The significance of the number of antral follicles prior to stimulation in predicting ovarian responses in an IVF programme

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Multiple follicular development plays a major role in the successful outcome of IVF and embryo transfer treatment. Prediction of ovarian responses prior to stimulation is useful in counselling patients and helpful in tailoring the dosage of gonadotrophin to individual patients. The objective of this study was to compare age of women, body mass index (BMI), basal FSH concentration, volume of both ovaries and the number of antral follicles of both ovaries in predicting the number of oocytes obtained. A total of 128 consecutive women, who had no history of ovarian surgery, were non-smokers and undergoing the first cycle using a standard regimen of ovarian stimulation were examined. The total number of antral follicles achieved the best predictive value, followed by basal FSH, BMI and age of women. In those women with fewer antral follicles, a longer duration and higher dosage of human menopausal gonadotrophin were required but the number of eggs obtained was significantly less than for those with more antral follicles. Significantly more cycles were cancelled before egg collection in women with \( \leq 6 \) antral follicles while more cycles of embryo transfer were postponed in order to reduce the risk of ovarian hyperstimulation syndrome in women with \( >9 \) antral follicles.

Key words: antral follicles/IVF/ovarian response/ovarian volume

Introduction

Recruitment and development of multiple follicles in response to gonadotrophin stimulation are the key factors leading to successful treatment by IVF and embryo transfer or other assisted reproductive methods. With the development of successful embryo cryopreservation programmes, it seems desirable to obtain as many embryos as possible to allow an increased number of embryo transfers, thus increasing the cumulative pregnancy rates (Wang et al., 1994). However, exaggerated responses will lead to an increased risk of ovarian hyperstimulation syndrome (OHSS) (Asch et al., 1991) and the resulting high serum oestradiol concentrations may also be detrimental to the outcome of IVF treatment (Simón et al., 1995; Ng et al., 2000). Poor ovarian response, on the other hand, is usually associated with poor pregnancy rates and many of these cycles are cancelled without proceeding to egg collection (Keay et al., 1997).

Prediction of ovarian responses prior to stimulation is useful in counselling patients and may be helpful in tailoring the dosage of gonadotrophin to individual patients. Women who are older, obese or smoking are at risk of poor ovarian response. Different hormonal parameters such as serum basal FSH concentrations in early follicular phase and stimulated FSH concentrations after a challenge test have been extensively evaluated to predict the ovarian responses during ovarian stimulation. Recently, ultrasound assessment of the ovarian volume and the number of antral follicles has been used in the prediction of the ovarian responses.

There are, however, very few studies evaluating and comparing different clinical, hormonal and ultrasound parameters in relation to the prediction of ovarian responsiveness. The objective of this prospective study was to compare age of women, body mass index (BMI), early follicular serum FSH concentrations, volume of both ovaries and the number of antral follicles of both ovaries in predicting the number of eggs obtained in infertile women undergoing the first IVF cycle using a standard regimen of ovarian stimulation.

Materials and methods

Consecutive women attending the Assisted Reproduction Unit at Department of Obstetrics & Gynaecology, the University of Hong Kong between June 1998 and March 1999 for IVF and embryo transfer treatment were recruited for study. Ethical approval was not required for this observational study because measurement of early follicular or basal FSH concentrations and ultrasound assessment of the ovaries were standard procedures at our centre. The information on the ovarian volume and the number of antral follicles in this study did not affect the subsequent clinical management.

Before the couples were enrolled into our IVF programme, they underwent a standard protocol of investigations including semen analysis and serum basal FSH concentrations, which were taken on day 2–3 of the cycle within 2 months of commencing treatment. The indications of IVF included tubal, male, endometriosis, unexplained, and mixed factors. Intracytoplasmic sperm injection (ICSI) was performed for couples with severe semen abnormalities where <100 000 motile spermatozoa were recovered after sperm preparation. In cases of obstructive azoospermia, surgically retrieved spermatozoa from epididymis or testis were used for ICSI.

Women had to fulfil the following criteria before they were included in this study: undergoing the first IVF cycle in order to avoid possible bias from previous experience of their ovarian responses, non-smoker, no past history of ovarian surgery and receiving our standard ovarian
stimulation regimen as described below. Exclusion criteria included the presence of only one ovary and any ovarian cyst of >10 mm in diameter on scanning. When the measurement of the ovarian volume and the counting of antral follicles could not be made with confidence because of the abdominal position of the ovary or the bowel shadowing, these cycles were also not included.

