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ORIGINAL ARTICLE

Relationship between sperm parameters and intracytoplasmic sperm injection outcome

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Abstract *Objectives:* With the adventure of intracytoplasmic sperm injection (ICSI) technique, great progresses have developed in the treatment of infertility. Concentration on the properties of male's gamete has been encouraged by the increasing concerns about the causes of ICSI failure. We hence conducted this study to investigate the probable association of sperm parameters with ISCI outcome. *Methods:* A total of 523 couples referred to Isfahan Fertility and Sterility Center from January 2007 to June 2008 for ICSI. Semen analysis was performed before ICSI procedure according to the WHO criteria. Patients were assigned into successful ICSI (case) and failed ICSI (control) groups. Sperm parameters were then compared between the 2 groups. *Results:* One hundred and six patients (20%) had successful ICSI results (case group) compared with 417 couples (80%) with undesirable ICSI outcomes (control group). Among evaluated factors, sperm agglutination ($p = 0.007$), sperm concentration ($p = 0.043$), leukocytospermia ($p = 0.026$) and head abnormality of sperm ($p = 0.019$) showed statistically significant differences between two groups with differing ICSI results. None of the other semen parameters revealed significant differences between these two groups. *Conclusion:* Our study showed that some sperm parameters are associated with desirable ICSI outcome. However, it is unclear whether these associations are causal.

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1. Introduction

Infertility is a considerable problem, affecting up to 15% of couples of reproductive age. For many years, it was assumed that most reproductive problems could be attributed to the

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female partner but some research has demonstrated that 30–50% of infertilities are caused by a male factor (1), while others reported that the male factor accounts for up to half of all cases of infertility and affects one man in 20 in general population (2).

The introduction of in vitro fertilization (IVF) led to great advances in treatment for infertility (3). However, effective treatment for male-factor infertility (determined on the basis of abnormal semen measurements) was not available until 1992, when intracytoplasmic sperm injection (ICSI) was introduced as a part of the IVF process in selected cases (4). In 1994, guidelines were published regarding the use of ICSI as a novel technique, revolutionized the treatment of male infertility, providing many men the chance to have their own children (5). However, the development of ICSI also greatly stimulated research into the causes of male infertility, and our knowledge has increased tremendously in the past decade. One of the main components in ICSI is a fertile male gamete which could be somehow evaluated by semen analysis.

In clinical practice, the manual–visual light microscopic methods for evaluating semen quality maintain their central role in assessment of male fertility potential. However, often a definitive diagnosis of male fertility cannot be made as a result of basic semen analysis. This consists of measuring seminal volume, pH, sperm concentration, motility, morphology and vitality (6,7). Focus on the properties of the male gamete has been intensified by the growing concern about the reason of failure in ICSI. The semen analysis indices such as sperm morphology have been reported to be associated with a favorable outcome in IVF including IUI (8). We conducted this study to investigate the probable association of seminal parameters with ICSI outcome.

2. Methods and materials

Among patients referred to Isfahan Fertility and Sterility Center affiliated to Isfahan University of Medical Sciences (Isfahan, Iran) between January 2006 to June 2007 for ICSI, 523 couples were selected according to the following criteria: failure in IVF, existence of inappropriate factors for IVF or denial to use freeze sperms. The study aims and protocols were completely explained for participants and all of them were requested to sign a written informed consent approved by the institutional board.

Then, a thorough history was taken, and general and genital examinations as well as semen analysis were achieved.

Semen analysis was performed before ICSI procedure. Semen samples were collected after a period of sexual abstinence for 4–5 days. All samples were retrieved in a specimen container and allowed to liquefy for 30 min over a slide warmer at 37 °C. A routine semen analysis was then performed according to World Health Organization (WHO) guidelines (9), including semen volume, viscosity, sperm concentration, morphology, motility and agglutination and leukocytospermia using an inverted polarized Olympus IXS21 microscope and plate at 37 °C. Morphological analysis of 100 sperm per sample was performed using the Papanicolau staining method (10).

After ICSI procedure and according to the successful results and pregnancy, documented by intra-vaginal sonography on the 5th week by an expert sonographist, the couples were assigned in two groups: with appropriate and inappropriate outcome of ICSI. The semen analysis results were retrospectively compared in these groups to evaluate any significant difference in seminal parameters.

Data analysis was performed using statistical package for social sciences (SPSS, version 13, Chicago, Inc). Numerical data were expressed as mean ± standard deviation (SD) and range. Comparisons were performed by student's *t*-test and Pearson's chi-square for quantitative and qualitative variables, retrospectively. $p < 0.05$ was considered statistically significant.

3. Results

Of 523 infertile couples enrolled in this study, 106 (20%) ones had successful ICSI considered as case group, while 417 (80%) patients had an undesired ICSI outcomes and were considered as controls.

