Research Paper:

Pregnancy Success Rates by Different Assisted Reproductive Techniques in Tubal, Ovarian, and Sperm Disorders

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ABSTRACT

Background: Assisted Reproductive Techniques (ART) have been used for addressing numerous causes of infertility. However, it remains unclear which kind of these methods are best for various infertility types. Accordingly, this study aimed at determining pregnancy success rates by different ART in tubal, ovarian, and sperm disorders.

Methods: The present descriptive retrospective study used the records of individuals who had referred to the Infertility Center of Kerman University of Medical Sciences from March 2016 to December 2017. All subjects underwent Intracytoplasmic Sperm Injection (ICSI) and In Vitro Fertilization (IVF). The sperm parameters were assessed based on the criteria of the World Health Organization (WHO) for determining the causes of male infertility. The data were documented and compared with the criteria of the WHO. Then, they were analyzed by analysis of variance, Paired Samples t-test, Chi-squared, or Fisher's Exact tests using SPSS.

Results: The overall Mean±SD fertility rate in IVF and ICSI was 4.28±2.87 and 3.62±2.54, respectively and the difference was not significant (t=1.02, P=0.319). There was a significant difference in the fertility rate due to tubal infertility (P=0.018) between ICSI and IVF; the fertility rate in the IVF method was significantly higher than that of the ICSI. The pregnancy rate in the freeze method was higher than those of the other methods (P<0.001). This discrepancy was also found in all causes of infertility. There was no significant difference in the disorders of sperm and the result of two methods (IVF/ICSI).

Conclusion: The obtained results suggested that in the freeze method, the pregnancy rate was higher than other approaches; this discrepancy was found in all the causes of infertility. It is suggested that frozen-thawed embryo transfer be used in infertile individuals. This is because it increases the success rate of pregnancy and prevents complications due to the repeated use of infertility treatments and exorbitant treatment costs.

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Highlights

- There was not a significant difference in pregnancy success rate between ICSI and IVF methods. However, in the ovary, tubal, and unexplained infertility, fertilization rate by IVF was more than that of ICSI. Additionally, the fertilization rate by ICSI was more than of IVF in asthenospermia and oligoasthenospermia.
- The fertility rate in the IVF method was significantly higher than that of ICSI in the tubal factor.
- There was not a significant association between the faults of sperm when using IVF and ICSI.
- In the freeze method, the pregnancy rate was higher than that of the other methods; this discrepancy was found in all causes of infertility.

Plain Language Summary

Two infertility assistance techniques are In Vitro Fertilisation (IVF) and Intracytoplasmic Sperm Injection (ICSI). With the development of assisted reproductive technology, embryo-freezing technology has become an essential part of IVF and ICSI therapies. Cryopreservation and verification technologies have greatly improved the traditional freezing technology. This study revealed that in all types of fertility, frozen-thawed embryo transfer can achieve better results, compared with new embryo transfer.

1. Introduction

Infertility is defined as the lack of pregnancy after one year of unprotected intercourse (Palermo et al., 2017). Infertility is generated by women, men, or both (Olooto et al., 2012). Male and female characteristics contribute to infertility (Moridi et al., 2019). Furthermore, 30% of infertility is related to male factors, 45% to female factors and 25% are due to unknown causes (Kazemeini et al., 2017). Ovulation disorders and uterine elements are the major causes of female infertility (Masoumi et al., 2015). Male infertility is associated with decreased sperm production and sperm motility disorder (Shokoohi et al., 2018). Tubal factor infertility accounts for one-third of female infertility (Yuan et al., 2019). Moreover, any problems with the fallopian tube are the significant cause of infertility (40%) (Hong et al., 2018).

Semen analysis is the first stage in the survey of male infertility. The World Health Organization (WHO) classified male infertility based on various sperm disorders; in oligospermia, sperm concentration is 15 million sperm/mL; in asthenospermia, total sperm motility is 40%, and in teratozoospermia, the normal forms of sperm are 4% (Cooper et al., 2010).