The details of the long protocol of ovarian stimulation regimen used at our centre have been previously published (Ng et al., 1997). In short, women were pre-treated with a gonadotrophin releasing hormone analogue, buserelin (Suprecur, Hoechst, Frankfurt, Germany) nasal spray 150 µg four times a day from the mid-luteal phase of the cycle preceding the treatment cycle. On the second day of the treatment cycle, serum oestradiol concentrations were checked. Transvaginal scanning was then performed by either EHYN or OST using a 5 MHz vaginal probe (Alolka, Model SSD-620, Aloka Co. Ltd, Japan) to measure the volume of the ovary and to count the number of antral follicles on both sides. The length, height and width of each ovary were measured in the sagittal and coronal planes and then the ovarian volume was obtained using a formula for the volume of an ellipsoid \( V = \frac{4}{3}\pi a \times b \times c \). Polycystic ovaries as previously described (Adams et al., 1986) were recorded, if present. Oestradiol was measured using a commercially available RIA kit (Diagnostic Products Corporation, Los Angeles, CA, USA). The coefficients of inter-assay and intra-assay variation were 4.2 and 4.0% respectively.

When the ultrasound scanning showed no abnormality and serum oestradiol concentrations were <200 pmol/l, human menopausal gonadotrophin (HMG, 75 IU FSH and LH; Pergonal, Serono, Geneva, Switzerland) injections were then started with four ampoules for the first 2 days and two ampoules each day afterwards. The ovarian response was monitored by serial transvaginal scanning and serum oestradiol concentrations. The dose of HMG injection was titrated according to the ovarian response only after 7–8 days of injection. Human chorionic gonadotrophin (HCG; Profasi, Serono, Geneva, Switzerland) injections were then given i.m. when the leading follicle reached 18 mm in diameter and there were at least three follicles >15 mm in diameter. Egg collection was scheduled 36 h after the HCG injection. Those cycles with fewer than three follicles of >15 mm in diameter were cancelled and egg collection was not performed.

A maximum of three normally cleaved embryos were replaced into the uterine cavity 48 h after the collection. Excess good quality embryos were frozen for subsequent transfer if the woman was not pregnant in that cycle. All fresh embryos were cryopreserved if serum oestradiol concentration on the day of ovariectomy HCG injection exceeded 30 000 pmol/l in order to reduce the risks of OHSS. Luteal phase was supported by repeated doses of HCG. A urine pregnancy test was done 16 days after embryo transfer. If it was positive, ultrasound examination was performed 10–14 days later to confirm intrauterine pregnancy and to determine the number of gestation sacs present.

### Statistical analysis

The primary outcome measure was the number of oocytes obtained. Data on age of women, BMI, basal FSH concentration, the total ovarian volume (volume of both ovaries), the total number of antral follicles (antral follicle number of both ovaries), the duration/dosage of HMG used, serum oestradiol concentration on the day of HCG, the number of oocytes aspirated/fertilized, the number of embryos frozen and the pregnancy rates were recorded. Data were expressed as median (range), unless indicated. Continuous data were log-transformed to correct for skewness prior to further statistical analysis. Correlation was assessed by the Pearson method and multiple regression analysis with the least-squares regression was applied to evaluate the predictive values of different parameters on the number of oocytes obtained. Comparison was carried out by t-test or analysis of variance (ANOVA) with multiple comparisons (Tukey HSD) for continuous data and \( \chi^2 \) or Fisher’s Exact tests for categorical data, where appropriate. \( P \)-value (two-tailed) of <0.05 was taken as significant.

### Results

A total of 128 women were recruited in this study: 31 tubal factors, nine endometriosis, 67 male infertility, 14 unexplained and seven mixed causes. The demographic data and ovarian responses are summarized in Table I. Only one woman had features compatible with polycystic ovaries on scanning. Three cycles were cancelled for poor response because the criteria for egg collection were not met. Failed fertilization was encountered in six cycles and in another three cycles embryos failed to cleave. Embryo transfer was postponed in seven cycles because of the risk of OHSS. Embryo transfer was performed in 109 cycles and 18 pregnancies resulted. The pregnancy rate was 14.1% per initiated cycle and 16.5% per transfer. A similar pregnancy rate was found in conventional IVF and ICSI cycles.

