
singleton	68%	81%	NS
multiple	32%	19%	NS
Implantation rate	16.9%	17%	NS

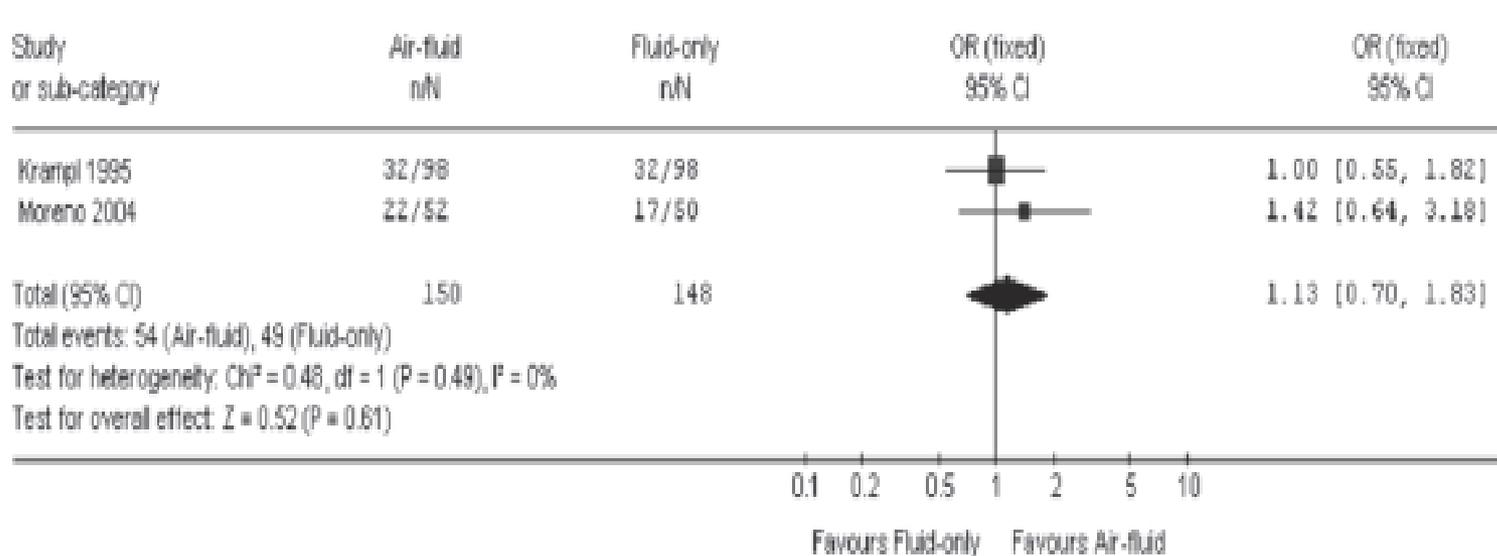
Loading Embryo to Catheter

- ❑ Embryos could expel into vagina, if transfer medium exceeds 60 μ l.
- ❑ Implantation could be affected when medium was less than 10 μ l .

Ebner T et al , 2001

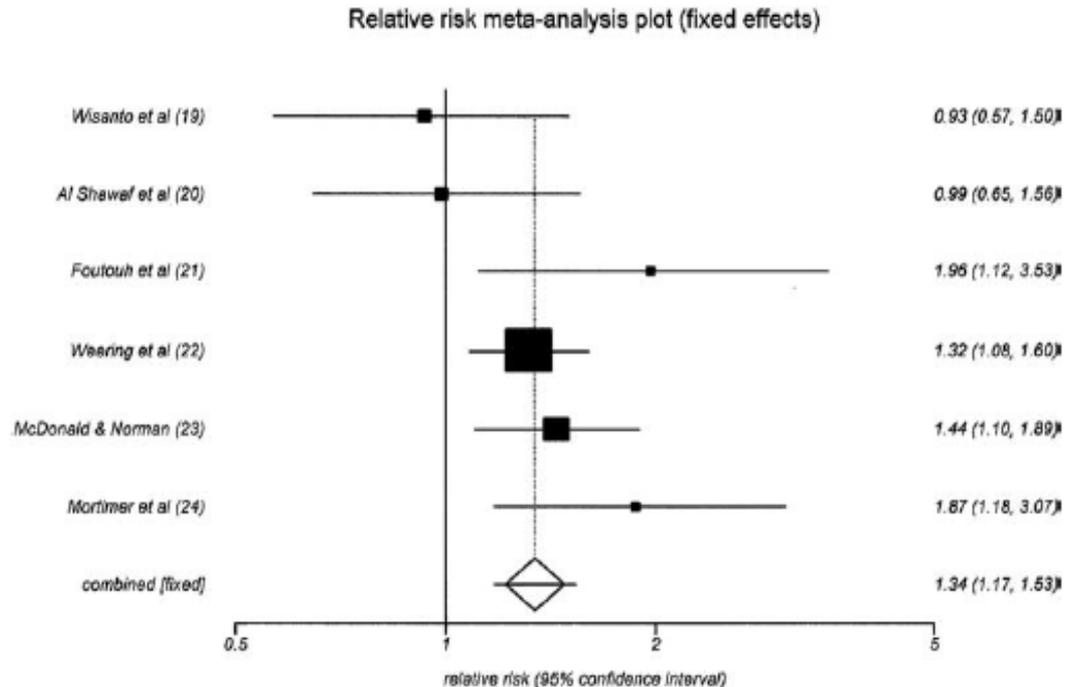
Loading transfer catheter with only medium or air/medium ?

