

Atlas of Oocytes Zygotes and Embryos in Reproductive Medicine

Marc Van den Bergh
Thomas Ebner
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Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Mexico City

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9781107004641

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First published 2012

Printed in the United Kingdom at the University Press, Cambridge

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication Data

Van den Bergh, Marc.

Atlas of oocytes, zygotes and embryos in reproductive medicine / Marc Van den Bergh,
Kay Elder, Thomas Ebner.

p. cm.

ISBN 978-1-107-00464-1

1. Fertilization in vitro, Human—Atlases. 2. Ovum—Atlases. 3. Zygotes—Atlases.
4. Human embryo—Atlases. I. Elder, Kay, 1946— II. Ebner, Thomas. III. Title.

RG135.V36 2012

618.178059900223—dc23

2011038744

ISBN 978-1-10700464-1 Hardback

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PREFACE

In common with many in vitro fertilization units worldwide, the County Hospital in Baden (Kantonsspital Baden, KSB) has a long-standing tradition of offering couples photographs of the embryos that are to be transferred. In 2002, a drastic change in the Swiss law on reproductive medicine prohibited embryo freezing, and placed a limitation of only three fertilized oocytes to be kept in culture for transfer. This restriction prevented us from using characteristics of cleaved embryos as selection criteria and, instead, we began to look in more detail at features of oocytes and zygotes as prognostic indicators. We thus created a large database of images in parallel with compulsory data collection for the national Swiss IVF register, FIVNAT-CH. All of the images collected during treatment cycles were simultaneously placed within their clinical and historical context, providing a useful atlas of human gametes, zygotes and embryos in parallel with the corresponding details and final outcome of each treatment cycle. The database contains all of the images for each individual case, amounting to several thousand photographs. The restrictions imposed by the Swiss law limits the usefulness of extended culture to blastocyst stage as an effective treatment strategy and, therefore, in order to complement the KSB data with this important feature, we called upon the experience of the

Kinderwunsch Zentrum at the Landes- Frauen- und Kinderklinik (LFKK) Linz in Austria to provide a similar set of cases that include images derived from extended culture to blastocyst stage. The atlas illustrates images for the oocytes, zygotes and embryos that led to embryo transfer in 111 clinical cases, and the complete set of images for each case is available on an accompanying CD that contains over 2000 photographs.

This unique combination of a photographic atlas, together with clinical details as well as access to a complete image database provides valuable insight into the daily practical approach to controlled ovarian stimulation, gamete culture and selection as performed by two experienced and successful IVF teams. In order to facilitate searching and comparison of images with reference to details of particular clinical and morphological features, we provide supplementary tables that group the cases according to female infertility cause, semen parameters, stimulation protocol, gonadotropin dose, oestrogen levels and final outcome.

We hope that this collection will provide a helpful learning tool and reference base not only for students but also for experienced embryologists and clinicians.

*‘I think one’s feelings waste themselves in words; they ought all to be distilled into actions which bring results.’
(Florence Nightingale)*

ACKNOWLEDGEMENTS

Sincere thanks to Mr. Martin Schlintl for his help in editing and optimizing images from Landes- Frauen-und Kinderklinik (LFKK) in Linz, Austria. We would also like to thank Kantonsspital Baden A.G. (KSB), Switzerland, LFKK, Austria and Bourn Hall Clinic, Cambridge for supporting the authors in this project.

MVB

TE

KTE

ABBREVIATIONS

AMH	anti-Mullerian hormone	ICSI	intracytoplasmic sperm injection
ART	assisted reproductive technology	IUI	intrauterine insemination
ATS	asthenoteratozoospermia	IVF	in vitro fertilization
BMI	body mass index	IVM	in vitro maturation
BT	blastocyst transfer	LDP	luteal (long) downregulation protocol
COC	cumulus–oocyte complex	LH	luteinizing hormone
COH	controlled ovarian hyperstimulation	MH	menstrual history
COI	cause of infertility	MPN	multipronucleate
CFTR	cystic fibrosis transmembrane conductance regulator	MZT	monozygotic twins
Cx	cervical	NAD	no abnormality detected
E	oestradiol	NPB	nucleolar precursor body
EEJ	electroejaculation	OATS	oligoasthenoteratozoospermia
ET	embryo transfer	OCR	oocyte retrieval
FBT	frozen blastocyst transfer	OHSS	ovarian hyperstimulation syndrome
FDP	follicular phase (short) downregulation protocol	PB	polar body
FET	frozen embryo transfer	PCO	polycystic ovaries/polycystic ovarian syndrome
FSH	follicular stimulating hormone	PN	pronuclear (scores)
GnRH	gonadotropin releasing hormone	POF	premature ovarian failure
GT	gonadotropin	PVP	polyvinylpyrrolidone
GV	germinal vesicle	PVS	perivitelline space
hCG	human chorionic gonadotropin	sER	smooth endoplasmic reticulum
HMG	human menopausal gonadotropin	s/c	subcutaneous (injection)
HSG	hysterosalpingogram	TE	trophectoderm
ICM	inner cell mass	TESE	testicular sperm extraction
		ZP	zona pellucida

TABLES

Table 1A Summary of clinical details of cases, ordered by cause of female infertility