The total number of antral follicles was significantly correlated with age of women \( (P < 0.05) \), basal FSH concentration \( (P < 0.01) \), total ovarian volume \( (P < 0.01) \), HMG duration and dosage \( (P < 0.01) \), serum oestradiol on the day of HCG administration \( (P < 0.01) \) and the number of oocytes obtained \( (P < 0.01) \) whereas the total ovarian volume was significantly correlated with the total number of antral follicles only \( (P < 0.01) \) (Table II). Age of women, basal FSH concentration, BMI, total antral follicles number and total ovarian volume were entered in a stepwise fashion in the multiple regression analysis using the number of eggs obtained as the dependent variable with constant included in the equation. The total number of antral follicles had the largest \( R^2 \) change, which was followed by basal FSH concentration, BMI and age of women (Table III). The total ovarian volume was excluded in the equation.

The total antral follicle number was similar in different

| Table I. Summary of demographic data and ovarian responses |
|---------------------------------|--------------|
| **Parameters**                  | **Median (range)** |
| Age (years)                     | 33 (21–40)    |
| Duration of infertility (years)| 4.8 (1–13)    |
| BMI (kg/m²)                     | 20.0 (15.6–30.0) |
| Basal FSH concentration (IU/l)  | 6.4 (3.1–10.5) |
| Ovarian volume (cm³)            | 5.8 (1.7–13.9) |
| Right                           | 5.5 (0.8–19.2) |
| Left                            | 11.8 (4.6–27.3) |
| Total                           | 11.0 (0–56)   |
| Antral follicle no.             | 4.0 (0–12)    |
| Right                           | 4.0 (0–10)    |
| Left                            | 9.0 (1–20)    |
| No. of eggs aspirated           | 6.0 (0–29)    |
| Right                           | 5.0 (0–27)    |
| Left                            | 11.0 (0–56)   |
| Oestradiol on HCG administration day (pmol/l) | 9728 (708–60 000) |

BMI = body mass index; HCG = human chorianic gonadotrophin.
to reduce the risk of OHSS in women with egg collection in women with/IH33355

of the total antral follicle number were four, six and nine the age of 37 years and precedes the menopause by 10–11005

CI

–

–

–

Unexplained 14 7.6 (6.6–

–

–

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Causes of infertility No. of women Geometric mean (95% CI) reproductive methods (Pearlstone et al., 1992; Templeton et al., 1996). The decrease in fertility with aging is apparently due to a decreasing number of primordial follicles. It has been observed (Block, 1952) that >250 000 primordial follicles were present at menarche whereas only a few hundreds or thousands remained at the end of the reproductive life. A total of 128 consecutive women undergoing IVF treatment. Smokers (El-Nemr et al., 1998) and those with only one ovary or having previous operation on ovaries (Nargund et al., 1995) are known to impair the ovarian response and were excluded from this study. In order to avoid other confounding variables, the study group consisted of women undergoing their first IVF cycle and receiving the same starting dose of gonadotrophin after a standard protocol of pituitary down-regulation for ovarian stimulation.

The results indicated that using a multiple regression analysis, the total antral follicle number achieved the best predictive value in relation to the ovarian response, followed by basal FSH concentration, BMI and age of women (Table III). A higher number of antral follicles will result in more oocytes obtained after stimulation, whereas higher basal FSH concentration, higher BMI and increasing age will impair the ovarian response. The total ovarian volume was not found to be useful in the prediction. The total antral follicle number appears to be a more sensitive parameter of ultrasound assessment in predicting the ovarian response than the total ovarian volume. Obese patients usually require significantly higher doses of gonadotrophin in a longer duration of stimulation (Dechaud et al., 1998) and should be advised to reduce weight before attempting IVF treatment.

Fertility is remarkably reduced with increasing age of women in both spontaneous conceptions (Tietze, 1957) and assisted reproductive methods (Pearlstone et al., 1992; Templeton et al., 1996). The decrease in fertility with aging is apparently due to a decreasing number of primordial follicles. It has been observed (Block, 1952) that >250 000 primordial follicles were present at menarche whereas only a few hundreds or thousands remained at the end of the reproductive life. A decline was also found in antral follicles of >1 mm. Similarly, the numbers of antral follicles ≥2 mm assessed by transvaginal ultrasonography decreased by ~60% between 22 and 42 years (Reuss et al., 1996). The loss of follicles accelerates around the age of 37 years and precedes the menopause by 10–12 years (Faddy and Gosden, 1995).

