Effect of sperm morphology on clinical outcome parameters in ICSI cycles

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Summary

Objective: To assess the effect of isolated teratozoospermia with a normal sperm count and total motility by means of the fertilization rates, embryo quality and clinical pregnancy rate only in ICSI cycles. *Materials and Methods:* We retrospectively analyzed the records of patients who underwent ICSI at Hacettepe University, Faculty of Medicine, Department of Obstetrics and Gynecology, Division of Fertility and Reproductive Endocrinology between July 2001 and January 2010. Only patients with normal sperm count and total motility were recruited. The remaining cycles were further divided into two groups according to their sperm morphology with respect to Kruger's strict criteria. In Group 1, 537 consecutive cycles were enrolled whose sperm morphology was < 4%. In Group 2, 118 cycles were identified with a morphology of ≥ 4%. *Results:* A total of 655 ICSI cycles were included in the final analysis. The fertilization rates were 72.0% and 70.8% in Groups 1 and 2, respectively. There were no differences regarding embryo quality, clinical pregnancy and implantation rates between the two groups. *Conclusion:* Our data suggest that detection of morphology defect has no value in the prediction of fertilization, embryo quality and clinical pregnancy in ICSI cycles.

Key words: Sperm morphology; Intracytoplasmic sperm injection; Fertilization.

Introduction

Decreased pregnancy rates in spontaneous [1-5] and in vitro fertilization (IVF) [6-11] cycles due to poor fertilization because of sperm morphological abnormalities have been demonstrated by several studies in the literature after it was first claimed by Kruger *et al*. in 1986 [6] when they published a new classification of sperm morphology.

After the introduction of intracytoplasmic sperm injection (ICSI) by Palermo *et al*. in 1992, a new gate of hope was opened for such patients because the fertilization defect was attributed to be the cause of decreased fertility in men with isolated teratozoospermia [12, 13]. Despite this new technique for fertilization, conflicting results continued to be published as some demonstrated improved outcomes with increased fertilization and clinical pregnancy rates [14-20], while others reported comparable results [21-24].

Most of the published data above compared conventional IVF to ICSI as the fertilization technique. The aim of this study was to assess the effect of isolated teratozoospermia with a normal sperm count and total motility by means of fertilization rates, embryo quality and clinical pregnancy rate only in ICSI cycles.

Materials and Methods

We retrospectively analyzed the records of patients who underwent ICSI at the Hacettepe University, Faculty of Medicine, Department of Obstetrics and Gynecology, Division of Fertility and Reproductive Endocrinology between July 2001 and January 2010. Before the beginning of data collection, institutional review board approval was obtained. Only patients with normal sperm count and total motility were recruited. The normal sperm count was accepted as ≥ 20 million/ml and a total motility of ≥ 50%. The remaining cycles were further divided into two groups according to their sperm morphology with respect to Kruger's strict criteria [25].

In Group 1, 537 consecutive cycles were enrolled whose sperm morphology were < 4%. In Group 2, 118 cycles were identified with a morphology of ≥ 4%. All patients underwent controlled ovarian hyperstimulation (COH) using luteal-long leuprolide acetate (LA; Lucrin; Abbott, Cedex, Istanbul, Turkey) and recombinant FSH (Gonal-F; Serono, Istanbul, Turkey) using the step-down protocol. The starting dose of gonadotropin was determined based on the woman's age, body mass index (BMI) and antral follicle count at baseline transvaginal ultrasonography (TVS). Ovarian response was monitored with frequent serum estradiol (E2) measurements and TVS. The criterion for hCG (Pregnyl; Organon, Istanbul, Turkey) administration was the presence of two or more follicles exceeding 17 mm in diameter. Oocyte retrieval was carried out under local anesthesia using a vaginal ultrasound-guided puncture of follicles 36 hours after hCG administration. Semen samples of the male patients were collected by masturbation after two to seven days of sexual abstinence on the day of egg retrieval.

ICSI was performed for all metaphase II oocytes, as described by Van Steirteghem *et al*. [26]. Spermatozoa were selected for injection based on motility. The presence of fertilization was evaluated by examining oocytes 12-17 h after injection for the presence of distinct two pronuclei and two polar bodies [27]. Embryos were graded on day 3 according to a 1-4 scoring system (with 1 being the best), which was based on fragmentation, cell symmetry and blastomere number. The embryos with even blastomeres and no fragmentation were

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graded as grade 1, the embryos with even blastomeres and < 20% fragmentation as grade 2a, the embryos with uneven blastomeres and no fragmentation as grade 2b, the embryos with uneven blastomeres and < 20% fragmentation as grade 2 ab. The embryos with 20-50% fragmentation and > 50% fragmentation were graded as the grade 3 and 4 embryos, respectively [28]. Grades 1-3 were considered as transferable embryos. All the procedures of embryo transfer were performed with soft catheter under TVS. The luteal phase was supported by daily vaginal progesterone suppositories (Crinone, Serono, Istanbul, Turkiye) starting one day after oocyte pick-up.

Clinical pregnancy was determined by ultrasound demonstration of a gestational sac at TVS.