Case	Female COI	Male diagnosis	F Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pmol/L	No. of hCG COC	Outcome	
1	None identified	TESE (fresh)	24	LDP	Not recorded	Not recorded	Not recorded	11	Positive	Biochemical pregnancy
2	None identified	OATS	27	LDP	3300	3014	11066	9	Positive	Live birth, healthy girl
3	None identified	ATS	28	LDP	5450	1796	6593	9	Positive	Live birth, healthy girl
4	None identified	OATS	28	LDP	1800	2378	8730	8	Negative	
5	None identified	ATS	29	Antagonist	1650	2003	7352	12	Positive	Ongoing singleton
6	None identified	OATS	29	LDP	1950	3153	11575	9	Positive	Twin pregnancy, 1st trimester spontaneous reduction to singleton
7	None identified	Cryptozoospermia	30	LDP	3150	3379	12405	12	Positive	Live birth, healthy boy
8	None identified	TESE (frozen)	31	LDP	3450	3877	14231	5	Negative	
9	None identified	Severe OATS	31	LDP	3375	1885	6921	8	Positive	Biochemical pregnancy
10	None identified	Post-oncology, frozen sample	32	LDP	3075	3533	12970	9	Negative	
11	None identified	Severe OATS	32	LDP	2325	4385	16099	9	Positive	Ongoing singleton
12	None identified	ATS	33	LDP	2100	1703	6253	5	Negative	
13	None identified	Severe OATS	33	Antagonist	1350	2745	10078	9	Positive	Spontaneous abortion, <12 wks
14	None identified	Severe OATS	33	Antagonist	1350	1193	4378	4	Positive	Ongoing singleton
15	None identified	ATS	34	LDP	2475	2025	7435	6	Negative	
16	None identified	ATS	34	LDP	4125	4066	14927	9	Positive	Ongoing singleton
17	None identified	ATS	34	LDP	2700	1186	4353	10	Negative	
18	None identified	Severe OATS	34	LDP	2475	2943	10803	8	Positive	Ongoing singleton
19	None identified	OATS	36	LDP	3375	1475	5416	7	Positive	Live birth, healthy boy
20	None identified	OATS	36	LDP	3150	3379	12403	14	Negative	
21	None identified	ATS	36	LDP	3000	898	3296	4	Positive	Biochemical pregnancy
22	None identified	Severe OATS	37	LDP	3150	1102	4046	16	Negative	

Table 1A (cont.)

Case	Female COI	Male diagnosis	F Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pmol/L	No. of hCG COC	Outcome
23	None identified	ATS	37	LDP	3150	2840	10426	5	Negative
24	None identified	OATS	38	LDP	2475	3074	11285	11	Positive Ongoing singleton
25	None identified	Cryptozoospermia	38	LDP	1425	1197	4395	5	Positive Live birth, healthy girl
26	None identified	OATS	38	LDP	2700	1384	5081	2	Negative
27	None identified	ATS	38	LDP	2925	2459	9028	8	Positive Spontaneous abortion, <12 wks
28	None identified	OATS	38	LDP	2700	2852	10468	11	Positive Ongoing singleton
29	None identified	Cryptozoospermia	38	LDP	2700	4120	15126	11	Positive Ongoing singleton
30	None identified	OATS	38	LDP	3000	3701	13586	5	Negative
31	None identified	Severe OATS	40	LDP	4500	2825	10369	11	Negative
32	None identified	ATS	39	Antagonist	1800	615	2258	5	Positive Live birth, healthy boy
33	None identified	OATS	41	LDP	2250	3925	14408	6	Negative
34	Tubal	ATS	30	LDP	3750	1055	3872	5	Negative
35	Tubal	ATS	30	LDP	3600	825	3030	5	Positive Ongoing singleton
36	Tubal	OTS	36	LDP	2475	3135	11509	18	Positive Missed abortion, 6.5 wks
37	Tubal	ATS	36	LDP	2925	1287	4726	9	Positive Live birth, healthy boy
38	Tubal, endometriosis	ATS	33	LDP	2700	3624	13305	11	Negative
39	Tubal	Asthenozoospermia	37	LDP	4650	1823	6692	4	Negative
40	Tubal	Severe OATS	39	LDP	3225	1733	6361	4	Negative
41	Cervical	Asthenozoospermia	37	LDP	4875	755	2773	5	Negative
42	Cervical	Teratozoospermia	30	LDP	2700	2098	7700	10	Positive Missed abortion: gestational sac, no FH activity
43	Cervical, fibroids	ATS	37	FDP	1875	3984	14624	13	Positive Biochemical pregnancy
44	Fibroids	OATS	39	LDP	3375	1659	6090	9	Positive Biochemical pregnancy
45	Endometriosis	TESE	29	LDP	2925	755	2771	5	Negative
46	Endometriosis, cervical, prolactinaemia	ATS	29	LDP	1875	3041	11165	12	Positive Ongoing singleton
47	Endometriosis	ATS	32	LDP	3600	4123	15135	14	Negative

Table 1A (cont.)

Case	Female COI	Male diagnosis	F Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pmol/L	No. of hCG COC	Outcome
48	Endometriosis	Severe OATS	32	LDP	3150	1605	5892	3	Negative
49	Endometriosis	ATS	33	LDP	2250	1707	6265	11	Positive Live birth, healthy boy
50	Endometriosis	Normozoospermia	34	LDP	2250	1307	4799	8	Negative
51	Endometriosis	Teratozoospermia	34	FDP	3300	2025	7432	5	Positive Ongoing singleton
52	Endometriosis	Teratozoospermia	35	FDP	5280	633	2325	3	Negative
53	Endometriosis	Teratozoospermia	35	Antagonist	1500	632	2321	3	Negative
54	Endometriosis	Asthenozoospermia	35	LDP	2326	4349	15966	10	Negative
55	Endometriosis, hyperprolactinaemia	ATS	35	FDP	4800	2269	8328	8	Positive Twin live birth, healthy boys
56	Endometriosis	OATS, EEJ	36	Antagonist	2250	1208	4436	2	Negative
57	Endometriosis, poor responder	TESE (fresh)	38	LDP	2925	636	2333	3	Negative
58	Endometriosis, poor responder	TESE (frozen)	38	FDP	3000	998	3663	1	Negative
59	Endometriosis	Normozoospermia	39	LDP	3300	2595	9528	3	Positive Spontaneous abortion, 10 wks
60	Endometriosis, age	TESE (frozen)	42	LDP	4350	3613	13265	5	Negative
61	Poor responder	Severe OATS	26	FDP	3000	2342	8597	5	Positive Live birth, healthy girl
62	Poor responder	Normozoospermia	35	FDP	4500	1370	5029	5	Negative
63	Poor responder	Cryptozoospermia	36	Antagonist	1500	549	2017	3	Negative
64	Poor responder	Cryptozoospermia	37	FDP	3750	1133	4158	3	Negative
65	Poor responder	TESE (frozen)	38	Antagonist	2400	667	2449	3	Negative
66	Poor responder	Normozoospermia	39	FDP	6750	1826	6702	3	Negative
67	Poor responder	Pre-vasectomy, frozen	42	Antagonist	3300	1346	4943	5	Negative
68	Ovulatory dysfunction	Teratozoospermia	32	Antagonist	2025	2055	7432	5	Negative
69	Ovulatory dysfunction	Severe OATS	38	LDP	2250	2452	9003	11	Negative
70	Anovulation	Normozoospermia	33	LDP	1875	3389	12442	16	Negative
71	Age	ATS	39	LDP	2850	4592	16856	13	Negative
72	PCO	ATS	31	LDP	2175	4709	17287	15	Negative
73	PCO	TESE (frozen)	31	Antagonist	1688	1195	4386	4	Negative

Table 1A (cont.)

