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 ICSI 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
female partner but some research has demonstrated that 30–50% of infertility cases 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 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 70.72 ± 0.82 in controls and 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.

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.

<table>
<thead>
<tr>
<th>Table 1 Sperm agglutination in ICSI with positive and negative results.</th>
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<tbody>
<tr>
<td><strong>Parameters of seminal fluid compared in two study groups</strong></td>
</tr>
<tr>
<td>Case: n (%)</td>
</tr>
<tr>
<td>Sperm agglutination</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Slight</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Sperm viscosity</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Slight</td>
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<tr>
<td>Moderate</td>
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<tr>
<td>Total</td>
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</tbody>
</table>
Table 2  Semen analysis parameters in ICSI with positive and negative results.

<table>
<thead>
<tr>
<th></th>
<th>Case (mean ± SD)</th>
<th>Control (mean ± SD)</th>
<th>p values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sperm concentration</td>
<td>49.10 ± 2.78</td>
<td>42.51 ± 1.47</td>
<td>0.043</td>
</tr>
<tr>
<td>Sperm motility</td>
<td>68.87 ± 1.46</td>
<td>70.72 ± 0.82</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Abnormal head</td>
<td>65.08 ± 1.67</td>
<td>69.48 ± 0.83</td>
<td>0.019</td>
</tr>
<tr>
<td>Abnormal neck</td>
<td>11.70 ± 0.53</td>
<td>12.46 ± 0.37</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Abnormal tail</td>
<td>13.19 ± 0.94</td>
<td>13.36 ± 0.52</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Sperm motility</td>
<td>22.84 ± 1.55</td>
<td>20.14 ± 0.81</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Sluggish motility</td>
<td>19.97 ± 0.86</td>
<td>19.17 ± 0.47</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Immotile</td>
<td>57.14 ± 1.77</td>
<td>60.36 ± 0.94</td>
<td>N.S.*</td>
</tr>
<tr>
<td>Leukocytospermia</td>
<td>1.04 ± 0.09</td>
<td>1.48 ± 0.14</td>
<td>0.026</td>
</tr>
</tbody>
</table>

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 noteworthy 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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