Figure 3. Meta-analysis forest plot showing clinical pregnancy rates.



Soft vs Stiff embryo transfer catheters

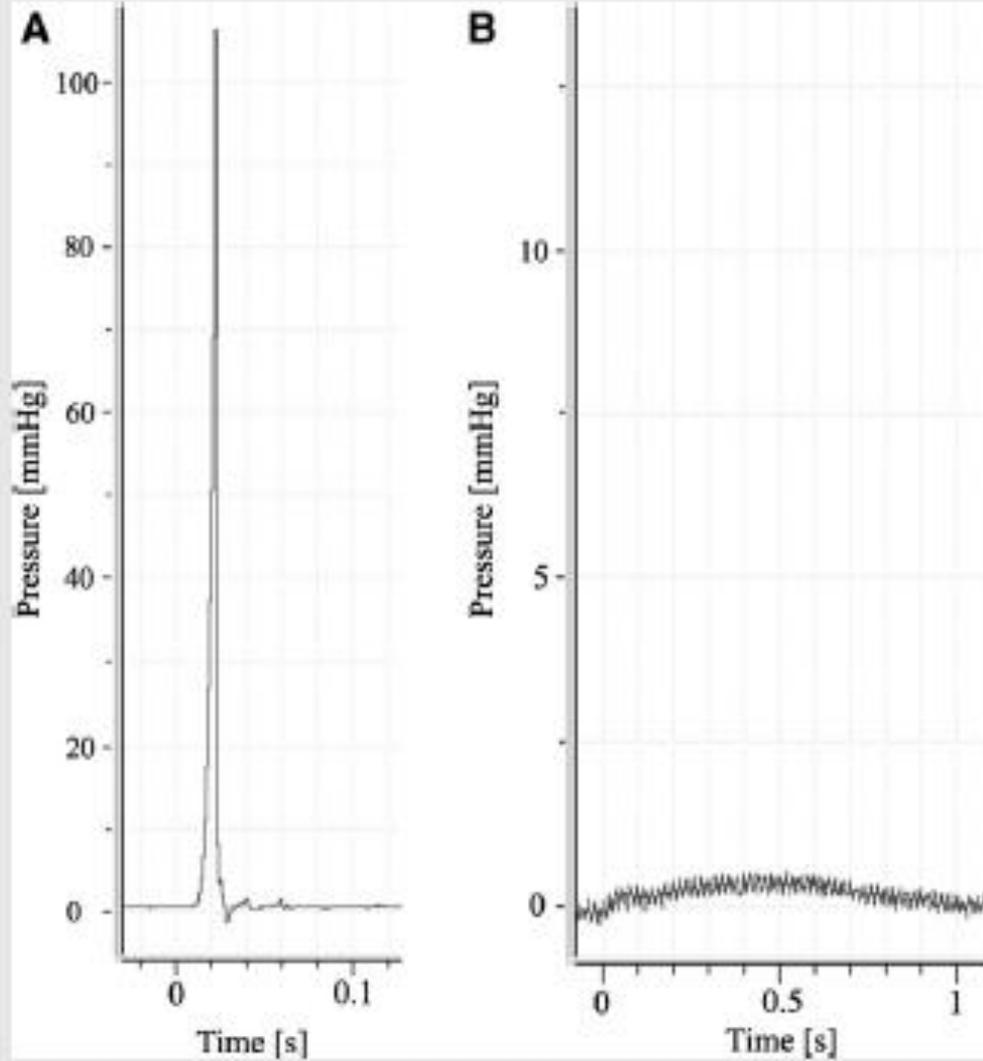
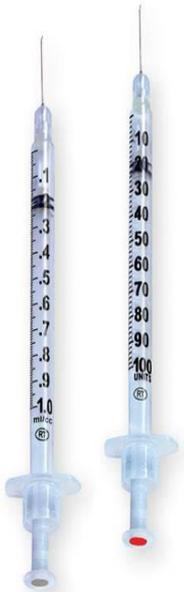
Relative risk for clinical pregnancy per embryo transfer in trials comparing soft with hard embryo transfer catheters (over unity in favor of soft catheters).