Age alone has limited value in predicting the pregnancy rate and the ovarian response undergoing assisted reproduction methods. Basal FSH concentration, which is being used in

Antral follicle number in predicting ovarian response in IVF

(Table V). Significant differences were also found in basal FSH concentration (P < 0.05), HMG duration/dosage (P < 0.05 or P < 0.01), oestradiol on day of HCG administration (P < 0.05 or P < 0.01), the number of oocytes obtained (P < 0.05 or P < 0.01) between those women with the total antral follicle number ≤4, 6 and 9 and >4, 6 and 9 respectively. Age of the women and the total ovarian volume were significantly different in women with ≤9 and >9 antral follicles (P < 0.05). The proportion of conventional IVF/ICSI (data not shown), BMI and pregnancy rate per cycle started or embryo transfer were all similar in these groups.

Discussion

This study compared the predictive values of age of women, basal FSH concentration, BMI, total ovarian volume and the total antral follicle number in relation to the number of oocytes obtained in 128 consecutive women undergoing IVF treatment.

<table>
<thead>
<tr>
<th>Causes of infertility</th>
<th>No. of women</th>
<th>Geometric mean (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubal</td>
<td>31</td>
<td>9.1 (8.4–11.1)</td>
</tr>
<tr>
<td>Endometriosis</td>
<td>9</td>
<td>5.8 (4.0–9.1)</td>
</tr>
<tr>
<td>Male</td>
<td>67</td>
<td>8.2 (8.1–9.9)</td>
</tr>
<tr>
<td>Unexplained</td>
<td>14</td>
<td>7.6 (6.6–9.5)</td>
</tr>
<tr>
<td>Mixed</td>
<td>7</td>
<td>8.1 (3.8–13.6)</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>8.1 (8.3–9.5)</td>
</tr>
</tbody>
</table>

CI = confidence interval.
Table V. Comparison of ovarian responses between those women with total antral follicle number ≤ 4, 6 and 9 and >4, 6 and 9. Results are given in geometric mean (95% CI)

<table>
<thead>
<tr>
<th>Total antral follicle no.</th>
<th>≤ 4 (n = 11)</th>
<th>&gt;4 (n = 117)</th>
<th>≤ 6 (n = 33)</th>
<th>&gt;6 (n = 95)</th>
<th>≤ 9 (n = 78)</th>
<th>&gt;9 (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.5 (31.2–35.4)</td>
<td>32.5 (32.1–33.4)</td>
<td>33.5 (32.6–34.8)</td>
<td>32.3 (31.8–33.2)</td>
<td>33.2 (32.5–34.0)</td>
<td>31.8 (31.2–33.0)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>20.5</td>
<td>20.6</td>
<td>19.9</td>
<td>20.9</td>
<td>20.3</td>
<td>21.1</td>
</tr>
<tr>
<td>Basal FSH concentration (IU/l)</td>
<td>7.4a (18.4–23.3)</td>
<td>6.2a (20.1–21.1)</td>
<td>6.4a (19.2–21.2)</td>
<td>6.1a (20.2–21.4)</td>
<td>6.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Total ovarian volume (cm³)</td>
<td>(6.4–9.0)</td>
<td>(6.0–6.6)</td>
<td>(6.4–7.7)</td>
<td>(5.9–6.6)</td>
<td>(6.3–7.1)</td>
<td>(5.6–6.4)</td>
</tr>
<tr>
<td>Total antral follicle no.</td>
<td>10.6</td>
<td>11.6</td>
<td>10.4</td>
<td>11.9</td>
<td>10.9a</td>
<td>12.5a</td>
</tr>
<tr>
<td>HMG dosage (ampoules)</td>
<td>2.8a (7.9–14.2)</td>
<td>8.9a (11.0–12.8)</td>
<td>4.4a (8.9–12.3)</td>
<td>10.0a</td>
<td>6.2b</td>
<td>12.2b</td>
</tr>
<tr>
<td>Oestradiol on day of HCG administration (pmol/l)</td>
<td>32.6b (23.0–49.0)</td>
<td>25.8b (24.6–28.2)</td>
<td>30.7b (26.7–38.8)</td>
<td>24.9b</td>
<td>28.3b</td>
<td>23.5b</td>
</tr>
<tr>
<td>No. of eggs aspirated</td>
<td>12.4a (3341–11 226)</td>
<td>10.3a (10 852–14 652)</td>
<td>11.5a (6302–12 276)</td>
<td>10.6a (11 097–15 367)</td>
<td>10.1a (8388–11 839)</td>
<td>9.7a (11 977–18 963)</td>
</tr>
<tr>
<td>Cycles cancelled (due to poor response)</td>
<td>6.1a (3.0–8.6)</td>
<td>10.6a (11.0–14.6)</td>
<td>7.4a (5.7–9.4)</td>
<td>11.2a</td>
<td>8.5b</td>
<td>13.3b</td>
</tr>
<tr>
<td>Embryo transfer postponed (due to risk of OHSS)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>PR/cycle started (%)</td>
<td>3/11 (27.3)</td>
<td>15/117 (12.8)</td>
<td>4/33 (12.1)</td>
<td>14/95 (14.7)</td>
<td>12/78 (15.4)</td>
<td>6/50 (12.0)</td>
</tr>
<tr>
<td>PR/embryo transfer (%)</td>
<td>3/9 (33.3)</td>
<td>15/100 (15.0)</td>
<td>4/26 (15.4)</td>
<td>14/83 (16.9)</td>
<td>12/68 (17.6)</td>
<td>6/41 (14.6)</td>
</tr>
</tbody>
</table>