Case	Female COI	Male diagnosis	F Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pmol/L	No. of hCG COC	Outcome	
74	PCO, endometriosis, tubal	ATS	36	Antagonist	1650	707	2595	5	Positive	Live birth, healthy baby
75	Hyperprolactinaemia	OATS	37	LDP	3600	857	3147	4	Positive	Live birth, healthy girl
76	Hyperprolactinaemia	OATS	40	FDP	3600	1473	5407	3	Negative	
77	Hyperprolactinaemia	ATS	29	LDP	2475	2285	8390	8	Negative	
78	Hyperprolactinaemia	Teratozoospermia	35	FDP	2700	2344	8606	8	Negative	
79	Hypothyroid	Mild ATS	30	LDP	2475	482	1768	5	Positive	Twin live birth, boy and girl
80	Recurrent abortion	ATS	34	LDP	2925	1983	7278	10	Negative	

Table 1B Summary of clinical details of cases, ordered by cause of female infertility

	Female COI	Male diagnosis	Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pm/L	No. of COC	hCG	Outcome
81	None identified	Severe OATS	25	Antagonist	1350	1285	4717	11	Positive	Ongoing singleton, vanishing twin
82	None identified	Teratozoospermia	27	LDP	1150	2390	8774	8	Positive	Ongoing singleton
83	None identified	ATS	28	LDP	1800	2138	7849	12	Positive	Monozygotic twins after single BT
84	None identified	Teratozoospermia	29	Antagonist	1350	933	3425	10	Positive	Ongoing singleton
85	None identified	Teratozoospermia	32	Antagonist	1300	961	3528	7	Positive	Ongoing singleton
86	None identified	ATS	32	LDP	1950	1215	4460	10	Positive	Ongoing twins
87	None identified	TESE (frozen)	32	LDP	2100	1849	6788	5	Negative	
88	None identified	Severe OATS	34	LDP	1600	3897	14306	13	Positive	Ongoing twins
89	None identified	Teratozoospermia	34	LDP	1650	1251	4592	9	Positive	Ongoing singleton
90	None identified	ATS	34	Antagonist	1387	970	3561	6	Negative	
91	None identified	Severe OATS	37	LDP	1650	1389	5099	6	Positive	Ongoing singleton
92	None identified	ATS	37	LDP	1650	1268	4655	9	Positive	Ongoing twins
93	Unexplained	ATS	32	LDP	1875	1960	7195	8	Positive	Molar pregnancy 8/40
94	Unexplained, failed IVF	Normozoospermia	40	Antagonist	1725	1022	3752	9	Negative	

Table 1B (cont.)

	Female COI	Male diagnosis	Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pm/L	No. of COC	hCG	Outcome
95	Tubal, hyperprolactinaemia	Asthenozoospermia	25	LDP	1087.5	1647	6046	6	Negative	
96	Tubal	Asthenozoospermia	32	LDP	1500	2622	9625	11	Negative	Positive after subsequent frozen BT
97	Tubal	Teratozoospermia	33	LDP	1500	881	3234	8	Positive	Ongoing singleton
98	Tubal	Teratozoospermia	38	LDP	2475	3291	12081	20	Negative	
99	Endometriosis	Mild teratozoospermia	27	Antagonist	1650	1703	6252	13	Positive	Ongoing singleton
100	Endometriosis	Asthenozoospermia	32	Antagonist	1350	1584	5815	10	Negative	
101	Endometriosis III, tubal	Teratozoospermia	34	LDP	1500	3237	11883	9	Positive	
102	Endometriosis, tubal	Teratozoospermia	41	Antagonist	3525	2584	9486	6	Negative	
103	PCO	Teratozoospermia	27	Antagonist	1050	1638	6013	6	Negative	
104	PCO, hyperprolactinaemia	Normozoospermia	32	LDP	2775	3162	11608	21	Positive	Ongoing twins
105	PCO (WHO I)	Normozoospermia	32	Antagonist	2327	2211	8117	12	Positive	Ongoing singleton
106	PCO	Teratozoospermia	33	Antagonist	972	1157	4247	11	Positive	Ongoing singleton
107	PCO	ATS	34	Antagonist	1400	1115	4093	7	Negative	
108	PCO	Teratozoospermia	38	Antagonist	1387.5	3198	11740	11	Negative	
109	PCO	Teratozoospermia	40	LDP	875	4379	16075	8	Negative	
110	POF	Teratozoospermia	30	Antagonist	2400	274	1006	1	Negative	
111	Translocation	Teratozoospermia	34	LDP	975	2483	9115	14	Negative	

Table 2A Summary of clinical details of cases, ordered by cause of male diagnosis

Male diagnosis	Case	Female COI	F Age (yrs)	Protocol	Total GT	E2 ng/mL	E2 pmol/L	No. of COC	hCG	Outcome
Normozoospermia	50	Endometriosis	34	LDP	2250	1307	4799	8	Negative	
Normozoospermia	59	Endometriosis	39	LDP	3300	2595	9528	3	Positive	Spontaneous abortion, 10 wks
Normozoospermia	62	Poor responder	35	FDP	4500	1370	5029	5	Negative	
Normozoospermia	66	Poor responder	39	FDP	6750	1826	6702	3	Negative	

Table 2A (cont.)

