ISSN: 2091-2331 (Print) 2091-234X (Online)

Journal of Nobel Medical College

Volume 14, Number 02, Issue 27, July-December 2025, 96-100

Original Article

Predictor of Outcome Among Patients with Infertility Undergoing In-Vitro fertilization /Intracytoplasmic Sperm Insemination

Miluna Bhusal, Shanti Subedi, Rupam Sah

Department of Obstetrics and Gynecology, Nobel Medical College Teaching Hospital, Biratnagar, Nepal

Article Received: 5th August, 2025; Accepted: 13th October, 2025; Published: 31st December, 2025

DOI: https://doi.org/10.3126/jonmc.v14i2.88111

Abstract

Background

Infertility is a prevalent global health concern arising from diverse etiologies, including hormonal imbalances, reproductive system disorders, lifestyle factors, genetic abnormalities, and age-related declines in reproductive capacity. In vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) remain cornerstone therapeutic interventions for couples experiencing reproductive difficulties.

Materials and Methods

A two years cross-sectional study was conducted to evaluate the underlying causes of infertility and to analyze treatment outcomes including success rates, pregnancy outcomes, and associated clinical factors among patients undergoing in vitro fertilization and intracytoplasmic sperm injection at the Nobel IVF Centre.

Results

The study enrolled 126 patients, comprising 77 in the IVF group and 49 in the ICSI group. The mean (SD) age of participants was 33.45 ± 6.01 years, and the median (IQR) age was 34 (29–38) years. Patients were categorized according to the underlying cause of infertility, including tubal factor infertility, diminished ovarian reserve based on Anti-Müllerian Hormone (AMH) levels, polycystic ovary syndrome (PCOS), oligospermia, asthenospermia, unexplained infertility, and combined etiologies. Pregnancy-related outcomes, including implantation rates and neonatal results, were systematically documented.

Conclusion

Higher pregnancy success rates were significantly associated with younger maternal age (<35 years). IVF demonstrated particularly favorable outcomes in cases of unexplained infertility and tubal factor infertility, whereas ICSI yielded superior results in male-factor infertility. Across all treatment groups, embryo quality remained a key determinant of implantation success.

Keywords: *Infertility, Intracytoplasmic Sperm Injection, In-Vitro Fertilization*

***Corresponding Author:**
Dr. Miluna Bhusal
Lecturer
Email: drmilunabhusal10@gmail.com
ORCID: https://orcid.org/0009-0003-2713-8229

Citation
Bhusal M, Subedi S, Sah R, Predictor of Outcome Among Patients with Infertility Undergoing In-Vitro fertilization /Intracytoplasmic Sperm Insemination, JoNMC. 14:2 (2025) 96-100. DOI: https://doi.org/10.3126/jonmc.v14i2.88111

Introduction

Infertility, affecting approximately 10–15% of couples worldwide, represents a significant public health concern. Beyond its physical implications, infertility can adversely impact emotional well-being and interpersonal relationships. Assisted reproductive technologies (ART), including in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), have become primary interventions for couples facing reproductive challenges, improving the likelihood of conception. Delayed childbearing contributes to infertility, primarily due to the natural decline in ovarian reserve with advancing maternal age [1–3].

Despite advances in ART, success rates remain variable, influenced by factors such as female age, ovarian reserve, semen quality, embryo quality, and the underlying cause of infertility [4]. Region-specific data from Nepal are limited, and patient profiles at tertiary centres such as Nobel IVF Centre may differ from global patterns. Identifying predictors of ART success is therefore crucial for optimizing outcomes and providing personalized patient care.

This study aims to evaluate predictors of IVF and ICSI success among patients at Nobel IVF Centre, with a focus on demographic characteristics, ovarian reserve markers (AMH), semen and ovum quality, embryo grading, and infertility etiology, to inform treatment strategies and improve pregnancy outcomes.

Materials and Methods

This cross-sectional study evaluated predictors of treatment outcomes among 126 patients undergoing in vitro fertilization (IVF; n=77) or intracytoplasmic sperm injection (ICSI; n=49) at the Nobel IVF Centre, Biratnagar, Nepal, over two years (Kartik 2078 to Kartik 2080; October 2021–October 2023). Ethical approval was obtained from the Institutional Review Committee of Nobel Medical College Teaching Hospital (Reference No. 832/2023). The sample size was calculated using the formula, $n = Z^2 \times p \times q / e^2$ [where, n = minimum required sample size, Z = 1.96 at 95% confidence interval, p = estimated prevalence 15% [1], $q = 1 - p$, e = margin of error (10%)] and hence calculated as 49. However, the study included all 126 eligible participants to increase statistical power.

