Reproductive Medicine; *Endocrinology and Infertility*

Effects of Sperm Parameters on Pregnancy Rate in Patients Undergoing Intrauterine Insemination

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ABSTRACT

OBJECTIVE: In this study, the effects of sperm parameters on the success of intrauterine insemination were investigated.

STUDY DESIGN: The data from 309 infertile couples who were admitted between 2012-2018 without a female factor were analyzed retrospectively and included in the study. After the administration of gonadotropin and hCG (5000-10000 IU), single insemination was performed in 36-40 hours in all cycles. All couples underwent routine infertility screening. The relationship between sperm parameters (motility, morphology, sperm count), patient age, duration of infertility with intrauterine insemination success was evaluated.

RESULTS: There was no statistically significant difference between the two groups in terms of mean age and age related-parity. There was no statistically significant difference between male ages, liquefaction, and sperm volumes between the two groups (p=0.898, p=0.448, p=0.651). Before washing; There was a statistically significant difference between the sperm concentration, percentage of total motile sperm, percentage of progressive motility sperm, percentage of normal sperm morphology, and total sperm count between the two groups (p=0.0001, p=0.0001, p=0.0001, p=0.0001, p=0.0001). After sperm washing; the results were similar to those obtained before washing. While statistically significant difference was observed between sperm volume and sperm concentrations (p=0.023, p=0.018), no significant difference was observed between the two groups in total sperm count (p=0.612).

CONCLUSION: As a result, during the application of intrauterine insemination to infertile couples, total motile sperm count, progressive motility sperm count ratio and high sperm ratio with normal morphology used in order to increase pregnancy success can be considered as criteria that increase the chances of success.

Keywords: Intrauterine insemination, Pregnancy, Sperm morphology, Total sperm motility

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Introduction

Fertilization is an essential factor regulating mammalian reproduction, and spermatozoon plays a key role in fertilizing the egg and subsequently developing embryos. Infertility is defined as a failure to achieve pregnancy after one year of unprotected intercourse (1). Researches show that infertility affects 10-15% of married couples. Male reproductive dysfunctions are responsible for almost up to 50% of infertility cases (2). Intrauterine insemination (IUI) is one of the methods used in the treatment of infertility as it is cheaper, simpler and less invasive than other assisted reproductive techniques (ART). Sperm morphology, sperm preparation methods, and sperm count and motility during insemination are important parameters that may affect IUI and pregnancy rates. However, when the literature is reviewed, significant differences are observed between these parameters and pregnancy rates (3). Although IUI is a widely used reproductive technology method in the world, the effect of various sperm characteristics on pregnancy rate is still controversial. The aim of our study is to evaluate the effect of sperm parameters on the results of IUI.

Material and Method

Approval was obtained for this research with the decision

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of the SANKO University Faculty of Medical Local Ethics Committee dated 22.10.2018/numbered 2018/10-02 and the study was conducted in compliance with the Helsinki Declaration Rules. All patients participating in the study were informed about the study and their written consent was obtained. The data supporting the results reported in the article are applicable. A retrospective analysis was performed on a 2.5-year data being applied in Gaziantep Medicalpark Hospital. Our data include information on the evaluation of semen quality on the day of insemination. A total of 309 IUI cycles were performed; sperm parameters of 53 couples with pregnancy (group 1) and 256 couples without pregnancy (group 2) were compared. Cycles without live birth were evaluated as unsuccessful. Semen quality was classified according to the 2010 semen criteria of the World Health Organization (WHO) (4). Couples who participated in this study together with their current partners had primary or secondary infertility for at least one year. A total of 225 (72.8%) couples had unexplained infertility while 84 (27.2%) patients had ovulation disorder. By analyzing our data, we established the criteria for inclusion and exclusion of our female patients after investigating the medical history and physical examination notes. Women who underwent hysterosalpingogram (HSG) or chromopertubation laparoscopy and who had both fallopian tubes, a passage through these tubes, no mass compressing the endometrial cavity, no endometrial adherence, and a regular period every 21 to 35 days, were included in the study. In this study, serum follicle-stimulating hormone (FSH), estradiol, prolactin, and thyroid hormone levels of all women were evaluated before starting the treatment and patients who were found to be abnormal, were excluded from the study. Patients with more than 7 antral follicles on endovaginal ultrasonography, were included in the study. Women with a history of endometrioma, endometriosis, stage 1-2 endometriosis on laparoscopy, tubal surgery, ovarian mass or unilateral salpingectomy, single fallopian tube closed in HSG, hysteroscopic synechiae correction surgery for endometrial synechiae and myomectomy for myoma uteri, were excluded from the study.

When gonadotropin was administered to the patients, adequate ovulation response was obtained and IUI was performed. For ovulation induction, treatment was started between the 2nd and 5th days of the cycle. When follicle diameter reached 18-20 mm in the follow-up with ultrasound, a single dose of HCG (5000-10000IU) was performed. Patients without ovulation were not included in the study.

Statistical analysis

The Statistical Package for the Social Sciences version 19 (SPSS Inc., Chicago, IL, USA) was used in our study. Kolmogorov-Smirnov test was used in order to determine whether or not the data were normally distributed. Independent Samples Test was applied to data showing normal distribution. $P<0.05$ was considered to be statistically significant.