Male diagnosis	Case	Female COI	F Age (yrs)	Protocol	Total GT	E2 ng/mL	E2 pmol/L	No. of COC	hCG	Outcome
Normozoospermia	70	Anovulation	33	LDP	1875	3389	12442	16	Negative	
Asthenozoospermia	39	Tubal	37	LDP	4650	1823	6692	4	Negative	
Asthenozoospermia	41	Cervical	37	LDP	4875	755	2773	5	Negative	
Asthenozoospermia	54	Endometriosis	35	LDP	2326	4349	15966	10	Negative	
Teratozoospermia	42	Cervical	30	LDP	2700	2098	7700	10	Positive	Missed abortion: gestational sac, no FH activity
Teratozoospermia	51	Endometriosis	34	FDP	3300	2025	7432	5	Positive	Ongoing singleton
Teratozoospermia	52	Endometriosis	35	FDP	5280	633	2325	3	Negative	
Teratozoospermia	53	Endometriosis	35	Antagonist	1500	632	2321	3	Negative	
Teratozoospermia	78	Hyperprolactinaemia	35	FDP	2700	2344	8606	8	Negative	
Teratozoospermia	68	Ovulatory dysfunction	32	Antagonist	2025	2055	7432	5	Negative	
Mild ATS	79	Hypothyroid	30	LDP	2475	482	1768	5	Positive	Twin live birth, boy and girl
ATS	3	None identified	28	LDP	5450	1796	6593	9	Positive	Live birth, healthy girl
ATS	5	None identified	29	Antagonist	1650	2003	7352	12	Positive	Ongoing singleton
ATS	12	None identified	33	LDP	2100	1703	6253	5	Negative	
ATS	15	None identified	34	LDP	2475	2025	7435	6	Negative	
ATS	16	None identified	34	LDP	4125	4066	14927	9	Positive	Ongoing singleton
ATS	17	None identified	34	LDP	2700	1186	4353	10	Negative	
ATS	21	None identified	36	LDP	3000	898	3296	4	Positive	Biochemical pregnancy
ATS	23	None identified	37	LDP	3150	2840	10426	5	Negative	
ATS	27	None identified	38	LDP	2925	2459	9028	8	Positive	Spontaneous abortion, <12 wks
ATS	32	None identified	39	Antagonist	1800	615	2258	5	Positive	Live birth, healthy boy
ATS	34	Tubal	30	LDP	3750	1055	3872	5	Negative	
ATS	35	Tubal	30	LDP	3600	825	3030	5	Positive	Ongoing singleton
ATS	37	Tubal	36	LDP	2925	1287	4726	9	Positive	Live birth, healthy boy
ATS	38	Tubal, endometriosis	33	LDP	2700	3624	13305	11	Negative	

Table 2A (cont.)

Male diagnosis	Case	Female COI	F Age (yrs)	Protocol	Total GT	E2 ng/mL	E2 pmol/L	No. of COC	hCG	Outcome
ATS	43	Cervical, fibroids	37	FDP	1875	3984	14624	13	Positive	Biochemical pregnancy
ATS	46	Endometriosis, prolactinaemia, cervical	29	LDP	1875	3041	11165	12	Positive	Ongoing singleton
ATS	47	Endometriosis	32	LDP	3600	4123	15135	14	Negative	
ATS	49	Endometriosis	33	LDP	2250	1707	6265	11	Positive	Live birth, healthy boy
ATS	55	Endometriosis, hyperprolactinaemia	35	FDP	4800	2269	8328	8	Positive	Twin live birth, healthy boys
ATS	71	Age	39	LDP	2850	4592	16856	13	Negative	
ATS	72	PCO	31	LDP	2175	4709	17287	15	Negative	
ATS	74	PCO, endometriosis, tubal	36	Antagonist	1650	707	2595	5	Positive	Live birth, healthy baby
ATS	77	Hyperprolactinaemia	29	LDP	2475	2285	8390	8	Negative	
ATS	80	Recurrent abortion	34	LDP	2925	1983	7278	10	Negative	
OATS	2	None identified	27	LDP	3300	3014	11066	9	Positive	Live birth, healthy girl
OATS	4	None identified	28	LDP	1800	2378	8730	8	Negative	
OATS	6	None identified	29	LDP	1950	3153	11575	9	Positive	Twin pregnancy, 1st trimester spontaneous reduction to singleton
OATS	19	None identified	36	LDP	3375	1475	5416	7	Positive	Live birth, healthy boy
OATS	20	None identified	36	LDP	3150	3379	12403	14	Negative	
OATS	24	None identified	38	LDP	2475	3074	11285	11	Positive	Ongoing singleton
OATS	26	None identified	38	LDP	2700	1384	5081	2	Negative	
OATS	28	None identified	38	LDP	2700	2852	10468	11	Positive	Ongoing singleton
OATS	30	None identified	38	LDP	3000	3701	13586	5	Negative	
OATS	33	None identified	41	LDP	2250	3925	14408	6	Negative	
OATS	36	Tubal	36	LDP	2475	3135	11509	18	Positive	Missed abortion, 6.5 wks
OATS	44	Fibroids	39	LDP	3375	1659	6090	9	Positive	Biochemical pregnancy

Table 2A (cont.)

Male diagnosis	Case	Female COI	F Age (yrs)	Protocol	Total GT	E2 ng/mL	E2 pmol/L	No. of COC	hCG	Outcome
OATS, EEJ	56	Endometriosis	36	Antagonist	2250	1208	4436	2	Negative	
OATS	75	Hyperprolactinaemia	37	LDP	3600	857	3147	4	Positive	Live birth, healthy girl
OATS	76	Hyperprolactinaemia	40	FDP	3600	1473	5407	3	Negative	
Severe OATS	9	None identified	31	LDP	3375	1885	6921	8	Positive	Biochemical pregnancy
Severe OATS	11	None identified	32	LDP	2325	4385	16099	9	Positive	Ongoing singleton
Severe OATS	13	None identified	33	Antagonist	1350	2745	10078	9	Positive	Spontaneous abortion, <12 wks
Severe OATS	14	None identified	33	Antagonist	1350	1193	4378	4	Positive	Ongoing singleton
Severe OATS	18	None identified	34	LDP	2475	2943	10803	8	Positive	Ongoing singleton
Severe OATS	22	None identified	37	LDP	3150	1102	4046	16	Negative	
Severe OATS	31	None identified	40	LDP	4500	2825	10369	11	Negative	
Severe OATS	40	Tubal	39	LDP	3225	1733	6361	4	Negative	
Severe OATS	48	Endometriosis	32	LDP	3150	1605	5892	3	Negative	
Severe OATS	61	Poor responder	26	FDP	3000	2342	8597	5	Positive	Live birth, healthy girl
Severe OATS	69	Ovulatory dysfunction	38	LDP	2250	2452	9003	11	Negative	
Cryptozoospermia	7	None identified	30	LDP	3150	3379	12405	12	Positive	Live birth, healthy boy
Cryptozoospermia	25	None identified	38	LDP	1425	1197	4395	5	Positive	Live birth, healthy girl
Cryptozoospermia	29	None identified	38	LDP	2700	4120	15126	11	Positive	Ongoing singleton
Cryptozoospermia	63	Poor responder	36	Antagonist	1500	549	2017	3	Negative	
Cryptozoospermia	64	Poor responder	37	FDP	3750	1133	4158	3	Negative	
TESE (fresh)	1	None identified	24	LDP	Not recorded	Not recorded	Not recorded	11	Positive	Biochemical pregnancy
TESE (frozen)	8	None identified	31	LDP	3450	3877	14231	5	Negative	
TESE (fresh)	45	Endometriosis	29	LDP	2925	755	2771	5	Negative	
TESE (fresh)	57	Endometriosis, poor responder	38	LDP	2925	636	2333	3	Negative	
TESE (frozen)	58	Endometriosis, poor responder	38	FDP	3000	998	3663	1	Negative	
TESE (frozen)	60	Endometriosis, age	42	LDP	4350	3613	13265	5	Negative	