Assisted reproduction outcomes after embryo transfers requiring a malleable stylet

Gian Mario Tiboni · Enrica Concetta Colangelo ·
Emiliana Leonzio · Elisabetta Gabriele

	With stylet (n=164)	Without stylet (n=389)	P value
Retrieved oocytes (n)	9.11±4.62	8.97±5.34	NS
Metaphase II oocytes (n)	8.05±4.45	6.88±2.59	0.000
Biochemical pregnancy only	11/164 (6.7%)	15/389 (3.8%)	NS
Implantation rate	68/492 (13.8%)	226/1167 (19.4%)	0.009
Pregnancy loss	6/51 (11.8%)	18/163 (11.0%)	NS
Ectopic pregnancy	3/164 (1.8%)	10/389 (2.6%)	NS
Clinical pregnancy	51/164 (31.1%)	163/389 (41.9%)	0.022
Grade A and B embryos	391/492 (79.5%)	878/1167 (75.2%)	NS
Number of ET at 48 h	58/164 (35.4%)	162/389 (41.6%)	NS
Number of ET at 72 h	106/164 (64.6%)	227/389 (58.4%)	NS
Clinical pregnancy/ET at 48 h	19/58 (32.8%)	69/162 (42.6%)	NS
Clinical pregnancy/ET at 72 h	32/106 (30.2%)	94/227 (41.4%)	NS
Twin pregnancy	11/51 (21.6%)	47/163 (28.8%)	NS
Triplets	3/51 (5.9%)	8/163 (4.9%)	NS
Live birth rate	45/164 (27.4%)	145/389 (37.3%)	0.033

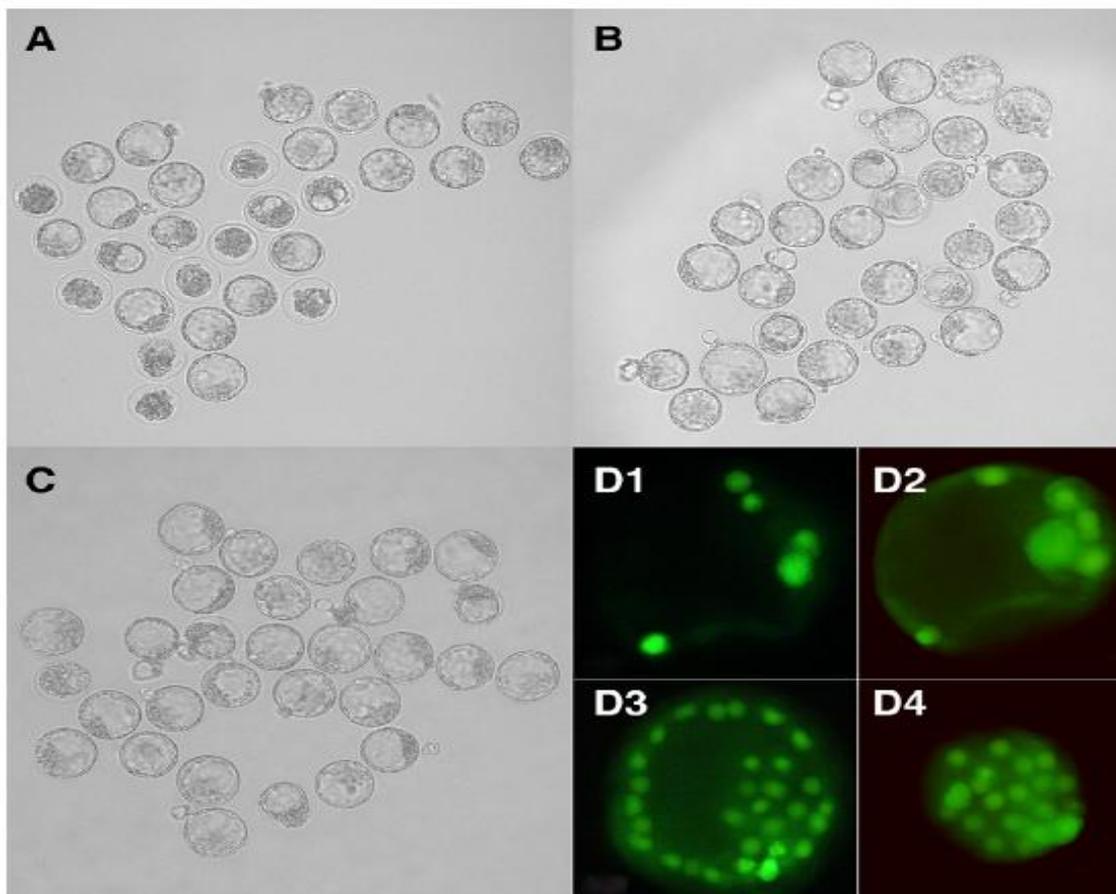


The exemplary recording of pressure changes during the mark ETs for the insulin syringe (A) and the micro-syringe (B).