Two infertility assistance techniques are In Vitro Fertilisation (IVF) and Intracytoplasmic Sperm Injection (ICSI) procedures (Hong et al., 2018). Numerous couples have resorted to assisted reproductive techniques, such as IVF or ICSI to treat infertility (Hu et al., 2018). The annual increase of infertility assistance techniques was approximately 5%-10% in countries; due to its economic burden, their effectiveness is critical (Mirzaei et al., 2018). Despite great advances in infertility treatment, the prevalence of infertility is increasing (Kazemeini et al., 2017). Therefore, this study aimed at comparing pregnancy success rates with different methods of Assisted Reproductive Techniques (ART) in tubal, ovarian, and sperm disorders.

2. Materials and Methods

The present retrospective descriptive cross-sectional study was conducted using the records of all infertile couples who had been treated with IVF/ICSI and referred to the Kerman Infertility Center from March 2016 to December 2017. The data of numerous files was insufficient, i.e. excluded from the study. Eventually, 166 records were entered into the study. In this study, the demographic data, including the age of women and men; diagnostic tests confirming the type of infertility; the duration of the marriage; primary or secondary infertility; the type of procedure used to treat infertility (IVF/ICSI); the number of eggs fertilized per procedure, and pregnancy outcomes per procedure were collected from the patients' records.

The sperm parameters were determined based on the WHO criteria for determining the cause of male infertil-

ity. The following parameters must be measured when the semen analysis is performed for the assessment of fertility: semen volume (1.5 mL); sperm number (39 million per ejaculate) or concentration (15 million per mL); sperm motility (40%), and sperm morphology (4.0%). Finally, the collected data were analyzed by Analysis of Variance (ANOVA), Paired Samples t-test, Chi-squared, or Fisher's Exact test using SPSS.

3. Results

In this study, 166 records of infertile couples were assessed. The age range of men was 20-60 years, and that of women was 19-50 years. Most of the men (n=91, 54.8%) aged between 31 and 40 and most women (n=81, 48.8%) were in the same age range. The duration of the studied subjects' marriage varied from 1 to 29 years, with the Mean±SD marriage duration of 6.77±4.65 years. The infertility duration varied from 1-20 years with the Mean±SD of 5.21±3.94 years. The reason for infertility in 12.7% of the cases was ovary, 10.2% tubal, 32.5% asthenospermia, 23.5% unexplained, and 21.1% oligozoospermia. The mean value of oocyte fertility according to the causes of infertility assistance is summarized in Table 1.

The overall Mean±SD fertility rate in IVF was 4.28±2.87; in the ICSI method, it equaled 3.62±2.54. The difference between these methods was not significant (t=1.02, P=0.319). However, in tubal infertility, there was a significant difference in the fertility rate between the two methods of ICSI and IVF (P=0.018); accordingly, the fertility rate in the IVF method was significantly higher than that of the ICSI. However, there

Table 1. The fertility rate in IVF and ICSI methods according to infertility reasons

Type of Fertility		Mean±SD					Statistic	P
		Ovary	Tubal	Astheno	Un Explained	Oligo		
IVF		5.33±3.05	7.83±2.99	4.62±2.38	3.75±3.09	4.5±0.7	F=1.79	0.174
ICSI		3.6±2.5	4.0±2.0	4.68±3.92	3.5±3.10	4.68±4.79	F=0.15	0.961
Comparison between IVF and ICSI in infertility group	Diff.	0.83±3.2	5.0±3.5	0.33±3.2	0.42±3.86	1.25±3.30		
	T	0.62	3.4	0.35	0.29	0.75		
	P	0.558	0.018	0.73	0.779	0.504		
Comparison between IVF and ICSI (Total)		T=1.02			P=0.319			

F: F-test; t:t-test (paired or independent samples test).