Statistical analyses were performed using Statistics Package for Social Sciences version 13.0 (SPSS Inc., Chicago, IL). Normal distribution of the variables was tested with Kolmogorov-Smirnov. Parametric and numeric variables were compared with the independent samples T test. The χ^2 test was used to analyze nominal variables in the form of frequency tables; *p* values of 0.05 or less were considered statistically significant. Values were expressed as mean ± SD, unless stated otherwise.

Table 1. — *Baseline characteristics of patients*.

	Normal sperm morphology (Group 1, n = 537, < 4%)	(Group 2, n = 118, ≥ 4%)	*p value*
Female age (years)	32.3 ± 4.5	33.3 ± 4.7	NS
Male age (years)	36 ± 5.3	36.6 ± 4.9	NS
Body mass index (kg/m^2)	26 ± 17.6	24.9 ± 4.1	NS
Duration of infertility (mo)	92.3 ± 61.2	86.6 ± 60	NS
Antral follicle count	10.7 ± 5.9	9.3 ± 4.8	NS
Estradiol level on the day of hCG administration (pg/ml)	2407.5 ± 1461.2	2341.4 ± 1671	NS

NS: not significant.
All values are expressed as mean ± SD.

Table 1. — *Embryological data and pregnancy outcome according to sperm morphology*.

	Normal sperm morphology (Group 1, n = 537, < 4%)	(Group 2, n = 118, ≥ 4%)	*p value*
No. of oocyte-cumulus complexes retrieved	11.8 ± 6.5	11.3 ± 6.3	NS
No. of metaphase II oocytes	10.1 ± 5.7	9.4 ± 5.4	NS
Fertilization rate (%)	72.0	70.8	NS
No. of available grade I embryo on Day 3	0.8 ± 1.3	1.0 ± 1.6	NS
No. of embryos having ≥ 7 blastomeres on Day 3	3.8 ± 3.4	3.6 ± 3.3	NS
No. of transferred embryo on Day 3	3.0 ± 1.1	3.2 ± 1.4	NS
Clinical pregnancy/embryo transfer (%)	53.7	53.5	NS
Implantation rate (%)	19.4	19.2	NS

NS: not significant.
All values are expressed as mean ± SD.

Results

A total of 655 ICSI cycles were included in the final analysis. The baseline characteristics of patients and demographic features were comparable between the two groups (Table 1). The controlled ovarian hyperstimulation performance was also similar. The fertilization rates were 72.0% and 70.8% in Groups 1 and 2, respectively (Table 2). There were no differences regarding embryo quality, clinical pregnancy and implantation rates between the two groups (Table 2).

Discussion

Fertilization rate was similar among couples with severe teratospermia and normal sperm morphology according to our study (Table 2). The baseline characteristics and ovarian response of the patients were comparable between the groups. Both groups with or without severe teratozoospermia had similar results according to embryo quality and clinical pregnancy rates.

Lundin et al. demonstrated the adverse affect of sperm morphology defect on fertilization and pregnancy rates in conventional IVF cycles and the improvement effect of ICSI in these patients [14]. They offered ICSI for patients with poor sperm morphology to improve fertilization. Similar to our study, they could not show any adverse effect of sperm morphology defect severity to fertilization in the ICSI cycle itself.

Osowa et al. reported similar fertilization and pregnancy results in both conventional IVF and ICSI cycles [17]. However, the adverse effect of severity of teratozoospermia on fertilization was seen in the conventional IVF cycles even though the total fertilization rate was comparable with the ICSI cycles. The similar total fertilization rate may be due to the small percentage of patients with severe teratozoospermia in the conventional IVF group. Again similar to the report by Lundin *et al*. [14], in our study there was no significant difference in the fertilization rate according to severity of teratozoospermia among the patients who underwent ICSI cycles.

To evaluate the effect of isolated teratozoospermia on assisted reproductive technologies success, Keegan *et al*. compared conventional IVF with ICSI cycles and demonstrated that there was no effect of teratozoospermia on fertilization and pregnancy rates either in conventional IVF or ICSI cycles [23]. They concluded that isolated teratozoospermia did not adversely affect the outcomes of ART. They showed similar rates of fertilization and pregnancy in all patients who underwent conventional IVF or ICSI cycles either with severe teratozoospermia or normal sperm morphology. Furthermore to search in more detail, they analyzed 17 cycles with half of the retrieved oocytes used in conventional IVF and the rest in ICSI cycles. Again no difference in the fertilization rate was found between the groups.

In a retrospective comparision of pregnancy outcome following conventional oocyte insemination vs ICSI for isolated abnormalities in sperm morphology using strict criteria; Check *et al*. reported significantly lower pregnancy rates with ICSI and suggested the zona pellucida can do a better job of sperm selection [29].

Similar to our study French *et al*. evaluated effects of severe teratozoospermia only in the ICSI cycles and could not demonstrate any adverse effect on the outcomes even in the subgroup analysis of teratozoospermia [24].

It is clear from the literature that severity of teratozoospermia does not affect ART outcomes in ICSI cyles and no effect surprasses in the comparison of outcomes between conventional IVF and ICSI cycles.

Our data suggest that detection of morphology defect has no value in the prediction of fertilization, embryo quality and clinical pregnancy in the ICSI cycles.

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