

## EVALUATION OF SPERM MORPHOLOGY USING KRUGER'S STRICT CRITERIA

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Prospective and retrospective studies were conducted to evaluate sperm morphology using strict criteria for predicting fertilization capacity in males. Severely impaired male fertility potential was measured by a result of  $\leq 4\%$  (denotes percentage sperm having normal morphology) and scores of  $> 14\%$  indicated normal fertilization potential. There were no statistically significant differences found in pregnancy rates in partners of men with normal morphology of  $\leq 4\%$  vs. those with  $14\%$  or greater ( $\chi^2$  analysis): the prospective study showed a  $41\%$  pregnancy rate in  $\leq 4\%$  group vs.  $29\%$  rate in  $> 14\%$  group ( $p = 0.44$  NS); the retrospective analysis showed a  $50\%$  pregnancy rate in the group with  $\leq 4\%$  morphology scores vs.  $67\%$  in  $> 14\%$  group ( $p = 0.45$  NS). When only the men with normal motile density ( $> 10 \times 10^6/\text{ml}$ ) were evaluated, a statistical difference was found in the retrospective study between the group with morphology results  $> 14\%$  ( $93\%$ ) vs. the group  $\leq 4\%$  ( $40\%$ ). However, the  $56\%$  success rate in the men with  $< 10 \times 10^6/\text{ml}$  sperm and normal morphology  $\leq 4\%$  reduces the significance of the diagnosis of sperm morphology using the new strict criteria.

**Key Words:** Fertilization; Morphology; Sperm.

### INTRODUCTION

Sperm morphology is considered by some clinicians to be the best parameter of semen analysis in predicting fertilization ability [3]. Kruger et al. [1] suggested that using stricter criteria for sperm morphology might be a valid predictor of poor fertility during in vitro fertilization (IVF). Extremely poor fertilization and subsequent low pregnancy rates occurred when this method demonstrated fewer than  $4\%$  sperm with normal morphology [1]. However, only men with normal parameters other than sperm morphology were included.

A priori, since it is even more difficult to fertilize in vivo, one would expect poor morphology results to better predict a subfertile male trying to achieve a pregnancy without IVF. Perhaps the critical level predictive of decreased IVF encompasses a larger range of values. We present herein two studies, one prospective and one retrospective, that were conducted to evaluate the ability of sperm morphology to predict rates of fertility and subsequent pregnancy in infertile couples.

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## MATERIALS AND METHODS

Two retrospective studies were conducted to evaluate 223 couples. In each of the couples, who had experienced at least 1 year of infertility, there were two baseline morphology evaluations performed on the male partner. This was done to evaluate the correlation between the sperm morphology and in vivo conceptions. In couples for whom all female infertility factors were considered corrected, pregnancy rates were determined and then correlated with results of morphology evaluations in the males. A patient was considered pregnant only if there was evidence of a gestational sac by ultrasonography performed at 7 weeks gestation.

A second study was performed as a prospective investigation. Thirty-four couples with normal morphology of only  $\leq 4\%$  were matched with infertile couples with  $> 14\%$  normal morphology. In this group all female factors were not corrected. After identifying a male with poor morphology of  $\leq 4\%$ , the next infertile couple where the male partner had a morphology  $> 14\%$  was enlisted in the study; this latter group comprised the controls.  $\chi^2$  analysis and Fisher's exact test were performed to evaluate the statistical significance of the results.

## RESULTS

The correlation of pregnancy rates in 6 months with sperm morphology was evaluated using the strict criteria of Kruger et al. [1] (Table 1). Included in the retrospective study were 129 pregnancies grouped for comparison according to morphological results as follows: 50% conceived when the morphology was  $\leq 4\%$ , 58% conceived when the score fell between 5 and 14%, and 61% at  $> 14\%$  ( $p = 0.45$  NS  $\chi^2$  analysis). In the group with subnormal motile densities (MDs) of  $< 10 \times 10^6/\text{ml}$ , it is interesting to note a statistically lower pregnancy rate ( $p = 0.03$   $\chi^2$  analysis) in the group with the highest score ( $> 14\%$ ) compared to the group with lower scores of  $\leq 4\%$ . However, in the group with normal MDs the opposite was seen in that the 93% pregnancy rate seen in the group  $> 14\%$  was statistically better than the  $\leq 4\%$  group with a 40% pregnancy rate ( $p < 0.007$  Fisher's exact test).