Table 2A (cont.)

Male diagnosis	Case	Female COI	F Age (yrs)	Protocol	Total GT	E2 ng/mL	E2 pmol/L	No. of COC	hCG	Outcome
TESE (frozen)	65	Poor responder	38	Antagonist	2400	667	2449	3	Negative	
TESE (frozen)	73	PCO	31	Antagonist	1688	1195	4386	4	Negative	
Post-oncology, frozen sample	10	None identified	32	LDP	3075	3533	12970	9	Negative	
Pre-vasectomy, frozen	67	Poor responder	42	Antagonist	3300	1346	4943	5	Negative	

Table 2B Summary of clinical details of cases, ordered by cause of male diagnosis

Male diagnosis		Female COI	Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pm/L	No. of COC	hCG	Outcome
Normozoospermia	94	Unexplained, failed IVF	40	Antagonist	1725	1022	3752	9	Negative	
Normozoospermia	104	PCO, hyperprolactinaemia	32	LDP	2775	3162	11608	21	Positive	Ongoing twins
Normozoospermia	105	PCO (WHO I)	32	Antagonist	2327	2211	8117	12	Positive	Ongoing singleton
Asthenozoospermia	95	Tubal, hyperprolactinaemia	25	LDP	1087.5	1647	6046	6	Negative	
Asthenozoospermia	96	Tubal	32	LDP	1500	2622	9625	11	Negative	Positive after subsequent frozen BT
Asthenozoospermia	100	Endometriosis	32	Antagonist	1350	1584	5815	10	Negative	
ATS	83		28	LDP	1800	2138	7849	12	Positive	Monozygotic twins after single BT
ATS	86		32	LDP	1950	1215	4460	10	Positive	Ongoing twins
ATS	90		34	Antagonist	1387	970	3561	6	Negative	
ATS	92		37	LDP	1650	1268	4655	9	Positive	Ongoing twins
ATS	93	Unexplained	32	LDP	1875	1960	7195	8	Positive	Molar pregnancy 8/40
ATS	107	PCO	34	Antagonist	1400	1115	4093	7	Negative	
Mild teratozoospermia	99	Endometriosis	27	Antagonist	1650	1703	6252	13	Positive	Ongoing singleton
Teratozoospermia	82		27	LDP	1150	2390	8774	8	Positive	Ongoing singleton
Teratozoospermia	84		29	Antagonist	1350	933	3425	10	Positive	Ongoing singleton
Teratozoospermia	85		32	Antagonist	1300	961	3528	7	Positive	Ongoing singleton

Table 2B (cont.)

Male diagnosis		Female COI	Age (yrs)	Stimulation	Total GT	E2 ng/mL	E2 pm/L	No. of COC	hCG	Outcome
Teratozoospermia	89		34	LDP	1650	1251	4592	9	Positive	Ongoing singleton
Teratozoospermia	97	Tubal	33	LDP	1500	881	3234	8	Positive	Ongoing singleton
Teratozoospermia	98	Tubal	38	LDP	2475	3291	12081	20	Negative	
Teratozoospermia	101	Endometriosis III, tubal	34	LDP	1500	3237	11883	9	Positive	
Teratozoospermia	102	Endometriosis, tubal	41	Antagonist	3525	2584	9486	6	Negative	
Teratozoospermia	103	PCO	27	Antagonist	1050	1638	6013	6	Negative	
Teratozoospermia	106	PCO	33	Antagonist	972	1157	4247	11	Positive	Ongoing singleton
Teratozoospermia	108	PCO	38	Antagonist	1387.5	3198	11740	11	Negative	
Teratozoospermia	109	PCO	40	LDP	875	4379	16075	8	Negative	
Teratozoospermia	110	POF	30	Antagonist	2400	274	1006	1	Negative	
Teratozoospermia	111	Translocation	34	LDP	975	2483	9115	14	Negative	
Severe OATS	81	None identified	25	Antagonist	1350	1285	4717	11	Positive	Ongoing singleton, vanishing twin
Severe OATS	88	None identified	34	LDP	1600	3897	14306	13	Positive	Ongoing twins
Severe OATS	91	None identified	37	LDP	1650	1389	5099	6	Positive	Ongoing singleton
TESE (frozen)	87	None identified	32	LDP	2100	1849	6788	5	Negative	

Table 3A Summary of clinical details of cases, ordered by stimulation protocol

Stimulation	Case	Female COI	Male diagnosis	F Age (yrs)	Total GT	E2 pmol/L	E2 ng/mL	No. of COC	hCG	Outcome
Antagonist	5	None identified	ATS	29	1650	7352	2003	12	Positive	Ongoing singleton
Antagonist	13	None identified	Severe OATS	33	1350	10078	2745	9	Positive	Spontaneous abortion, <12 wks
Antagonist	14	None identified	Severe OATS	33	1350	4378	1193	4	Positive	Ongoing singleton
Antagonist	32	None identified	ATS	39	1800	2258	615	5	Positive	Live birth, healthy boy
Antagonist	53	Endometriosis	Teratozoospermia	35	1500	2321	632	3	Negative	
Antagonist	56	Endometriosis	OATS, EEJ	36	2250	4436	1208	2	Negative	
Antagonist	63	Poor responder	Cryptozoospermia	36	1500	2017	549	3	Negative	

Table 3A (cont.)