Eligible participants were women aged 18–45 years undergoing their first assisted reproductive technology (ART) cycle. Patients with severe systemic illness, known genetic disorders, or incomplete medical records were excluded. Convenience sampling was used, and all consecutive eligible cases during the study period were included.

Descriptive statistics were used to summarize baseline characteristics and treatment outcomes. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution. Categorical variables were presented as frequencies and percentages. Between-group comparisons (IVF vs. ICSI) for categorical outcomes were conducted using the chi-square (χ^2) test or Fisher's exact test, as appropriate. A two-tailed p-value <0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics version 27.

Results

Among the 126 patients who underwent assisted reproductive treatment, 77 (61%) received IVF and 49 (39%) underwent ICSI. Descriptive characteristics of the study population are given in Table 1. The majority of treatment cycles were performed using patients' own oocytes. Overall, 79.4% of cycles relied on self-oocytes, whereas 20.6% utilized donor oocytes. This distribution highlights a predominant preference for autologous oocyte use. It also reflects the clinical tendency to reserve donor oocytes for selected indications.

Table 1: Clinical Characteristics of the study population

Process in 126 cases	Number (%)	Baby outcome in 126 cases	Number (%)
IVF	77 (61.1)	Male	23 (17.6)
ICSI	49 (38.9)	Female	24 (19.2)
Ovum factor in 126 cases		Twins	10 (8.0)
Own	100 (79.4)	Baby outcome pending	1 (0.8)
Donor	26 (20.6)	No outcome (abortion)	8 (6.4)
Pregnancy result in 126 cases		No outcome (biochemical pregnancy)	3 (2.4)
Positive	69 (54.8)	Negative pregnancy	57 (45.6)
Negative	57 (45.2)	**Cause of infertility in 126 cases**	**Number (%)**
Pregnancy outcome n 126 cases		Tubal factor	2 (1.6)
Delivered	54 (42.9)	Poor ovarian reserve	50 (40.0)
Abortion	9 (7.1)	Oligospermia	19 (15.2)
Biochemical pregnancy	4 (3.2)	Asthenospermia	4 (3.2)
Pending	1 (0.8)	PCOS	17 (13.6)
Negative pregnancy	58 (46.0)	Unknown	23 (17.6)
		Combined	11 (8.8)
Age (years) n 126 cases			
Mean ± SD		33.45 ± 6.01	
Median (IQR)		34 (29, 38)	

The distribution of infertility etiologies in our cohort revealed that poor ovarian reserve was the predominant factor, accounting for 40% of cases, followed by unexplained infertility (17.6%)

and male-factor abnormalities such as oligospermia (15.2%) and asthenospermia (3.2%). Among female-related causes, polycystic ovary syndrome (13.6%) also represented a substantial proportion, while combined male–female factor infertility comprised 8.8% of cases. Tubal pathology was comparatively rare, contributing only 1.6% to the overall etiology. Collectively, these findings highlight a clear predominance of female-factor infertility, especially diminished ovarian reserve and PCOS. The overall clinical pregnancy rate of 54.8% indicates a moderately high success rate within this mixed cohort of IVF and ICSI cycles. Furthermore, a live birth (take-home baby) rate of 42.9% was achieved, accompanied by a miscarriage rate of 7.1%, a biochemical pregnancy rate of 3.2%, and a twin pregnancy rate of 8%, underscoring favorable clinical outcomes consistent with contemporary assisted reproductive technology benchmarks. Clinical characteristics of the study population is given in Table 2.

