about 30 - 45 minutes. However, special care must be taken to prevent injury to the urethra, bladder neck, bladder and ureters, and cystoscopic examination is advised after each strip is inserted. Under certain circumstances the insertion of ureteric catheters may be indicated before the operation.

Adequate retropubic stripping and freeing of the bladder and urethra from the pubis to the levator fascia are also very important, and there must be a well-opened vaginal tunnel on each side of the bladder neck up to the retropubic space.

The vaginal strips sling procedure has a high success rate, and I feel that it is worth considering in certain circumstances.

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The *in vitro* fertilisation programme at Tygerberg Hospital and the University of Stellenbosch

Five years' experience, April 1983 - January 1988

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Summary

The results of the *in vitro* fertilisation programme at Tygerberg Hospital for the period April 1983 to January 1988 are presented. Of the 1 117 laparoscopies performed, 825 patients reached the transfer stage. A live-birth rate of 9,3% was achieved. The pregnancy rate after transfer of 4 embryos was 25,9% compared with 15,4% after 2 embryos and 10,8% after 3 embryos ($P = < 0,0001$). The multiple pregnancy rate was 2,8% in the group receiving 2 embryos and 11,7% and 10,4% in those receiving 3 and 4 embryos, respectively. Of the 77 successful pregnancies (90 babies), 1 baby died at 34 weeks' gestation as the result of abruptio placentae due to pre-eclampsia and 1 cot death occurred. The only congenital abnormality encountered was a cleft palate.

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The birth of the first baby conceived by *in vitro* fertilisation (IVF) in this clinic opened a new era for infertility treatment in the RSA. At present at least 7 of the 11 clinics practising IVF in South Africa make use of the protocol established at Tygerberg Hospital.

Regular review of results of IVF programmes are essential for the medical and scientific staff to assess their techniques and results as well as to justify the expense involved in the use of this procedure. Review will also help to answer the often-asked question: 'How successful is IVF and what is the prognosis for a successful pregnancy?' It will also enable the IVF team to give the patient a more realistic prognostic prediction.

The results of patients treated by IVF in our unit over the 5-year period from April 1983 - January 1988 are therefore reviewed here.

Patients and methods

Previous articles[1-3] have outlined the criteria for admission to our IVF programme. This study includes all patients treated by IVF over the period April 1983 - January 1988. The indications for IVF treatment were endometriosis, unexplained infertility, immunological factors, and infertility due to a male factor. The ovulation induction programme we followed,[1,2,4,5] the protocol used in our IVF laboratory[1,6] and our technique of embryo transfer (ET),[1,6,7] have been described previously.

After a viable pregnancy had been confirmed by ultrasonography at 8 weeks' gestation, the patients were referred to their private obstetricians for antenatal care and delivery.

Results

In the period under review 1 117 laparoscopies were performed and 4 611 oocytes retrieved. The fertilisation rate was 67,2%. In 825 embryo transfers 130 pregnancies were achieved. The overall pregnancy rate per transfer was 15,8% with a live-birth rate per embryo transfer of 9,3% (77 deliveries, 90 babies). The abortion rate was 40,8% (Table I).

TABLE I. RESULTS OF PHASE 4 OF THE IVF PROGRAMME AT TYGERBERG HOSPITAL

Laparoscopies performed	1 117
Follicles aspirated	5 542
Oocytes obtained	4 611
Oocytes/laparoscopy	4,1
Oocytes fertilised	3 098
Fertilisation rate	67,2%
Embryo transfer	825
Transfer/laparoscopy (825/1 117)	73,9%
No. of pregnancies	130
Pregnancies/transfer	15,8%
Pregnancies/laparoscopy	11,6%
Babies born	90
Deliveries	77
Abortion rate (53/130)	40,8%
Delivery rate/transfer (77/825)	9,3%

The pregnancy rate, based on the number of embryos transferred, is set out in Table II. Using the chi-square test, there was a statistically significant difference in pregnancy rate between patients receiving 2 or 3 embryos and those receiving 4 embryos at transfer ($P < 0,001$).

The multiple-pregnancy incidence was 2,8% (1/35 pregnancies) when 2 embryos were transferred, 11,7% (2/17) with 3 embryos, 10,4% (5/48) with 4 embryos and 20% (3/15) with 5 embryos. There were no multiple pregnancies when either 1 or 6 embryos were transferred (Table II). These differences were not statistically significant.

The pregnancy rate was 14,88% (59 out of 645 transfers) in patients in whom a tubal factor was the reason for infertility, but only 4,1% (3/72) when severe teratozoospermia was the cause of infertility. In patients with patent fallopian tubes, if no male factor was present (before the era of gamete intrafallopian transfer (GIFT)), the pregnancy rate was 18,86% (10/53) while if a male factor was present, only 1 out of 6 conceived.

To determine whether there was a difference in the pregnancy rate in subsequent cycles data from 893 cycles in which 109 pregnancies occurred were analysed and the pregnancy rate for each treatment cycle determined (Table III). This

TABLE II. NO. OF EMBRYOS TRANSFERRED, PREGNANCY RATE AND MULTIPLE PREGNANCY RATE

No. of embryos transferred	No. of patients	Pregnant		Multiple/twin pregnancies (%)
		No.	%	
1	177	10	5,6	0
2	227	35	15,4	2,8
3	158	17	10,8*	11,7
4	185	48	25,9*	10,4
5	63	15	23,8	20†
6	15	5	33,3	0
Total	825	130		

*$P < 0,001$.
†Quadruplets included.