Table 2. The fertility success rate in patients according to the type of infertility

Type of Fertility		No. (%)						Statistic	P
		Total	Ovary	Tubal	Astheno	Un Explained	Oligo		
IUI		12 (18.2)	1 (9.1)	1 (12.5)	5 (25)	5 (29.4)	0 (0)	4.58	0.317
IVF		12 (50)	2 (66.7)	2 (37.7)	6 (66.7)	2 (50)	0 (0)	3.76	0.524
ICSI		17 (32.1)	1 (20)	3 (100)	4 (18.2)	3 (75)	6 (31.6)	10.59	0.017
Frizz		21 (91.3)	2 (100)	-	3 (100)	12 (85.7)	4 (100)	1.45	0.999
Total		62 (37.3)	6 (28.6)	6 (35.3)	18 (33.3)	22 (56.4)	10 (28.6)	8.3	0.581
Comparison between fertility types	Statistic	41.24	8.09	6.41	12.06	10.58	13.12	-	
	P	<0.001	0.027	0.027	0.003	0.008	0.001	-	

Chi-squared or Fisher's Exact tests were used.

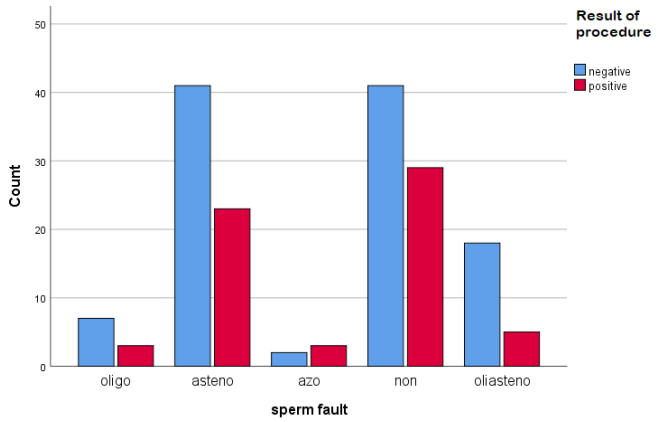

Figure 1. The outcome of pregnancy in sperm disorder

was no significant difference between the two methods of ICSI and IVF in other causes.

Of 166 couples, 66 (39.8%) were treated by Intra Uterine Insemination (IUI), 24 (14.5%) by IVF, 53 (31.9%) by ICSI, and 23 (13.9%) by Frozen-Thawed (FT) embryo. The success rate of pregnancy respecting different methods are presented in Table 2. According to this table, there was no significant difference in the success rate of pregnancy between the 5 reasons for infertility. However, there was a statistically significant difference between the 4 methods; in the FT method, the pregnancy rate was higher than those of the other methods (P<0.001). This discrepancy was also found in all causes of infertility. The relationship between the faults of sperm and the results of two methods (IVF/ICSI) were checked by the Fisher's Exact test. There was no significant relationship between the disorders of sperm and the results of two methods (IVF/ICSI) (Figure 1).

4. Discussion

ICSI is mainly used for severe male infertility (Palermo et al., 1992). Some studies have indicated that employing ICSI can increase the rate of pregnancy in infertile individuals with female factors (Khamsi et al., 2001). ICSI is more prevalently applied in individuals with impaired semen parameters (Jain & Gupta 2007); nevertheless, whether ICSI can replace IVF in female infertility remains controversial (American Society for Reproductive Medicine, 2012). According to the current study results, the pregnancy rate in different causes of infertility was not significant concerning ICSI and IVF approaches. But in the ovary, tubal, and unexplained infertility, IVF-induced fertilization rate was more than that of ICSI (5.33, 7.83, 3.75 in IVF group vs. 3.6, 4.0, 3.5 in ICSI group, respectively).

Moreover, in asthenospermia and oligoasthenospermia, the ICSI-generated fertilization rate was higher than that of IVF (4.68, 4.68 in the ICSI group vs. 4.62, 4.5 in the IVF group). Kim et al. suggested no difference in implantation and fertilization rates between the IVF and ICSI procedures (Kim et al., 2007). The same results were observed by Xi and associates (Xi et al., 2012). Consistent with our study, Bhattacharya et al. argued that ICSI is only more effective for severe male infertility and it has no better effect on female infertility than IVF (Bhattacharya et al., 2001). Contrary to our study, Eftekhar et al. reported that the rate of fertilization and implantation in IVF was higher than that of ICSI (Eftekhar et al., 2012).