Table 2: Comparison between Patients under gone IVF Vs ICSI

Parameters	IVF (N=77)		ICSI (N=49)		P - value
	n	%	n	%	
Ovum factor:					
Own	60	77.9	40	81.6	0.61
Donor	17	22.1	9	18.4	
Causes of Infertility:					
Tubal factor	0	-	2	4.1	
Poor Ovarian Reserve	40	52.6	10	20.4	
Oligospermia	1	1.3	18	36.7	
Asthenospermia	0	-	4	8.2	-
PCOS	15	19.7	2	4.1	
Unknown	20	26.3	2	4.1	
Combined	0	-	11	22.4	
Pregnancy result:					
Positive	44	57.1	25	51.0	0.50
Negative	33	42.9	24	49.0	
Pregnancy outcome:					
Delivered	34	44.2	20	40.8	
Abortion	7	9.1	2	4.1	
Biochemical	3	3.9	1	2.0	0.48
Negative	33	42.9	25	51.0	
Pending	0	-	1	2.0	
Baby outcome:					
Male	17	22.1	5	10.4	
Female	13	16.9	11	22.9	0.25
Twins	5	6.5	5	10.4	
Age (mean ± SD)	33.62 ± 6.39		33.18 ± 5.42		0.69

The IVF group demonstrated comparatively superior clinical outcomes, with higher positive pregnancy rates (57% vs. 51%) and live birth rates (44.2% vs. 40.8%) than the ICSI group. Etiological profiles differed markedly: male-factor infertility predominated in the ICSI cohort, particularly oligospermia (36.7%) and asthenospermia (8.2%), whereas tubal-factor infertility was minimally represented (2.4%). Poor ovarian reserve was observed in both groups, though more frequently in IVF (52.6% vs. 20.4%).

Most cycles employed autologous oocytes (IVF 77.9%, ICSI 82.6%), with donor oocyte use slightly higher in IVF (22.1% vs. 18.4%). Neonatal outcomes indicated that IVF resulted in a higher proportion of male infants and twin gestations, whereas ICSI yielded more female infants (23%) and fewer twin pregnancies.

Overall, these findings suggest that although IVF is associated with higher success rates across several clinical endpoints, ICSI remains indispensable for managing male-factor infertility. The elevated twin rate in IVF may reflect variation in embryo transfer practices.

Delivery rates were higher in the IVF cohort, while negative pregnancy outcomes were more frequent in ICSI. Abortion and biochemical pregnancy rates were comparable between groups. Consistent with clinical indications, ICSI was predominantly used for male-factor infertility, whereas IVF was more often associated with female-factor etiologies such as poor ovarian reserve and PCOS.

Discussion

Patient age is widely regarded as the strongest predictor of clinical pregnancy outcomes. Nonetheless, several hormonal biomarkers offer additional insights into oocyte quantity across different age groups [1]. Our study also showed higher pregnancy success rates were significantly associated with younger maternal age (<35 years). Follicle-stimulating hormone (FSH) levels typically increase with advancing age, whereas anti-Müllerian hormone (AMH) levels decline. AMH demonstrates a strong correlation with other indicators of ovarian reserve [3]. Cai et al. (2011) reported that the likelihood of conception following a completed treatment cycle progressively declines with increasing maternal age, with a particularly pronounced decrease after age 35. This decline mirrors the reduction in both total embryo number and good-quality embryos observed beyond this age. These findings suggest that the age-related decrease in IVF success is primarily driven by a diminishing ovarian reserve, characterized by reductions in both oocyte quantity and quality [5].

In our study we did not find any association between male or female BMI in ART outcome. Schliep et al., in a prospective cohort study, found no association between male or female BMI and fertilization rate, pregnancy rate, or live birth in

IVF cycles [6]. However, several published studies have reported significant associations between female BMI and ART outcomes [7–9]. The duration of infertility also exerts a moderate influence on IVF outcomes [10–12]. This highlights the need for individualized patient counselling and carefully tailored treatment strategies to optimize success rates. The benefit plateaued between 15 and 20 oocytes and gradually declined thereafter, emphasizing the importance of balanced ovarian stimulation to maximize success while minimizing risks associated with excessive response [13].

A history of prior pregnancy particularly one conceived through IVF is a strong predictor of success in subsequent IVF cycles. Importantly, this beneficial effect persists regardless of whether the previous pregnancy resulted in a live birth or miscarriage [14]. Our study also found higher rate of multiple pregnancies and higher rate of caesarean delivery. Thompson et al. [15] reported that pregnancies conceived through assisted reproductive technology (ART) carry a twofold increased risk of caesarean delivery compared with spontaneously conceived pregnancies. Similarly, analysis of the Canadian Assisted Reproductive Technologies Register by Gunby et al. [16] found that the rate of multiple pregnancies with IVF approaches 30%. Fechner et al. have suggested that elevated production of steroid hormones and peptide proteins during ovarian stimulation may contribute to the increased risk of preterm birth. Supporting this, a meta-analysis reported that singleton pregnancies conceived through IVF/ICSI after single or double embryo transfer are 1.8–2.1 times more likely to result in preterm delivery compared with naturally conceived pregnancies [17].