Parameters of seminal fluid compared in two study groups include sperm agglutination, leukocytospermia, sperm volume, sperm motility, sperm viscosity, sperm abnormality and sperm immaturity. The stated factors in two groups with related *p* values are demonstrated in Tables 1 and 2.

Among evaluated factors sperm normal agglutination (19.8% in cases vs. 29.3% in controls, $p = 0.007$), sperm concentration (49.10 vs. 42.51, $p = 0.043$), leukocytospermia (1.04 vs. 1.48, $p = 0.026$) and head abnormality of sperm (65.08 vs. 69.48, $p = 0.019$) number of motile sperm was different in ICSI patients with successful results (42.89 ± 1.69) compared to controls (39.59 ± 0.9), but this difference did not reach a statistical significance ($p = 0.097$). Furthermore, the mean of sperm abnormality was 68.87 ± 1.46 in cases with successful ICSI results when compared to 70.72 ± 0.82 in controls and the difference was not statistically significant, but in different subgroups of sperm abnormality, including head, neck and tail abnormality, a significant difference was observed in head abnormality of sperms ($p = 0.019$). Progressive motility of sperms (power = 84%), abnormality of sperm tail (power = 88%) and immaturity of sperms (power = 83%) revealed no effect in success of ICSI. Other seminal factors, demonstrated no significant difference between two study groups.

Table 1 Sperm agglutination in ICSI with positive and negative results.

	Cases: *n* (%)	Controls: *n* (%)	*p* values
Sperm agglutination			0.007
Normal	21 (19.8%)	122 (29.3%)	
Slight	63 (59.4%)	252 (60.4%)	
Moderate	22 (20.8%)	43 (10.3%)	
Sperm viscosity			PV > 0.05
Normal	102 (96.2%)	395 (94.7%)	
Slight	2 (1.9%)	13 (3.1%)	
Moderate	2 (1.9%)	9 (2.2%)	
Total	106 (100%)	417 (100%)	

Table 2 Semen analysis parameters in ICSI with positive and negative results.

	Case (mean ± SD)	Control (mean ± SD)	*p* values
Semen volume	4.11 ± 0.34	3.68 ± 0.08	N.S.*
Sperm concentration	49.10 ± 2.78	42.51 ± 1.47	0.043
Sperm abnormality	68.87 ± 1.46	70.72 ± 0.82	N.S.*
Abnormal head	65.08 ± 1.67	69.48 ± 0.83	0.019
Abnormal neck	11.70 ± 0.53	12.46 ± 0.37	N.S.*
Abnormal tail	13.19 ± 0.94	13.36 ± 0.52	N.S.*
Sperm motility			
Progressive motility	22.84 ± 1.55	20.14 ± 0.81	N.S.*
Sluggish motility	19.97 ± 0.86	19.17 ± 0.47	N.S.*
Immotile	57.14 ± 1.77	60.36 ± 0.94	N.S.*
Leukocytospermia	1.04 ± 0.09	1.48 ± 0.14	0.026

NS; Not Significant.

4. Discussion

Our results revealed that sperm concentration and agglutination were positively correlated with successful ICSI while head abnormality of sperm and leukocytospermia were inversely associated with appropriate results of ICSI.

Some prior investigators reported non-significant association between ICSI outcome and sperm concentration, motility and abnormality. Nevertheless a statistically significant association was observed between fertilization rate and pregnancy (11–14).

It is note worthy that none of these studies reported any power for their observations when $p > 0.05$.

Considering sperm head abnormality, our results are similar to two previous studies in which ICSI positive outcome was found out to be lower in patients with 100% abnormality of sperm head (15,16). In case of midpiece abnormality of sperm head, there is report on higher fertilization rate and pregnancy that is in agreement with our study (16).

Sperm agglutination is widely related to antisperm antibodies levels and a positive association was determined between ICSI appropriate outcome and sperm agglutination which is similar to results of Nagy et al. (11), reporting a higher fertilization rate with positive antisperm antibodies. Conversely, Mercan et al. (14) described non-significant association between fertilization rate and antisperm antibodies. The effects of these antibodies and sperm agglutination on ICSI outcome remain a controversial entity; need more precise studies for a neat conclusion.

Leukocytes are reported to have negative effects on fertilization rate (17) and this rate is significantly lower in leukocytospermic patients (18). Likewise, a negative association was observed between leukocytospermia and pregnancy in our study. It has been discussed that the presence of leukocytes in seminal fluid, cause oxidative stress and DNA fragmentation in sperms (19,20), which may decrease the fertilization rate (21) and pregnancy. In another study the percentage of sperms with DNA damage was reported to be twice in leukocytospermic individuals (22).

In conclusion, our results showed that some sperm parameters are contributed to ICSI outcome. However it is unclear whether these associations are causal; hence, further investigations are necessary to determine the effects of these parameters on ICSI outcome.

Conflict of interest

The authors do not have any conflict of interest.

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