Use of Semen Quality to Predict Pregnancy in Couples Undergoing ICSI

Gordana Kozarov1,2 and Ljiljana Stosic2

1Clinic Perinatal, Special Hospital for Gynecology, Serbia
2Clinical Embryologist, Special Hospital for Gynecology, Serbia

Submission: February 25, 2016; Published: March 10, 2016

*Corresponding author: Gordana Kozarov, Gynecologist, Clinic Perinatal, Special Hospital for Gynecology, Ilije Ognjanovica 10, Novi Sad, Serbia, Tel: 381(65)/588-0000; Email: klinikaklinikaperinatal.com

Abstract

The objective of this study was to determine how fertilization, implantation and pregnancy depend on two basic sperm parameters, sperm concentration and sperm motility in ICSI procedure. Primary outcome as fertilization rate (FR), implantation rate (IR), βhCG/cycle, clinical pregnancy rate (PR) and live births rate (LBR) to be stated. In our center 44 cycles of ICSI were carried out in natural and stimulated cycle. Male subfertility was defined as semen quality not meeting the criteria for normality as defined by the World Health Organization (WHO, 1999). FR, IR, βhCG/cycle, PR and LBR were not significantly different between the 5 form male subfertility (normo-, oligo-, astheno-, oligo-astheno- and oligoasthenoteratozoospermia) in ICSI (P < 0.05). In oligoasthenoteratozoospermia IR, βhCG/cycle, PR and LBR was higher than in other cases. The best results are achieved in the case of fertilization rate. PR and LBR had the lowest values in the case of oligoasthenozoospermia. In normozoospermia were extremely low values PR and LBR. The only factor that obviously impacts on ICSI-related pregnancy is maternal age, impairing oocyte/embryo quality. The answer to the question of how to predict and increase the success of the ICSI procedure should be sought in assessment of sperm DNA integrity.

Keywords: Intracytoplasmic sperm injection; Semen quality; Male subfertility; Pregnancy

Abbreviations: FR: Fertilization Rate; IR: Implantation Rate; PR: Pregnancy Rate; LBR: Live Births Rate; WHO: World Health Organization; ICSI: Intracytoplasmic Sperm Injection; hMGs: Human Menopausal Gonadotropins; hCG: Human Chorionic Gonadotropin; MII: Metaphase II; OAT: Oligoasthenoteratozoospermia

Introduction

Abnormalities in sperm production or function, alone or in combination with other factors, account for 35–50% of all cases of infertility. A multi center study conducted by the World Health organization (WHO) concluded that in 20% of infertile couples, the predominant cause of infertility is the male factor, while in another 27% of couples both partners contribute. While these statistics underline the importance of male factor in reproduction, the clinical methodology used to diagnose male infertility has depended on assessment of sperm concentration, motility and sperm morphology [1].

Male infertility is certainly multi-factorial. It is improbable that one sperm function test will prove to be a panacea, owing to the multiple steps involved in fertilization. In addition to arriving at the site of fertilization, sperm must undergo capacitation and the acrosome reaction; they must penetrate the cumulus, bind to the zona pellucida, penetrate through the zona, fuse with the oolemma, activate the oocyte, undergo nuclear decondensation, form the male pronucleus, and then fuse with the female pronucleus. As intracytoplasmic sperm injection (ICSI), more and more logical questions are being asked about the proper role for sperm function testing. For ICSI, live sperm with the ability to activate the oocyte and form a pronucleus are necessary, but morphology, motility, and acrosome status are generally not important [2-6]. It has been demonstrated that the positive outcome of ICSI is largely independent of the three basic sperm parameters – motility, morphology, and concentration in couples in whom these characteristics are severely impaired [7]. In the latter case, its successful application to surgically retrieved sperm proves that this micromanipulation technique is able to achieve fertilization regardless of the maturation of the gametes. The possibility to bypass the steps of testicular and epididymal sperm maturation, acrosome reaction, binding to the zona pellucida, and fusion with the oolemma now permits infertility due to a male factor to be addressed successfully.
only factor that obviously impacts on ICSI-related pregnancy rates is maternal age, impairing oocyte/embryo quality.

Is it possible to predict what extent, whether and in what way the sperm quality affects on ICSI result? Is it possible to identify what are the sperm parameters that best predict result of ICSI procedure? Is there a correlation between the different forms of male infertility and fertilization, embryo development and ultimately the conception and birth of a healthy child? The most common reasons for rejection of potential donors are poor sperm count and poor motility [8]. However, individual semen parameters seem to have little accuracy in predicting pregnancy rates [9-14]. Most semen characteristics seem to be positively correlated, suggesting that the different parameters are not independent. That is a semen sample with poor values for one parameter (e.g., count) is likely to have poor values for other parameters as well, such as motility [15]. The purpose of our current study was to determine how fertilization, implantation and pregnancy depend on two basic sperm parameters, sperm concentration and sperm motility in ICSI procedure.