Stimulation	Case	Female COI	Male diagnosis	F Age (yrs)	Total GT	E2 pmol/L	E2 ng/mL	No. of hCG COC	hCG	Outcome
Antagonist	65	Poor responder	TESE (frozen)	38	2400	2449	667	3	Negative	
Antagonist	67	Poor responder	Pre-vasectomy, frozen	42	3300	4943	1346	5	Negative	
Antagonist	68	Ovulatory dysfunction	Teratozoospermia	32	2025	7432	2055	5	Negative	
Antagonist	73	PCO	TESE (frozen)	31	1688	4386	1195	4	Negative	
Antagonist	74	PCO, endometriosis, tubal	ATS	36	1650	2595	707	5	Positive	Live birth, healthy baby
FDP	43	Cervical, fibroids	ATS	37	1875	14624	3984	13	Positive	Biochemical pregnancy
FDP	51	Endometriosis	Teratozoospermia	34	3300	7432	2025	5	Positive	Ongoing singleton
FDP	52	Endometriosis	Teratozoospermia	35	5280	2325	633	3	Negative	
FDP	55	Endometriosis, hyperprolactinaemia	ATS	35	4800	8328	2269	8	Positive	Twin live birth, healthy boys
FDP	58	Endometriosis, poor responder	TESE (frozen)	38	3000	3663	998	1	Negative	
FDP	61	Poor responder	Severe OATS	26	3000	8597	2342	5	Positive	Live birth, healthy girl
FDP	62	Poor responder	Normozoospermia	35	4500	5029	1370	5	Negative	
FDP	64	Poor responder	Cryptozoospermia	37	3750	4158	1133	3	Negative	
FDP	66	Poor responder	Normozoospermia	39	6750	6702	1826	3	Negative	
FDP	76	Hyperprolactinaemia	OATS	40	3600	5407	1473	3	Negative	
FDP	78	Hyperprolactinaemia	Teratozoospermia	35	2700	8606	2344	8	Negative	
LDP	1	None identified	TESE (fresh)	24	Not recorded	Not recorded	Not recorded	11	Positive	Biochemical pregnancy
LDP	2	None identified	OATS	27	3300	11066	3014	9	Positive	Live birth, healthy girl
LDP	3	None identified	ATS	28	5450	6593	1796	9	Positive	Live birth, healthy girl
LDP	4	None identified	OATS	28	1800	8730	2378	8	Negative	
LDP	6	None identified	OATS	29	1950	11575	3153	9	Positive	Twin pregnancy, 1st trimester spontaneous reduction to singleton
LDP	7	None identified	Cryptozoospermia	30	3150	12405	3379	12	Positive	Live birth, healthy boy

Table 3A (cont.)

Stimulation	Case	Female COI	Male diagnosis	F Age (yrs)	Total GT	E2 pmol/L	E2 ng/mL	No. of COC	hCG	Outcome
LDP	8	None identified	TESE (frozen)	31	3450	14231	3877	5	Negative	
LDP	9	None identified	Severe OATS	31	3375	6921	1885	8	Positive	Biochemical pregnancy
LDP	10	None identified	Post-oncology, frozen sample	32	3075	12970	3533	9	Negative	
LDP	11	None identified	Severe OATS	32	2325	16099	4385	9	Positive	Ongoing singleton
LDP	12	None identified	ATS	33	2100	6253	1703	5	Negative	
LDP	15	None identified	ATS	34	2475	7435	2025	6	Negative	
LDP	16	None identified	ATS	34	4125	14927	4066	9	Positive	Ongoing singleton
LDP	17	None identified	ATS	34	2700	4353	1186	10	Negative	
LDP	18	None identified	Severe OATS	34	2475	10803	2943	8	Positive	Ongoing singleton
LDP	19	None identified	OATS	36	3375	5416	1475	7	Positive	Live birth, healthy boy
LDP	20	None identified	OATS	36	3150	12403	3379	14	Negative	
LDP	21	None identified	ATS	36	3000	3296	898	4	Positive	Biochemical pregnancy
LDP	22	None identified	Severe OATS	37	3150	4046	1102	16	Negative	
LDP	23	None identified	ATS	37	3150	10426	2840	5	Negative	
LDP	24	None identified	OATS	38	2475	11285	3074	11	Positive	Ongoing singleton
LDP	25	None identified	Cryptozoospermia	38	1425	4395	1197	5	Positive	Live birth, healthy girl
LDP	26	None identified	OATS	38	2700	5081	1384	2	Negative	
LDP	27	None identified	ATS	38	2925	9028	2459	8	Positive	Spontaneous abortion, <12 wks
LDP	28	None identified	OATS	38	2700	10468	2852	11	Positive	Ongoing singleton
LDP	29	None identified	Cryptozoospermia	38	2700	15126	4120	11	Positive	Ongoing singleton
LDP	30	None identified	OATS	38	3000	13586	3701	5	Negative	
LDP	31	None identified	Severe OATS	40	4500	10369	2825	11	Negative	
LDP	33	None identified	OATS	41	2250	14408	3925	6	Negative	
LDP	34	Tubal	ATS	30	3750	3872	1055	5	Negative	
LDP	35	Tubal	ATS	30	3600	3030	825	5	Positive	Ongoing singleton
LDP	36	Tubal	ATS	36	2475	11509	3135	18	Positive	Missed abortion, 6.5 wks

Table 3A (cont.)