Influence of embryo transfer on blastocyst viability

Cezary Grygoruk, M.D., Ph.D.,^a Piotr Sieczynski, M.Sc., Ph.D.,^b Jacek A. Modlinski, Ph.D., D.Sc.,^c
Barbara Gajda, Ph.D., D.Sc.,^d Pawel Greda, M.Sc., Ph.D.,^c Izabela Grad, M.Sc.,^d Piotr Pietrewicz, M.Sc.,^a
and Grzegorz Mrugacz, M.D., Ph.D.^a

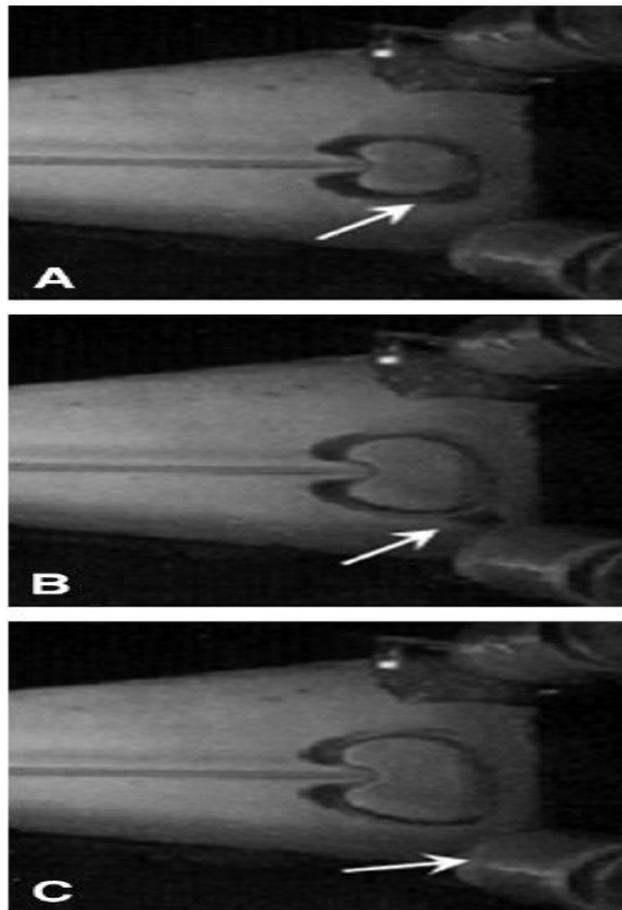
Blastocysts 1 hour after embryo transfer (ET). (A) Group A. (B) Group B. (C) Control group C. (D) Apoptotic cells in mouse blastocysts stained by TUNEL: (D1) blastocyst not exposed to ET (apoptotic index 11%), (D2) blastocyst 1 hour after "slow" ET (apoptotic index 21%), (D3) morphologically unchanged blastocyst 1 hour after "fast" ET (apoptotic index 86%), (D4) collapsed blastocyst 1 hour after "fast" ET (apoptotic index 69%).



Evaluation of the embryo transfer protocol by a laboratory model of the uterus

Osnat Eytan, Ph.D.,^a David Elad, D.Sc.,^b and Ariel J. Jaffa, M.D.^a

Simulation of how ectopic pregnancy may occur. Dispersion of the transferred volume injected at a high speed ($T = 1$ s) in a horizontal uterine model ($\theta = 0^\circ$) while the catheter is close to the fundus: (A) $t = 0.5$ s, (B) $t = 0.75$ s, and (C) $t = 0.875$ s. The *arrows* mark the part of the liquid that enters into the glass tube.