IVF is a suitable treatment for patients with fallopian tube disorder; it has also been used to treat male infertility (Aboulghar et al., 1996). Regarding the tubal factor, our results indicated a significant difference in the fertility rate between the two methods (7.83 in IVF vs. 4.0 in ICSI) (P=0.018); accordingly, the fertility rate in the IVF method was significantly higher than that of ICSI in the tubal factor. Okohue et al. stated that the fertilization rate in the tubal infertility was higher than that of Polycystic Ovary Syndrome (PCOS), i.e. 81.48%, compared to 63.24% for PCOS (P<0.0001) (Okohue et al., 2013). Borges et al. documented no difference in pregnancy outcomes between male infertility and tubal infertility; it was also reported that ICSI leads to better results in male factors (Borges Jr et al., 2017). Aboulghar et al. indicated a significant difference in egg fertilization rate between IVF and ICSI methods in patients with borderline semen. In other words, it was higher in ICSI, compared to IVF (59% vs. 27%) (Aboulghar et al., 1996).

Sperm motility plays an essential role in pregnancy (Sati & Huszar 2015). According to the obtained data, there was no significant difference in the faults of sperm and the result of the explored methods (IVF/ICSI). Nilgun Turhan

et al. demonstrated that the severe defect of sperm motility in oligospermia does not prevent fertilization in ICSI; however, the success rate of ICSI may be affected by progressive sperm motility. They stated that in individuals with >10% sperm motility, pregnancy odds are higher (Turhan et al., 2011). According to our study findings, there was a statistically significant difference between the 4 investigated methods. In the FT method, pregnancy rate was higher than that of the other methods (P<0.001); this difference was found in all the causes of infertility.

With the development of ART, embryo-freezing technology has become an essential part of IVF and ICSI approaches (Wong et al., 2014). This is because cryopreservation and verification technology have greatly improved the conventional freezing technology (Rienzi et al., 2017). Furthermore, FT embryo transfer can achieve the same or even better results, compared to novel embryo transfer in types of infertility (Roque et al., 2015). In a study, the pregnancy rate in frozen samples was higher than that of fresh samples (Aflatoonian et al., 2010). Takeshima et al. suggested a pregnancy rate of 24% for fresh IVF-ET (In Vitro Fertilization and Embryo Transfer) cycles, 20% for fresh ICSI cycles, and 32% for frozen embryos transfer cycles (Takeshima et al., 2014).

The current research results can be a guide for selecting the best method of ART per fertility disorder and avoid the cost and waste of time for pregnancy.

This study was conducted at the Kerman Infertility Center by assessing the couples' records. The study sample size was small, i.e. because of incomplete records. Due to the small sample size, we received assistance from a statistician and attempted to use the best tests to lessen errors concerning the results.

5. Conclusion

The present study results revealed that in the FT method, the pregnancy rate was higher than that of the other methods; this discrepancy was found in all causes of infertility. The overall fertility rate in IVF and ICSI methods was not significantly different. However, there was a significant difference in the fertility rate in ICSI and IVF approaches between the two groups due to tubal infertility; the fertility rate in the IVF method was significantly higher than that of the ICSI.

Ethical Considerations

Compliance with ethical guidelines

Ethics approval was obtained from Kerman University of Medical Sciences (Code: IR.KMU.REC.1396.2342) on 2018/7/27. The anonymity of the samples was observed.

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This study is based on a research plan approved at Kerman University of Medical Sciences and the design code is 196000719.

Authors' contributions

Conceptualization: All authors; Methodology, writing - original draft, and supervision: Zeinab Hajaliakbari; Investigation: Zeinab Hajaliakbari, Faezeh Kashi; Writing - review and editing: Zeinab Hajaliakbari and Milad Ahmadi.

Conflict of interest

The authors declared no conflict of interest.

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