Results

There was no statistically significant difference between the mean ages and age related-parity between the two groups. In terms of infertility duration, there was a statistically significant difference between the two groups ($p=0.018$) (Table I). The mean age of male participants was found to be 30.46±6.57 years in group 1 and 30.35±6.31 years in group 2. Of the 309 cycles, 64 pregnancies occurred and 53 of them had live births. Sperm parameters before and after washing prior to IUI were compared between group 1 and group 2 (Table II, III). There was no statistically significant difference observed between male ages, liquefaction, and sperm volumes between the two groups ($p=0.898$, $p=0.448$, $p=0.651$). Before washing, a statistically significant difference was observed between sperm concentration, percentage of total motile sperm, percentage of progressive motility sperm, percentage of normal sperm morphology, and total sperm count between both groups ($p=0.0001$, $p=0.0001$, $p=0.0001$, $p=0.0001$, $p=0.0001$ (Table II). After washing, the results were similar to the pre-wash results. There was no difference in total sperm count between two groups ($p=0.612$) (Table III), while sperm volume and sperm concentrations were significantly different between the two groups ($p=0.023$, $p=0.018$) (Table III).

Table I: *Demographic and baseline data of couples*

	Group 1 (n=63)	Group 2 (n=246)	*p*
Female age (year)	28.0±5.7	27.6±5.3	0.69
Male age (year)	30.4±6.5	30.3±6.3	0.89
Parity	0.6±0.8	0.5±0.7	0.40
Duration of infertility (month)	21.2±6.0	24.4±10.1	0.02*

• $p<0.05$

Table II: *Comparison of sperm parameters before washing*

	Group 1 (n=63)	Group 2 (n=246)	*p*
Liquefaction	30.9±16.2	32.8±18.2	0.448
Sperm volume	4.33±1.24	4.2±1.6	0.651
Sperm concentration	84.8±49.9	45.1±40.2	0.0001
Total moving (percentage of sperm)	48.1±10.9	35.2±25.8	0.0001
progressive motility	38.1±10.9	24.0±18.9	0.0001
Morphology (normal percentage)	12.2±4.7	6.31±5.68	0.0001
Total sperm count	347.0±226.5	183.8±171.5	0.0001

Statistics Independent Samples T-Test, P-value of significance p<0.05

Table III: *Comparison of sperm parameters after washing*

	Group 1 (n=63)	Group 2 (n=246)	*p*
Liquefaction	30.9±16.2	32.8±18.2	0.448
Sperm volume	1.7±0.6	2.0±1.1	0.023
Sperm concentration	50.6±31.4	37.6±39.9	0.018
Total moving (percentage of sperm)	77.0±18.1	52.5±41.9	0.0001
progressive motility	70.9±14.7	39.2±26.5	0.0001
Morphology (normal percentage)	28.4±11.9	9.1±8.5	
0.0001zrm count	83.7±72.0	77.0±99.1	0.612

Statistics Independent Samples T-Test, P-value of significance p<0.05

Discussion

The aim of our study is to evaluate the effect of sperm count, motility and morphology on the results of IUI. In our study, we showed that sperm concentration, total sperm motility, motile sperm count and sperm morphology were effective on the success of IUI.

Semen parameters are known to affect IUI success. Although the reference values of WHO for semen analysis are widely used to evaluate sperm quality, predictive sperm parameters and threshold values are still to be elucidated according to the semen characteristics of successful IUI (1). In our study, the higher the number of motile sperm, the higher the pregnancy rate. Motility plays an important role not only for sperm transit but also during fertilization. The mechanical propulsion provided by motility enables the sperm to move along the outer layers of the cumulus-oocyte complex (5). There are studies (6) suggesting that the increase in abstinence affects motility negatively, and in our study, at least 3 days of abstinence was applied in our patients. The pregnancy rate (17%, 53/309) in our study was similar to the literature which is 11-25% (1,7,8). In a study, it was concluded that even though fertilization was provided with sperms with poor morphology, the chance of successful pregnancy was low in serious sperm head anomalies (1,5). Furthermore, in a similar study, they reported that defects and DNA anomalies of sperm DNA and heterogeneous nucleoproteins may be the main factors affecting sperm fertilization capacity regardless of morphology (9). Similarly, in our study, the pregnancy rate was found to be high in the group with a high percentage of those with normal morphology. In studies, while comparing sperm concentrations $<20x10^6$ /mL (4.1%) and sperm concentrations $\geq 20x10^6$/mL (7.3%), pregnancy rates per cycle were found to be slightly lower (1,5,7,8). A study showed that there was no significant difference between pregnancy rates and increasing sperm concentration. Pregnancy rates are 7.5% when sperm concentration is $<10x10^6$/mL, whereas the rates are 10.9% when concentration is $>40x10^6$/mL (10). In our study, unlike these studies, a statistically significant difference was found between pregnancy rates as sperm concentration increased. In a retrospective study including 1.576 IUI cycles, it was reported that advanced male age had no effect on pregnancy (11). In our study, since there was no statistically significant difference between male and female ages between the two groups, it was not possible to investigate the effect of advanced male age on pregnancy. Although the in vivo effects of leukocytes are less obvious, in vitro studies have shown that high leukocyte levels may induce oxidative stress and alter the sperm parameters (12). In a retrospective study investigating the unexplained infertile 1.637 IUI cycles and the effect of leukospermia on

pregnancy, there was no statistically significant difference in sperm motility and morphology between the two groups, while there was a statistically significant deterioration in semen volume, concentration and total sperm count in the leukospermic group (13). In our study, patients with leucocyte counts higher than 1 million, were excluded from the study.

There are some limitations to our study. The number of cycles could be more. Sperm DNA damage and other advanced tests were not performed in couples without pregnancy.

It can be observed more clearly in prospective randomized studies in larger series.

As a result, during the application of IUI to infertile couples, total motile sperm count, progressive motility sperm count rate and high sperm rate with normal morphology used in order to increase pregnancy success can be considered as the criteria that increase the chances of success. Further studies are needed on this subject.

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Author Contributions: MD: Did physical examinations and acquired the data of patients. MS: Studied design. MD: Performed the statistical analysis and interpretation of the data drafting of the manuscript. MS: Worked on the critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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