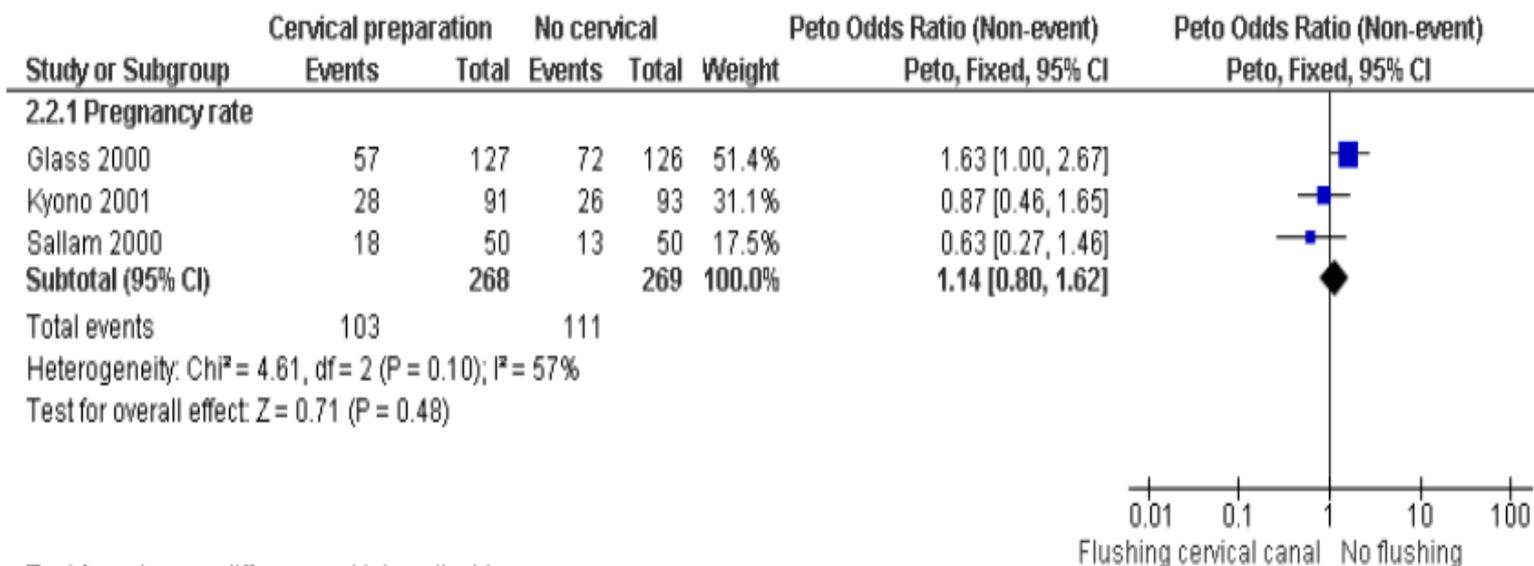
Preparation of cervix: Removal of mucus

- ❑ Obstruct catheter tip
- ❑ Contamination with cervical flora
- ❑ Embryos can be embedded in mucus and dislodged

	Mucus aspiration^a	No aspiration^a	OR	95% CI
Clinical pregnancy rate ^b	63 (44.1)	38 (26.6)	2.18	1.32 3.58
Implantation rate	69/500 (13.8)	63/471 (13.4)	1.04	0.72 1.50
Rate of difficult embryo transfer ^b	14 (9.8)	5 (3.5)	3.00	1.05 8.55

Cervical Mucus

Figure 6. Forest plot of comparison: 2 Cervical preparation interventions versus no intervention, outcome: 2.2 Flushing the endocervical canal vs no intervention.



Test for subgroup differences: Not applicable

Effect of blood and mucus on the success rates of embryo transfers

Bulent Tiras^a, Umit Korucuoglu^{b,*}, Mehtap Polat^a, Ayse Saltik^a, Hulusi Bulent Zeyneloglu^c, Hakan Yarali^a

Effect of different degrees of blood on pregnancy rates and outcomes.

	No blood	Mild blood	Moderate blood	Severe blood	<i>p</i>
hCG \geq 45/ET	3103/6897 (45.0%)	476/1168 (40.8%)	13/33 (39.4%)	70/213 (32.8%)	<0.001
Clinical pregnancy/ET	2909/6897 (42.1%)	455/1168 (38.9%)	12/33 (36.3%)	62/213 (29.1%)	<0.001
Biochemical pregnancy/(+) hCG	194/3103 (6.2%)	21/476 (4.4%)	1/13 (7.6%)	8/70 (11.4%)	ns
Miscarriage	146/1093 (13.4%)	26/183 (14.2%)	1/10 (10.0%)	3/23 (13.0%)	ns
Live birth/pregnancy	686/1093 (62.8%)	109/183 (59.6%)	5/10 (50.0%)	12/23 (52.0%)	ns
Live birth/ET	686/6897 (9.9%)	109/1168 (9.3%)	5/33 (15.0%)	12/213 (5.6%)	0.023

Effect of mucus on pregnancy rates and outcomes.

	No mucus	Mucus (+)	<i>p</i>
hCG \geq 45/ET	2702/6162 (43.8%)	933/2081 (44.8%)	0.4492
Clinical pregnancy/ET	2526/6162 (41.0%)	882/2081 (42.4%)	0.2767
Biochemical pregnancy/(+) hCG	176/2702 (6.5%)	51/933 (5.5%)	0.2884
Miscarriage	138/975 (14.2%)	36/319 (11.3%)	0.2266
Live birth/pregnancy	604/975 (61.9%)	199/319 (62.4%)	0.9425

Moulding the catheter (Sallam et al)

Ultrasound guidance and moulding the catheter facilitates the transfer uterocervical angle

	USG	No USG	
Difficult transfer	8.4%	26,8%	0,0001
Blood on tip	5%	13,4%	0,01
CPR	26,2%	18,4%	0,02

	CPR
No angle	35,9%
<30	34,4%
30-60	31,1%
>60	16,9%

Embryo afterloading: a refinement in embryo transfer technique that may increase clinical pregnancy

Adrienne B. Neithardt, M.D.,^{a,b,c} James H. Segars, M.D.,^{a,b,c} Sasha Hennessy, M.S.,^c Aidita N. James, Ph.D.,^c and Jeffrey L. McKeeby, M.D.^d

Comparison of pregnancy outcomes with direct vs. afterloaded ET methods. IR = implantation rate, defined as the number of embryos transferred divided by number of gestational sacs on ultrasound. CPT/T = clinical pregnancy per ET cycle based on ultrasound evidence of fetal cardiac activity at 6–8 weeks of gestation. A, $P = \text{NS}$; B, $P = .06$ by χ^2 analysis. *Red*, afterloaded ET; *blue*, direct ET.