Stimulation	Case	Female COI	Male diagnosis	F Age (yrs)	Total GT	E2 pmol/L	E2 ng/mL	No. of COC	hCG	Outcome
LDP	37	Tubal	ATS	36	2925	4726	1287	9	Positive	Live birth, healthy boy
LDP	38	Tubal, endometriosis	ATS	33	2700	13305	3624	11	Negative	
LDP	39	Tubal	Asthenozoospermia	37	4650	6692	1823	4	Negative	
LDP	40	Tubal	Severe OATS	39	3225	6361	1733	4	Negative	
LDP	41	Cervical	Asthenozoospermia	37	4875	2773	755	5	Negative	
LDP	42	Cervical	Teratozoospermia	30	2700	7700	2098	10	Positive	Missed abortion: gestational sac, no FH activity
LDP	44	Fibroids	OATS	39	3375	6090	1659	9	Positive	Biochemical pregnancy
LDP	45	Endometriosis	TESE	29	2925	2771	755	5	Negative	
LDP	46	Endometriosis, prolactinaemia, cervical	ATS	29	1875	11165	3041	12	Positive	Ongoing singleton
LDP	47	Endometriosis	ATS	32	3600	15135	4123	14	Negative	
LDP	48	Endometriosis	Severe OATS	32	3150	5892	1605	3	Negative	
LDP	49	Endometriosis	ATS	33	2250	6265	1707	11	Positive	Live birth, healthy boy
LDP	50	Endometriosis	Normozoospermia	34	2250	4799	1307	8	Negative	
LDP	54	Endometriosis	Asthenozoospermia	35	2326	15966	4349	10	Negative	
LDP	57	Endometriosis, poor responder	TESE (fresh)	38	2925	2333	636	3	Negative	
LDP	59	Endometriosis	Normozoospermia	39	3300	9528	2595	3	Positive	Singleton clinical pregnancy, spontaneous abortion 10 wks
LDP	60	Endometriosis, age	TESE (frozen)	42	4350	13265	3613	5	Negative	
LDP	69	Ovulatory dysfunction	Severe OATS	38	2250	9003	2452	11	Negative	
LDP	70	Anovulation	Normozoospermia	33	1875	12442	3389	16	Negative	
LDP	71	Age	ATS	39	2850	16856	4592	13	Negative	
LDP	72	PCO	ATS	31	2175	17287	4709	15	Negative	
LDP	75	Hyperprolactinaemia	OATS	37	3600	3147	857	4	Positive	Live birth, healthy girl

Table 3A (cont.)

Stimulation	Case	Female COI	Male diagnosis	F Age (yrs)	Total GT	E2 pmol/L	E2 ng/mL	No. of COC	hCG	Outcome
LDP	77	Hyperprolactinaemia	ATS	29	2475	8390	2285	8	Negative	
LDP	79	Hypothyroid	Mild ATS	30	2475	1768	482	5	Positive	Twin live birth, boy and girl
LDP	80	Recurrent abortion	ATS	34	2925	7278	1983	10	Negative	

Table 3B Summary of clinical details of cases, ordered by stimulation protocol

Stimulation		Female COI	Male diagnosis	Age (yrs)	Total GT	E2 pm/L	E2 ng/mL	No. of COC	hCG	Outcome
Antagonist	81	None identified	Severe OATS	25	1350	4717	1285	11	Positive	Ongoing singleton, vanishing twin
Antagonist	84	None identified	Teratozoospermia	29	1350	3425	933	10	Positive	Ongoing singleton
Antagonist	85	None identified	Teratozoospermia	32	1300	3528	961	7	Positive	
Antagonist	90	None identified	ATS	34	1387	3561	970	6	Negative	
Antagonist	94	Unexplained, failed IVF	Normozoospermia	40	1725	3752	1022	9	Negative	
Antagonist	99	Endometriosis	Mild teratozoospermia	27	1650	6252	1703	13	Positive	Ongoing singleton
Antagonist	100	Endometriosis	Asthenozoospermia	32	1350	5815	1584	10	Negative	
Antagonist	102	Endometriosis, tubal	Teratozoospermia	41	3525	9486	2584	6	Negative	
Antagonist	103	PCO	Teratozoospermia	27	1050	6013	1638	6	Negative	
Antagonist	105	PCO (WHO I)	Normozoospermia	32	2327	8117	2211	12	Positive	Ongoing singleton
Antagonist	106	PCO	Teratozoospermia	33	972	4247	1157	11	Positive	Ongoing singleton
Antagonist	107	PCO	ATS	34	1400	4093	1115	7	Negative	
Antagonist	108	PCO	Teratozoospermia	38	1387.5	11740	3198	11	Negative	
Antagonist	110	POF	Teratozoospermia	30	2400	1006	274	1	Negative	
LDP	82	None identified	Teratozoospermia	27	1150	8774	2390	8	Positive	Ongoing singleton
LDP	83	None identified	ATS	28	1800	7849	2138	12	Positive	Monozygotic twins after single BT
LDP	86	None identified	ATS	32	1950	4460	1215	10	Positive	Ongoing twins
LDP	87	None identified	TESE (frozen)	32	2100	6788	1849	5	Negative	
LDP	88	None identified	Severe OATS	34	1600	14306	3897	13	Positive	Ongoing twins

Table 3B (cont.)

Stimulation		Female COI	Male diagnosis	Age (yrs)	Total GT	E2 pm/L	E2 ng/mL	No. of COC	hCG	Outcome
LDP	89	None identified	Teratozoospermia	34	1650	4592	1251	9	Positive	Ongoing singleton
LDP	91	None identified	Severe OATS	37	1650	5099	1389	6	Positive	Ongoing singleton
LDP	92	None identified	ATS	37	1650	4655	1268	9	Positive	Ongoing twins
LDP	93	Unexplained	ATS	32	1875	7195	1960	8	Positive	Molar pregnancy 8/40
LDP	95	Tubal, hyperprolactinaemia	Asthenozoospermia	25	1087.5	6046	1647	6	Negative	
LDP	96	Tubal	Asthenozoospermia	32	1500	9625	2622	11	Negative	Positive after subsequent frozen BT
LDP	97	Tubal	Teratozoospermia	33	1500	3234	881	8	Positive	Ongoing singleton
LDP	98	Tubal	Teratozoospermia	38	2475	12081	3291	20	Negative	
LDP	101	Endometriosis III, tubal	Teratozoospermia	34	1500	11883	3237	9	Positive	
LDP	104	PCO, hyperprolactinaemia	Normozoospermia	32	2775	11608	3162	21	Positive	Ongoing twins
LDP	109	PCO	Teratozoospermia	40	875	16075	4379	8	Negative	
LDP	111	Translocation	Teratozoospermia	34	975	9115	2483	14	Negative	