Materials and Methods

In 2010, in our center 44 cycles of ICSI were carried out in natural and stimulated cycle. Age of women ranged from 24 to 44 years. Even 18 (41%) were women older than 39 years. 57% of our small sample, were women older than 35 years (Figure 1). The medical records of women were examined for relevant details. The pertinent obstetric history and gynecological history were recorded. Notes on the patients infertility, duration of infertility, presence and type of any contributing female factors, and type of contributing male factors. Any pregnancies were noted, along with the outcomes of the pregnancies (miscarriage or live birth). The semen samples were collected after 48 to 72 hours of abstinence. Sperm specimen was obtained by masturbation into sterile specimen cups. Ejaculates were left to liquefy for 20 to 30 min. Male subfertility was defined as semen concentration and sperm motility in ICSI procedure.

Results

Results are shown in Table 1 and Graph 1. Fertilization rate (FR), implantation rate (IR), βhCG/cycle, pregnancy rate (PR) and live births rate (LBR) were not significantly different between the 5 form male subfertility (normo-, oligo-, astheno-, oligo-astheno- and oligoasthenoteratozoospermia) in ICSI. In Graph 1 it is easily observed deviation results in the case of the most severe form of male infertility (oligoasthenoteratozoospermia). Implantation rate, βhCG/cycle, pregnancy rate and live births rate was higher than in other cases, which are not expected. Research has shown that the best results are achieved in the case of fertilization rate. High values of this parameter were obtained in all cases of infertility. The biggest differences between the 5 forms of subfertility can be seen on the properties of oocyte/embryo quality. The biggest differences between the 5 forms of subfertility can be seen on the properties of oocyte/embryo quality. The biggest differences between the 5 forms of subfertility can be seen on the properties of oocyte/embryo quality. The biggest differences between the 5 forms of subfertility can be seen on the properties of oocyte/embryo quality. The biggest differences between the 5 forms of subfertility can be seen on the properties of oocyte/embryo quality.

Table 1: Success of ICSI in five abnormalities of spermatozoa.

|                   | Normozoospermia (N) | Oligozoospermia (O) | Asthenozoospermia (A) | Oligoasthenozoospermia (OA) | Oligoasthenoteratozoospermia (OAT) |
|-------------------|---------------------|---------------------|-----------------------|-----------------------------|-----------------------------------|
| FR                | 87%                 | 72%                 | 100%                  | 80%                         | 89%                               |
| IR                | 14%                 | 15%                 | 15%                   | 16%                         | 33%                               |
| βhCG/cycle       | 19%                 | 25%                 | 23%                   | 20%                         | 67%                               |
| PR                | 10%                 | 25%                 | 30%                   | 10%                         | 67%                               |
| LBR               | 14%                 | 17%                 | 27%                   | 13%                         | 67%                               |

P<0.05

How to cite this article: Gordana K, Liljiana S. Use of Semen Quality to Predict Pregnancy in Couples Undergoing ICSI. J Gynecol Women’s Health. 2016; 1(1): 555555. DOI: 10.19080/JGWH.2016.01.555555
In 2010, in our center 44 cycles of ICSI were carried out in natural and stimulated cycle. Age of women ranged from 24 to 44 years. Even 18 (41%) were women older than 39 years. 57% of our small sample, were women older than 35 years (Figure 1).

The number of oocytes obtained per patient ranged from 0 to 18 (Figure 1). Apparently, most of the women had a deficient response to stimulation. Among them, 25 (57%) received less than 5 oocytes during cycle. Supernumerary oocytes (more than 10) had 5 patients, which were reflected in the quality of their oocytes. These probably less quality cells make up 31% of the total number of collected cells. Number of mature oocytes was 195 (82%), as it is used for microfertilization.

**Discussion**

The results from our experiments have shown that fertilization rate, implantation rate, βhCG/cycle, pregnancy rate and live births rate did not correlate with any of the forms of male infertility. This is in accordance with the [2-6]. These authors have found that for ICSI, live sperm with the ability to activate the oocyte and form a pronucleus are necessary, but morphology, motility, and acrosome status are generally not important. Also it has been demonstrated that the positive outcome of ICSI is largely independent of the three basic sperm parameters – motility, morphology, and concentration in couples in whom these characteristics are severely impaired [7]. This is consistent with our results. Although [8] found that the most common reasons for rejection of potential donors are poor sperm count and poor motility. These parameters in our case did not have a significant role to success. This can be explained by the fact that ICSI micromanipulation technique is able to achieve fertilization regardless of the maturation of the gametes. The possibility to bypass the steps of testicular and epididymal sperm maturation, acrosome reaction, binding to the zona pellucida, and fusion with the oolemma now permits infertility due to a male factor to be addressed successfully. The only factor that obviously impacts on ICSI-related pregnancy rates is maternal age, impairing oocyte/embryo quality. Sidhu [9-14] found that individual semen parameters seem to have little accuracy in predicting pregnancy rates. Also Agarwal [15] found that the most semen characteristics seem to be positively correlated, suggesting that the different parameters are not independent. That is, a semen sample with poor values for one parameter (e.g., count) is likely to have poor values for other parameters as well, such as motility [15]. Our results are not inconsistent with these statements. We have not examined...
the correlation between semen parameters. The appearance that almost all parameters, except fertilization rate in case oligoasthenoteratozoospermia (OAT) were higher than in other forms of infertility can be explained by the following factors: 1) too small a sample, 2) unfavorable age structure of women and 3) poor response to stimulation, which led to a small number of oocytes in the sample studied. For the same reasons as in the case of normozoospermia obtained extremely low levels of PR and LBR, which were not expected.