*p < 0.05.

Sample for continuous data and χ² test or Fisher’s exact test for categorial data.

CI = confidence interval; BMI = body mass index; OHSS = ovarian hyperstimulation syndrome; PR = pregnancy rate; FSH - follicle stimulating hormone; HMG = human menopausal gonadotrophin; HCG = human choriocarcin gonadotrophin.

many assisted reproduction treatment programmes to predict the pregnancy rates, has been shown to be a better predictor of ovarian responsiveness to stimulation than the age of women (Cahill et al., 1994; Sharif et al., 1998). Our results supported this finding. Higher basal FSH concentrations have similar significance in women with only one ovary (Khalifa et al., 1998). However, basal FSH concentrations may vary from cycle to cycle (Scott et al., 1990) and the reported threshold values can range from 10–25 IU/l (Sharara et al., 1998). These may lead to variable results in the prediction of the ovarian response.

Ultrasound examination of ovaries becomes an integral part of most assisted reproduction treatment programmes in assessing patients prior to stimulation and monitoring the ovarian response during stimulation. The recent introduction of measuring ovarian volume and counting the antral follicle number during scanning may further refine or improve the prediction of ovarian responsiveness. It was found (Syrop et al., 1995) that the total ovarian volume and the volume of the smallest ovary were significant variables predicting peak oestradiol concentrations and number of oocytes and embryos. Total ovarian volume was a predictor of cycle cancellation while the volume of the smallest ovary was a predictor of clinical pregnancy. More recently, the mean ovarian volume prior to the stimulation was shown to be predictive of poor ovarian response (Lass et al., 1997). Ovarian volume is also found to be a better measure of ovarian reserve than basal FSH concentration (Syrop et al., 1999).

By counting the number of antral follicles, the resulting ovarian response could also be predicted (Tomás et al., 1997; Chang et al., 1998). In 166 women undergoing the first IVF cycle after pituitary down-regulation it was concluded (Tomás et al., 1997) that the number of antral follicles present before ovarian stimulation was a better predictor of the ovarian response than the ovarian volume or age alone. They revealed that the number of antral follicles was correlated more strongly with the number of recovered oocytes while the ovarian volume was correlated with the number of antral follicles before the stimulation but not with the number of oocytes. Basal serum FSH concentrations were not measured and the starting dose of gonadotrophin was not detailed in this study.

Chang et al. (Chang et al., 1998) studied 130 women in 149 IVF cycles after they failed six cycles of infertility treatment including ovarian stimulation with or without intra-uterine insemination. They found highly significant correlation between the antral follicle count and the number of oocytes, and a higher chance of cycle cancellation, lower oestradiol concentration, higher HMG dosage in cycles with antral follicle number ≤ 3. Both long and short protocols of gonadotrophin-releasing hormone (GnRH) analogues were used in this study and experience of previous stimulation cycles may also affect the choice of long or short protocols. The use of long or short
protocol of GnRH analogues (Bhattacharya and Templeton, 1998) and the starting dose of gonadotrophin (Land et al., 1996) certainly affect the number of oocytes obtained. All women in this study received a standard protocol of pituitary down-regulation and the same starting dose of gonadotrophins in the first 7–8 days.