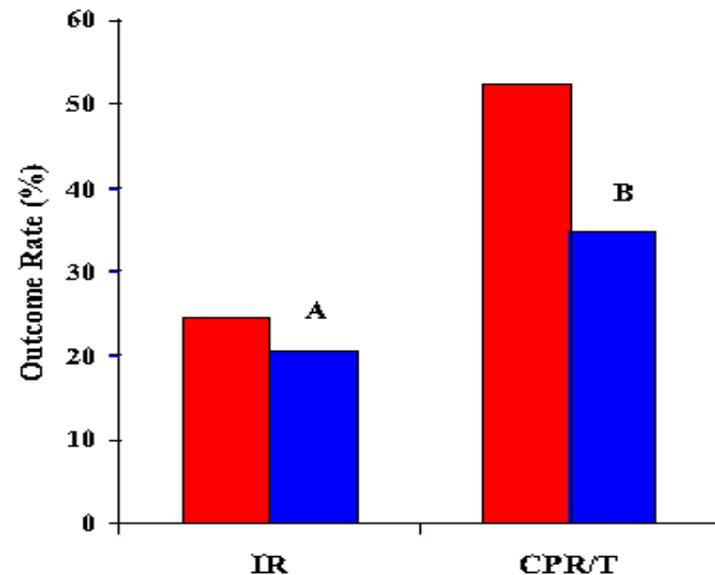
Features of the ET.

	Afterload (n = 84)	Direct (n = 43)	P
Difficulty, hard	0	0	1.00 ^a
Difficulty, moderate	6 (7.10)	4 (9.30)	.73 ^a
Presence of blood	8 (9.5)	4 (9.30)	1.00 ^a
Presence of mucus	5 (5.95)	11 (25.58)	.002 ^b

Note: Data in parentheses are percents.

^aBy a two-tailed Fischer's exact test.

^bBy χ^2 analysis.



The effect of retained embryos on pregnancy outcome in an in vitro fertilization and embryo transfer program

Kubilay Vicdan*, Ahmet Zeki Işık, Cem Akarsu, Eran Sözen, Gamze Çağlar, Bihter Dingiloğlu, Görkem Tuncay

Pregnancy rates and outcomes in patients with and without retained embryos

	Retained embryos (<i>n</i> : 41)		Non-retained embryos (<i>n</i> : 1413)		<i>p</i>
Positive β -hCG	24	(%58.5)	688	(%48.7)	NS
Biochemical pregnancy	2	(%4.7)	71	(%5.1)	NS
Clinical pregnancy	22	(%53.6)	617	(%43.6)	NS
Multiple pregnancies	8	(%36.3)	273	(%44.2)	NS
Twins	6	(%27.3)	189	(%30.6)	
Triplets	2	(%9)	84	(%13.6)	
Implantation rate	33/137	(%24)	986/4340	(%22.7)	NS

Multiple attempts at embryo transfer: does this affect in-vitro fertilization treatment outcome?

Nahi et al, 1997

	Single attempt	Second attempt	Third attempt
n	1135	61	8
CPR (%)	24,7	23,2	25

What is the best site for embryo deposition? A systematic review and meta-analysis using direct and adjusted indirect comparisons

	<i>DTC-II</i>	<i>DTC-III</i>	<i>DTC-IV</i>	<i>DTC-III/DTC-IV</i>
<i>Live-birth rate</i>				
DTC-I	OR = 0.76 [*] , 95% CI = 0.47-1.23 [*]	NA	NA	OR = 0.70, 95% CI = 0.51-0.97
DTC-II		OR = 0.62, 95% CI = 0.29-1.30	OR = 0.42, 95% CI = 0.20-0.89	OR = 0.92, 95% CI = 0.64-1.32
DTC-III			OR = 0.69, 95% CI = 0.33-1.42	NA
DTC-IV				NA
<i>Ongoing pregnancy rate</i>				
DTC-I	OR = 0.77 [*] , 95% CI = 0.48-1.25 [*]	NA	NA	OR = 0.71, 95% CI = 0.52-0.98
DTC-II		OR = 0.62, 95% CI = 0.29-1.30	OR = 0.43, 95% CI = 0.20-0.89	OR = 0.92, 95% CI = 0.64-1.32
DTC-III			OR = 0.69, 95% CI = 0.33-1.42	NA
DTC-IV				NA
<i>Clinical pregnancy rate</i>				
DTC-I	OR = 0.88 [*] , 95% CI = 0.57-1.36 [*]	NA	NA	OR = 0.86, 95% CI = 0.64-1.15
DTC-II		OR = 0.67, 95% CI = 0.33-1.38	OR = 0.43, 95% CI = 0.21-0.90	OR = 0.98, 95% CI = 0.69-1.38
DTC-III			OR = 0.64, 95% CI = 0.31-1.33	NA
DTC-IV				NA

Live-birth, ongoing pregnancy and clinical pregnancy rates are **significantly improved** when the tip of the catheter is positioned in the middle area of the endometrial cavity

Impact of embryo replacement depth on in vitro fertilization and embryo transfer outcomes

Bulent Tiras, M.D.,^{a,b} Mehtap Polat, M.D.,^a Umit Korucuoglu, M.D.,^b Hulusi Bulent Zeyneloglu, M.D.,^c and Hakan Yarali, M.D.^d

Pregnancy rates and outcome of gestation in the five groups studied.