A significantly higher pregnancy rate overall ( $p < 0.001$ ) was found in the normal group (46/125, or 77%) vs. the subnormal MD group (33/98, or 34%). However, normal sperm morphology did not reduce the detrimental effect of subnormal MD, since the 23% pregnancy rate in the group with subnormal MD but normal morphology had the lowest pregnancy rate of all groups including subnormal MD and subnormal morphology.

The prospective study produced similar results. The 41% rate of pregnancy after 6 months

**TABLE 1** Correlation of 6-Month Pregnancy Rates with Kruger Strict Test for Sperm Morphology and Motile Density (Retrospective Study)

Kruger Score (% Normal)	Group 1 MD $< 10 \times 10^6/\text{ml}$			Group 2 MD $> 10 \times 10^6/\text{ml}$		
	Total	Number of Pregnancies	Pregnancies (%)	Total	Number of Pregnancies	Pregnancies (%)
$\leq 4$ ( $N = 28$ )	18	10	56	10	4	40
5-14 ( $N = 119$ )	45	15	33	74	54	73
$> 14$ ( $N = 76$ )	35	8	23	41	38	93
Total all groups	98	33	34	125	96	77

in female partners of men with subnormal morphology despite not all female factors corrected compared to 29% female partners of men with scores  $> 14\%$  further reduces the credibility of the use of morphological evaluation in predicting the subfertile male in vivo. The abortion rates in the wives of men with low scores was 7% compared to 2% in those with normal scores (chemical pregnancies without ultrasound confirmation were excluded from this study). It would appear that these data do not support the strict criteria test for morphology as an effective method of distinguishing the fertile from subfertile male in vivo. Male motile density seems to be a more reliable parameter for predicting male fertility potential.

## DISCUSSION

Kruger et al. [1] described a fertilization rate of only 7.6% during the IVF cycles in which normal morphology was  $< 4\%$  and the morphology index as  $< 30\%$ ; however, a 64% fertilization rate was reported when the morphology was  $> 4\%$ . If such poor fertilization occurs in vitro, an in vivo pregnancy should be almost impossible. However, using  $\leq 4\%$  as the cutoff for our in vivo study, there were 14/28 pregnancies (50%). These findings did not require the majority of patients to be at the 4% mark because had we used  $< 4\%$  as the criteria there would have been an even higher pregnancy rate ( $10/19 = 53\%$ ). We allowed 1% higher because of the predicted greater difficulty in achieving in vivo pregnancy. In no instance where the test was  $\leq 4\%$  did the morphology index, including slightly amorphous forms, show  $> 30\%$ .

Oehninger et al. [2] evaluated the IVF pregnancy outcome in accordance with the strict criteria evaluation scores. Their data confirmed the original Kruger study in that the normal ( $> 14\%$ ) group had 94% fertilization compared to only 44.5% in the poor Kruger group with  $< 4\%$ . The normal group had a 44% pregnancy rate compared to only 8.5% per cycle with the lower group.

Although a statistical difference was found in our study in the  $> 10 \times 10^6/\text{ml}$  group with normal morphology scores vs.  $< 4\%$  ( $p = 0.007$  Fisher's exact test) and thus was similar to the findings by Kruger, the failure to demonstrate similar trends in the  $< 10 \times 10^6/\text{ml}$  group lessens the credibility of the test, especially as a means to predict whether a given individual is fertile or not. Lowering the motile density seemingly negates the adverse effect of poor sperm morphology.

At least in vivo, a low morphology result does not ensure a true male factor problem. Correction of all female infertility factors even if sperm morphology is very poor is therefore strongly suggested. Sperm morphology even using Kruger's strict criteria as the best semen parameter to distinguish the fertile from subfertile male cannot be supported by these data.

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