The total ovarian volume was found to be correlated with total antral follicle number only and unrelated to age of women, basal FSH, number of eggs obtained and oestradiol concentrations. These findings were similar to those previously reported (Tomás et al., 1997; Sharara and Mcclamrock, 1999). The total ovarian volume was significantly larger in women with >9 antral follicles on both ovaries. The exclusion of the total ovarian volume in the multiple regression equation may be due to the correlation between the total ovarian volume and the total number of antral follicles. The results of this study also confirm the observation that the total antral follicle number is a more sensitive ultrasound parameter than the ovarian volume in predicting the ovarian response. It is perhaps not surprising because the pool of antral follicles seen prior to stimulation will develop under the stimulation of gonadotrophins.

The total antral follicle number was similar in different causes of infertility (Table IV). The number of antral follicles appears to be smaller in women with endometriosis compared to other causes or the whole group but the difference did not reach statistical significance. The reason for the decrease in the total antral follicle number in those with endometriosis is not known and all of them had no previous surgery on the ovaries and no evidence of ovarian cysts >10 mm in diameter on scanning. It may be just due to the small number of subjects involved and a larger study would be required to confirm or refute this.

Table V clearly showed that a much higher dosage of HMG was required in a longer duration in women with a smaller number of antral follicles. The findings of this study indicated that the number of cycle cancellations (3/33, 9.1%) was significantly higher in women with ≤6 antral follicles (P < 0.05), whereas the number of embryo transfers postponed to reduce the risk of OHSS (6/50, 12%) was significantly increased in women with >9 antral follicles (P < 0.05). The number of antral follicles indicating a higher cycle cancellation rate in this study is higher than that of Chang et al. (Chang et al., 1998), i.e. ≤6 versus ≥3 respectively. Different stimulation protocols may account for the difference observed. Despite the rarity of polycystic ovaries on scanning (one woman), embryo transfer was postponed in 12% of the cycles from women with >9 antral follicles. Caution, however, has to be taken in the interpretation of these threshold values because only small numbers of cycle cancellations (n = 3) and embryo transfers postponed (n = 7) were encountered in this study.

This information is important in counselling patients prior to stimulation especially for those who have no past record of ovarian stimulation. Increasing dosage of gonadotrophins in potential poor responders and use of a milder form of ovarian stimulation in potential hyper-responders may be helpful in optimizing the ovarian stimulation regimen. Based on the results of this study, we are now using a higher starting dose of HMG (6 ampoules for the first 2 days followed by three ampoules daily) in women with ≤6 antral follicles and a lower dosage of HMG (two ampoules throughout) in those with >9 antral follicles.

Despite a reduced number of oocytes obtained in women with less antral follicles prior to stimulation, pregnancy rates per cycle started or embryo transfer appeared similar to those with a higher number of antral follicles. This suggested that the antral follicle number was not a good predictor of the pregnancy rate, which reflected the quality of oocytes to some extent. Chang et al. (Chang et al., 1998) also failed to show any significant effect of the antral follicle count on pregnancy rates. No attempt has been made in this study to evaluate the effects of the clinical, hormonal and ultrasound parameters on pregnancy rates because of the small number of pregnancies (n = 18).

The main limitation of this study is that none of the women were >40 years old. Increasing age and high basal FSH concentrations are associated with poor ovarian responses. The dosage of gonadotrophin is empirically increased in many of these women in order to improve their ovarian responses. Further studies could be performed in older women or women with high basal FSH concentrations to examine the significance of the antral follicle number in these women, especially with regard to the effects of different doses of gonadotrophin on the ovarian responses. Further research should also be conducted to determine whether incorporating other hormonal and ultrasound parameters might further improve the prediction of ovarian response. Hormonal markers include stimulated FSH concentrations after clomiphene citrate (Tanbo et al., 1992), the day 3 oestradiol concentration (Smotrich et al., 1996) and the day 3 serum inhibin B concentrations (Seifer et al., 1999). The use of color Doppler in assessing the stromal blood flow (Zaidi et al., 1996) may be another new ultrasound parameter and may also be used to predict the quality of oocytes (Huay et al., 1999).

In summary, this study showed that the total number of antral follicles achieved the best predictive value in relation to the ovarian response, followed by basal FSH concentration, BMI and age of women in the first IVF cycle of 128 consecutive women using the same ovarian stimulation protocol. In those women with fewer antral follicles, a longer duration and higher dosage of HMG were required but the number of eggs obtained were significantly less than those with more antral follicles. Significantly more cycles were cancelled before planned egg collection in women with ≤6 antral follicles while more cycles of embryo transfer were postponed in order to reduce the risk of OHSS in women with >9 antral follicles.

References


Received on February 7, 2000; accepted on May 24, 2000.