Variable	Group 1 (n = 31; 0.6%)	Group 2 (n = 676; 13.4%)	Group 3 (n = 2,690; 53.2%)	Group 4 (n = 1,296; 25.6%)	Group 5 (n = 362; 7.2%)
Pregnancy rate/transfer (%; n)	32.3% (10/31)	44.9% (304/676)	44.2% (1,189/2,690)	44.2% (566/1,281)	43.3% (156/360)
Ongoing pregnancy rate (%; n)	29.0% (9/31)	40.2% (272/676)	40.0% (1,076/2,690)	40.0% (512/1,281)	39.2% (141/360)
Miscarriage rate (%; n)	10.0% (1/10)	9.5% (29/304)	9.2% (109/1,189)	9.2% (52/566)	9.6% (15/156)
Ectopic pregnancy rate (%; n)	—	1.0% (3/304)	0.3% (4/1,189)	0.4% (2/566)	—

Influence of the time interval between embryo catheter loading and discharging on the success of IVF

R.Matorras, R.Mendoza, A.Expósito and F.J.Rodriguez-Escudero

Table II. Duration of the interval loading discharging embryos (ILDE), cycle characteristics and cycle results

	< 30 s (n = 113)	31 60 s (n = 214)	61 120 s (n = 76)	> 120 s (n = 47)	P
Woman's age (years)	34.01 + 3.04	34.40 + 2.83	33.97 + 3.57	33.93 + 3.73	Ns
Infertility duration (years)	5.21 + 2.54	5.07 + 2.66	5.19 + 2.54	5.20 + 2.61	Ns
Primary infertility (%)	91.1	89.7	89.5	89.4	Ns
ICSI (%)	53.1	50.9	57.8	57.5	Ns
Obtained oocytes	11.00 + 6.13	12.28 + 6.22	12.22 + 6.20	13.23 + 5.83	Ns
Inseminated oocytes	9.30 + 5.30	10.29 + 5.30	9.92 + 5.08	10.46 + 4.03	Ns
Fertilized oocytes	5.30 + 3.97	6.03 + 4.07	5.34 + 3.63	5.74 + 3.16	Ns
Transferred embryos	3.05 + 1.06	3.12 + 0.99	3.07 + 1.09	3.14 + 0.85	Ns
Transferred class I embryos	1.95 + 1.00	2.10 + 0.98	2.37 + 0.98	2.17 + 0.99	Ns
% of non easy transfers	2.6	0.5	1.3	19.1	<0.001
Pregnancy rate (%)	38.9	33.2	31.6	19.1	<0.05
Implantation rate (%)	21.2	15.4	15.9	9.4	<0.01
Pregnancy rate excluding non-easy transfers (%)	40.0	33.3	32.0	19.4	<0.05
Implantation rate excluding non easy transfers (%)	21.4	15.4	16.2	8.8	<0.01

Prolonged duration of transfer does not affect outcome in cycles with good embryo quality

The demographics and outcome of cycles in which good and poor quality embryos were transferred.

Embryo quality	Good		Poor	
	Easy	Difficult	Easy	Difficult
Cycles (N)	187	34	71	8
Mean age of women \pm SD (years; range)	31.6 \pm 4.3 (18–39)	31.5 \pm 4.5 (21–39)	31.6 \pm 4.8 (22–39)	30.3 \pm 5.9 (23–39)
Mean day 3 FSH \pm SD (mIU/mL)	6.9 \pm 3.2 ^c	5.7 \pm 3.7 ^c	8.2 \pm 3.5	9.9 \pm 4.3
Mean peak E ₂ \pm SD (pg/mL)	2791 \pm 1633	3037 \pm 1569	1943 \pm 1301 ^d	1983 \pm 1104
Mean thickness of endometrium at transfer \pm SD (mm)	10.7 \pm 2.3	11.2 \pm 2.8	10.5 \pm 2.3	11.5 \pm 2.7
Mean number of retrieved oocytes \pm SD (N)	17.5 \pm 10.0 (3,277)	17.9 \pm 7.7 (610)	11.7 \pm 8.2 (834) ^d	16.6 \pm 13.7 (133)
% Mean M2/retrieved oocytes \pm SD (N)	81.3 \pm 15.5 (2,640)	82.5 \pm 9.6 (497)	80.5 \pm 15.3 (417)	81.8 \pm 15.1 (106)
% Mean 2PN/M2 oocytes \pm SD (N)	76.5 \pm 16.9 (1,973) ^c	72.9 \pm 13.3 (355)	66.7 \pm 21.0 (417)	66.5 \pm 27.2 (64)
Mean number of good quality embryos ^a \pm SD (N)	5.9 \pm 4.4 (1,097) ^c	6.6 \pm 4.5 (225) ^c	1.2 \pm 2.1 (82)	0.9 \pm 1.4 (7)
Mean number of embryos transferred \pm SD (N)	2.8 \pm 0.5 (526)	2.9 \pm 0.3 (100)	2.5 \pm 0.9 (176) ^d	2.9 \pm 0.4 (23)
Mean ET duration \pm SD (seconds; range)	86.1 \pm 44.6 (38–315) ^e	225.7 \pm 108.2 (61–480)	91.5 \pm 59.0 (35–340) ^e	253.6 \pm 98.7 (130–378)
N positive β -hCG cycles	135	25	41	2
N biochemical pregnancy (% positive cycles)	5 (3.7)	1 (4.0)	12 (29.3) ^d	0
N clinical pregnancy (% ET)	130 (69.5) ^{bc}	24 (70.6) ^c	29 (40.8)	2 (25.0)
N implantation (%)	194 (36.9) ^c	38 (38.0) ^c	37 (21.0)	2 (8.7)
N ongoing pregnancy (cycles; % ET)	103 (55.1) ^c	20 (58.8) ^c	24 (33.8)	2 (25.0)