Table 4A Summary of clinical details of cases, ordered by oestradiol level on day of hCG

E2 ng/mL	E2 pmol/L	Total GT	Case	Female COI	Male	F Age (yrs)	Stimulation	No. of COC	hCG	Outcome
482	1768	2475	79	Hypothyroid	Mild ATS	30	LDP	5	Positive	Twin live birth, boy and girl
549	2017	1500	63	Poor responder	Cryptozoospermia	36	Antagonist	3	Negative	
615	2258	1800	32	None identified	ATS	39	Antagonist	5	Positive	Live birth, healthy boy
632	2321	1500	53	Endometriosis	Teratozoospermia	35	Antagonist	3	Negative	
633	2325	5280	52	Endometriosis	Teratozoospermia	35	FDP	3	Negative	
636	2333	2925	57	Endometriosis, poor responder	TESE (fresh)	38	LDP	3	Negative	
667	2449	2400	65	Poor responder	TESE frozen	38	Antagonist	3	Negative	

Table 4A (cont.)

E2 ng/mL	E2 pmol/L	Total GT	Case	Female COI	Male	F Age (yrs)	Stimulation	No. of COC	hCG	Outcome
707	2595	1650	74	PCO, endometriosis, tubal	ATS	36	Antagonist	5	Positive	Live birth, healthy baby
755	2771	2925	45	Endometriosis	TESE	29	LDP	5	Negative	
755	2773	4875	41	Cervical	Asthenozoospermia	37	LDP	5	Negative	
825	3030	3600	35	Tubal	ATS	30	LDP	5	Positive	Ongoing singleton
857	3147	3600	75	Hyperprolactinaemia	OATS	37	LDP	4	Positive	Live birth, healthy girl
898	3296	3000	21	None identified	ATS	36	LDP	4	Positive	Biochemical pregnancy
998	3663	3000	58	Endometriosis, poor responder	TESE (frozen)	38	FDP	1	Negative	
1055	3872	3750	34	Tubal	ATS	30	LDP	5	Negative	
1102	4046	3150	22	None identified	Severe OATS	37	LDP	16	Negative	
1133	4158	3750	64	Poor responder	Cryptozoospermia	37	FDP	3	Negative	
1186	4353	2700	17	None identified	ATS	34	LDP	10	Negative	
1193	4378	1350	14	None identified	Severe OATS	33	Antagonist	4	Positive	Ongoing singleton
1195	4386	1688	73	PCO	TESE (frozen)	31	Antagonist	4	Negative	
1197	4395	1425	25	None identified	Cryptozoospermia	38	LDP	5	Positive	Live birth, healthy girl
1208	4436	2250	56	Endometriosis	OATS, EEJ	36	Antagonist	2	Negative	
1287	4726	2925	37	Tubal	ATS	36	LDP	9	Positive	Live birth, healthy boy
1307	4799	2250	50	Endometriosis	Normozoospermia	34	LDP	8	Negative	
1346	4943	3300	67	Poor responder	Pre-vasectomy, frozen	42	Antagonist	5	Negative	
1370	5029	4500	62	Poor responder	Normozoospermia	35	FDP	5	Negative	
1384	5081	2700	26	None identified	OATS	38	LDP	2	Negative	
1473	5407	3600	76	Hyperprolactinaemia	OATS	40	FDP	3	Negative	
1475	5416	3375	19	None identified	OATS	36	LDP	7	Positive	Live birth, healthy boy
1605	5892	3150	48	Endometriosis	Severe OATS	32	LDP	3	Negative	
1659	6090	3375	44	Fibroids	OATS	39	LDP	9	Positive	Biochemical pregnancy

Table 4A (cont.)

E2 ng/mL	E2 pmol/L	Total GT	Case	Female COI	Male	F Age (yrs)	Stimulation	No. of COC	hCG	Outcome
1703	6253	2100	12	None identified	ATS	33	LDP	5	Negative	
1707	6265	2250	49	Endometriosis	ATS	33	LDP	11	Positive	Live birth, healthy boy
1733	6361	3225	40	Tubal	Severe OATS	39	LDP	4	Negative	
1796	6593	5450	3	None identified	ATS	28	LDP	9	Positive	Live birth, healthy girl
1823	6692	4650	39	Tubal	Asthenozoospermia	37	LDP	4	Negative	
1826	6702	6750	66	Poor responder	Normozoospermia	39	FDP	3	Negative	
1885	6921	3375	9	None identified	Severe OATS	31	LDP	8	Positive	Biochemical pregnancy
1962	7278	2925	80	Recurrent abortion	ATS	34	LDP	10	Negative	
2003	7352	1650	5	None identified	ATS	29	Antagonist	12	Positive	Ongoing singleton
2055	7432	2025	68	Ovulatory dysfunction	Teratozoospermia	32	Antagonist	5	Negative	
2025	7432	3300	51	Endometriosis	Teratozoospermia	34	FDP	5	Positive	Ongoing singleton
2025	7435	2475	15	None identified	ATS	34	LDP	6	Negative	
2098	7700	2700	42	Cervical	Teratozoospermia	30	LDP	10	Positive	Missed abortion: gestational sac, no FH activity
2269	8328	4800	55	Endometriosis, hyperprolactinaemia	ATS	35	FDP	8	Positive	Twin live birth, healthy boys
2285	8390	2475	77	Hyperprolactinaemia	ATS	29	LDP	8	Negative	
2342	8597	3000	61	Poor responder	Severe OATS	26	FDP	5	Positive	Live birth, healthy girl
2344	8606	2700	78	Hyperprolactinaemia	Teratozoospermia	35	FDP	8	Negative	
2378	8730	1800	4	None identified	OATS	28	LDP	8	Negative	
2452	9003	2250	69	Ovulatory dysfunction	Severe OATS	38	LDP	11	Negative	
2459	9028	2925	27	None identified	ATS	38	LDP	8	Positive	Spontaneous abortion, <12 wks
2595	9528	3300	59	Endometriosis	Normozoospermia	39	LDP	3	Positive	Spontaneous abortion, 10 wks
2745	10078	1350	13	None identified	Severe OATS	33	Antagonist	9	Positive	Spontaneous abortion, <12 wks