Research has shown that best results are achieved in the case of fertilization rate. High values of this parameter were obtained in all cases of infertility. It has only confirmed that as ICSI, more and more logical questions are being asked about the proper role for sperm function testing. In addition to arriving at the site of fertilization, sperm must undergo capacitation and the acrosome reaction; they must penetrate the cumulus, bind to the zona pellucida, penetrate through the zona, fuse with the oolemma, activate the oocyte, undergo nuclear decondensation, form the male pronucleus, and then fuse with the female pronucleus.

Conclusion

Fertilization rate (FR), implantation rate (IR), βhCG/cycle, pregnancy rate (PR) and live births rate (LBR) were not significantly different between the 5 form male subfertility (normo-, oligo-, astheno-, oligo-astheno- and oligoasthenoteratozoospermia) in ICSI. The possibility to bypass the steps of testicular and epididymal sperm maturation, acrosome reaction, binding to the zona pellucida, and fusion with the oolemma now permits infertility due to a male factor to be addressed successfully. The only factor that obviously impacts on ICSI-related pregnancy is maternal age, impairing oocyte/embryo quality. The answer to the question of how to predict and increase the success of the ICSI procedure should be sought in assessment of sperm DNA integrity. Standard measurements may not reveal subtle sperm defects such as DNA damage, and these defects can affect fertility. New markers are needed to better discriminate infertile men from fertile ones, predict pregnancy outcome in the female partner, and calculate the risk of adverse reproductive events.

References

1. Jegou AM (2004) Clinical andrology-still a major problem in the treatment of infertility. Hum Reprod 19(6): 1245-1249.
2. Baker G, Liu DY, Bourne H (1999) Assessment of the male and preparation of sperm for ARTs. In: Trounson AO, Gardner DK, eds. Handbook of In Vitro Fertilization. Boca Raton: CRC Press pp. 99-126.
3. Nagy Z, Liu J, Cecile S, Silber S, Devroey P, et al. (1995) Using ejaculated, fresh, and frozen-thawed epididymal and testicular spermatozoa gives rise to comparable results after intracytoplasmic sperm injection. Fertil Steril 63(4): 808-815.
4. Nagy Z, Verheyen G, Tournaye H, Van Steirteghem AC (1998) Special applications of intracytoplasmic sperm injection: the influence of sperm count, motility, morphology, source and sperm antibody on the outcome of ICSI. Hum Reprod 13(Suppl 1): 143-154.
5. Bourne H, Richings N, Liu DY, Clarke GN, Harari O, et al. (1995) Sperm preparation for intracytoplasmic injection: methods and relationship to fertilization results. Reprod Fertil Dev 7(2): 177-183.
6. Dozortsev D, Rybouchkin A, De Sutter P, Qian C, Dhont M (1995) Human oocyte activation following intracytoplasmic injection: the role of the sperm cell. Hum Reprod 10(2): 403-407.
7. Palermo GD, Cohen J, Alikani M, Adler A, Rosenwaks Z (1995) Intracytoplasmic sperm injection: a novel treatment for all forms of male factor infertility. Fertil Steril 63(6): 1231-1240.
8. Sidhu RS, Sharma RK, Kachoria S, Curtis C, Agarwal A (1997) Reasons for rejecting potential donors from a sperm bank program. J Assist Reprod Genet 14(6): 354-360.
9. Sidhu RS, Sharma RK, Agarwal A (1997) Effects of cryopreserved semen quality and timer intrauterine insemination on pregnancy rate and gender of offspring in a donor insemination program. J Assist Reprod Genet 14(9): 531-537.
10. Bielsa MA, Andolk P, Gris JM, Martinez P, Eguez E (1994) Which semen parameters have a predictive value for pregnancy in infertile couples? Hum Reprod 9(10): 1887-1890.
11. Byrd W, Bradshaw K, Carr B, Edman C, Odom J, et al. (1999) A prospective randomized study of pregnancy rates following intrauterine and intracervical insemination using frozen donor sperm. Fertil Steril 73(3): 521-527.
12. Ombelet W, Vandeput H, Van de Putte G, Cox A, Jansen M, et al. (1997) Intrauterine insemination after ovarian stimulation with clophene citrate: predictive potential of insemination motile count and sperm morphology. Hum Reprod 12(7): 1456-1463.
13. Thyer AC, Patton PE, Burry KA, Mixon BA, Wolf DP (1999) Fecundability trends among sperm donors as a measure of donor performance. Fertil Steril 71(5): 891-895.
14. Ali-Inany HG, Dunselm an GA, Dumoutin JC, Maas JW, Evers JL (1999) Fertility potential of individual sperm donors. Gynecol Obstet Invest 47(3): 147-150.
15. Agarwal A, Sharma RK, Nelson DR (2003) New semen quality scores developed by principal component analysis of semen characteristics. J Androl 24(3): 343-352.