Note: The description of difficult and easy transfers are given in the text. ET= embryo transfer.

^a Embryos with \leq 20% fragmentation, four to five cells (day 2 transfers) and seven to nine cells (day 3 transfers).

^b Four ectopic pregnancies included.

^c Significantly different from "poor embryo quality" cycles.

^d Significantly different from "good embryo quality" cycles.

^e Significantly different from "difficult" transfers.

The Role of Acupuncture in Assisted Reproductive Technology

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CPR

Study or subgroup	Acupuncture		Control		Weight	Odds ratio M-H, random, 95% CI	Odds ratio M-H, random, 95% CI
	Events	Total	Events	Total			
Paulus et al. [21]	34	80	21	80	5.9%	2.08 [1.07, 4.04]	
Paulus et al. [22]	43	100	37	100	6.8%	1.28 [0.73, 2.26]	
Smith et al. [23]	34	110	31	118	6.7%	1.26 [0.71, 2.23]	
Westergaard et al. [24]	70	200	21	100	6.9%	2.03 [1.15, 3.55]	
Dieterle et al. [25]	39	116	17	109	6.1%	2.74 [1.44, 5.22]	
Benson et al. [26]	54	106	67	152	7.5%	1.32 [0.80, 2.17]	
Craig et al. [27]	21	48	32	46	4.5%	0.34 [0.15, 0.79]	
Fratterelli et al. [29]	213	402	278	598	10.2%	1.30 [1.01, 1.67]	
Domar et al. [31]	24	78	23	68	5.6%	0.87 [0.43, 1.74]	
So et al. [33]	72	185	91	185	8.4%	0.66 [0.44, 0.99]	
So et al. [34]	41	113	50	113	7.1%	0.72 [0.42, 1.22]	
Andersen et al. [35]	101	314	112	321	9.4%	0.88 [0.64, 1.23]	
Madaschi et al. [36]	84	208	67	208	8.6%	1.43 [0.95, 2.13]	
Moy et al. [38]	39	86	39	74	6.3%	0.74 [0.40, 1.39]	
Total (95% CI)		2146		2272	100.0%	1.12 [0.89, 1.42]	
Total events	869		886				

Heterogeneity: $\tau^2 = 0.12$; $\text{Chi}^2 = 39.14$, $\text{df} = 13$ ($P = 0.0002$); $I^2 = 67\%$

Test for overall effect $Z = 1.00$ ($P = 0.32$)

0.1 0.2 0.5 1 2 5 10
Favours control Favours treatment

Does standing upright immediately after ET affect embryo position ?
(Woolcott et al, 1997)

- ❑ No movement occurred in 94.1%
- ❑ <1cm movement in 4%
- ❑ 1-5 cm in 2%

Post-embryo transfer interventions for women undergoing in vitro fertilization (IVF) and intracytoplasmic sperm injection

Abou-Setta et al Cochrane review

- ❑ There was no evidence of an effect bed rest in improving the rate of clinical pregnancies and miscarriages

Implantation site of embryo after transfer

Baba et al

Prospective controlled study

- ❑ 22 pregnancies after ET
- ❑ 80% of the gestational sacs were detected on the site of air bubbles spreaded

Conclusion:

Factors affecting success after ET: proven evidence based

- Ultrasound guidance
- Soft catheters

Conclusion:

Factors affecting success after ET: limited proven evidence based

- ❑ Mid uterine position of catheter tip
- ❑ Shortening of loading and discharging interval time of embryos

Conclusion:

Factors affecting success after ET: no proof of benefit

- Use of mock transfer
- Use of cervical tenaculum
- Removal or flushing of the cervical mucus
- Antibiotic administration during ET
- Bed rest following ET

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