TABLE III. PREGNANCY RATE PER CYCLE, SEPTEMBER 1984 - JANUARY 1988

Cycle	No. of cycles	Pregnancy	Pregnancy/laparoscopy (%)
1	390	48	12,3
2	228	27	11,8
3	138	17	12,3
4	61	7	11,5
5	36	5	13,9
6	26	2	7,7
7	9	3	33,3*
8	3	—	—
9	1	—	—
10	1	—	—
Total	893	109	

*Not statistically significant.

revealed no statistical difference between the pregnancy rates in the different treatment cycles.

Of the 130 pregnancies, 90 babies were delivered: 66 were singleton pregnancies, 20 babies were from twin pregnancies, and 4 from a quadruplet pregnancy. The multiple pregnancy rate was 12,2% per baby born.

Of the 66 singleton pregnancies, 33 infants were delivered by caesarean section, and 33 by the vaginal route — 8 of these were forceps deliveries. Ten of the 11 multiple pregnancies were delivered by caesarean section.

The mean weight of the singleton pregnancy babies was 3 066 g (range 1 750 - 4 140 g) and that of the multiple pregnancy babies was 2 300 g (range 1 510 - 3 600 g). There were 41 female and 49 male infants. There was one intrauterine death at 34 weeks' gestation due to abruptio placentae as a result of pre-eclampsia and 1 of the quadruplets died 2 months after discharge from hospital (the diagnosis was cot death). One baby was born with a cleft palate and this was surgically corrected.

Pregnancy did not progress in 53 of the 130 patients (40,8%). Twenty (15,4%) of these pregnancies were diagnosed biochemically, 4 (3,1%) had ectopic pregnancies and 29 (22,3%) aborted (proven on histological examination). No abortion occurred in patients who progressed beyond 20 weeks' gestation.

Discussion

Today the success of IVF in well-established units ranges from 10% to 20% per laparoscopy.[8,9] In this series of 1 117

laparoscopies resulting in 850 transfers, the pregnancy rate per ET compares favourably with that of two leading Australian groups, as does our live-birth rate of 9,3% (13,8% for the Monash group and 10,02% for the Royal Women's Hospital).[8]

It is important to note that the overall pregnancy rate per transfer when a tubal factor was the cause of the fertility was 14,03% whereas it was 4,05% in cases with a severe teratozoospermia. We have recently achieved a pregnancy rate of 10% per cycle by using the GIFT procedure in patients with severe teratozoospermia (< 5% normal forms) (J.P. van der Merwe — unpublished data). At present we are therefore using the GIFT procedure as a treatment modality of choice in patients where there is no tubal factor and in whom the infertility is due solely to severe teratozoospermia.

We are still transferring up to 4 embryos at a time because the multiple pregnancy rate is 11,7% in the group receiving 3 embryos and 10,4% in the group receiving 4 embryos. In this study the multiple pregnancy rate in the group with 5 embryos was 20%. The pregnancy rate was also significantly better in the group receiving 4 embryos: 25,9% compared with 10,8% in the group receiving 3 embryos and 15,4% in the 2-embryo group (Table II).

In this study the pregnancy rate for patients in the second and subsequent cycles in the programme remained constant, indicating that the chances for pregnancy did not decrease after 2 or 3 unsuccessful cycles (Table III). This coincides with the findings of Guzick *et al.*,[10] who made a study of this aspect of the problem using a mathematical equation. The finding that the chances of pregnancy do not decrease with each subsequent cycle, provides motivation for persevering with IVF treatment.

There was only 1 congenital abnormality (1,1%) among the 90 babies born and this infant had a cleft palate, which was successfully treated by plastic surgery. In a collaborative study involving 2 342 pregnancies, Cohen *et al.*[11] reported a 2,5% congenital abnormality rate with single births and 3,6% with multiple births. Taking into account that many of the patients undergoing IVF are in the older age group, these percentages do not differ from that found in the general population.[12]

The majority of patients with successful pregnancies were not delivered by us but by their private obstetricians. The caesarean section rate of 50% in the singleton pregnancy group is not too surprising as this high incidence of abdominal delivery has also been recorded in other units.[13,14] We agree with Frydman *et al.*[13] that the caesarean section rate will fall as the successful pregnancy rate with IVF rises.

The outcome of IVF programme pregnancies that progress beyond 20 weeks' gestation has been recorded in Australia by the National Perinatal Statistics Unit at Sydney University[15] which reported a perinatal mortality figure of 34,5%/1 000 total births for singleton pregnancies and 72,4%/1 000 for multiple pregnancies resulting in an average figure of 49,4%/1 000. Our perinatal mortality rate was 11,1%/1 000 total births (1:90) and was an intra-uterine death due to abruptio placentae that occurred in a patient who developed pre-eclampsia at 34 weeks' gestation. In addition, 1 baby of a quadruplet pregnancy died as a result of cot death 6 weeks after discharge from hospital.

In conclusion, *in vitro* fertilisation is here to stay. It is still a very costly procedure and not available to all patients. It is important to realise that the chance of success (the birth of a baby) today is only in the region of 10 - 15% in good units. Patients must be prepared to continue with treatment because their chances are not reduced in subsequent cycles. If this can be achieved, the prognosis for success in our unit is good and the outcome for baby and mother is excellent.

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