This study has several limitations. First, the relatively small sample size restricts the strength of causal inferences. Second, the study population was derived from a single centre, which may limit the generalizability of the findings. Third, outcomes were not stratified by stimulation protocols or embryo-transfer practices, both of which could have influenced the observed results. Finally, potential confounders such as lifestyle characteristics and genetic predispositions were not captured and may have affected the analyses.

Conclusion

In our study, Higher pregnancy success rates were significantly associated with younger maternal age (<35 years). IVF demonstrated a more favorable overall clinical outcome than ICSI. Positive pregnancy rates and live birth rates were higher in the IVF group, although these differences did not reach statistical significance. The distribution of infertility etiologies varied markedly across the study population. This variation strongly influenced the selection of treatment modality. Overall, the findings highlight the importance of individualized, etiology-based decision-making in assisted reproductive treatments.

Acknowledgement: None

Conflict of interest: None

References

[1] Tehraninezhad ES, Mehrabi F, Taati R, Kalantar V, Aziminekoo E, Tarafdari A, Analysis of ovarian reserve markers (AMH, FSH, AFC) in different age strata in IVF/ICSI patients, Int J Reprod Biomed. 4:8 (2016) 501-6. PMID: 27679824.

[2] Barbakadze L, Kristesashvili J, Khonelidze N, Tsagareishvili G, The correlations of anti-mullerian hormone, follicle-stimulating hormone and antral follicle count in different age groups of infertile women, Int J Fertil Steril. 8:4 (2015) 393-8. DOI: 10.22074/ijfs.2015.4179. PMID: 25780521.

[3] Somigliana E, Berlanda N, Benaglia L, Viganò P, Vercellini P, Fedele L, Surgical excision of endometriomas and ovarian reserve: a systematic review on serum antimüllerian hormone level modifications, Fertil Steril. 98:6 (2012) 1531-8. DOI: 10.1016/j.fertnstert.2012.08.009 . PMID: 22975114.

[4] Chen Y, Pei H, Chang Y, Chen M, Wang H, Xie H, et al, The impact of endometrioma and laparoscopic cystectomy on ovarian reserve and the exploration of related factors assessed by serum anti-Mullerian hormone: a prospective cohort study, J Ovarian Res. 7:108 (2014). DOI: 10.1186/s13048-014-0108-0. PMID: 25424986.

[5] Cai QF, Wan F, Huang R, Zhang HW, Factors predicting the cumulative outcome of IVF/ICSI treatment: a multivariable analysis of 2450 patients, Hum Reprod. 26:9 (2011) 2532-40. DOI: 10.1093/humrep/der228. PMID: 21771773.

[6] Schliep KC, Mumford SL, Ahrens KA, Hotaling JM, Carrell DT, Link M, et al., Effect of male and female body mass index on pregnancy and live birth success after in vitro fertilization, Fertil Steril. 103:2 (2015) 388-95. DOI: 10.1016/j.fertnstert.2014.10.048. PMID: 25497445.

[7] MacHtinger R, Combelles CM, Missmer SA, Correia KF, Fox JH, Racowsky C, The association between severe obesity and characteristics of failed fertilized oocytes, Hum Reprod. 27:11 (2012) 3198-207. DOI: 10.1093/humrep/des308.PMID: 22968161.

[8] Moragianni VA, Jones SM, Ryley DA, The effect of body mass index on the outcomes of first assisted reproductive technology cycles, Fertil Steril. 98:1 (2012) 102-8. DOI: 10.1016/j.fertnstert.2012.04.004. PMID: 22584023.

[9] Zhang JJ, Feret M, Chang L, Yang M, Merhi Z, Obesity adversely impacts the number and maturity of oocytes in conventional IVF not in minimal stimulation IVF, Gynecol Endocrinol. 31:5 (2015) 409-13. DOI:

10.3109/09513590.2015.1014785. PMID: 25856299.
[10] Gong X, Zhang Y, Zhu Y, Wang P, Wang Z, Liu C, et al., Development and validation of a live birth prediction model for expected poor ovarian response patients during IVF/ICSI, Front Endocrinol (Lausanne). 31:14 (2023) 1027805. DOI: 10.3389/fendo.2023.1027805. PMID: 36798666.
[11] Templeton A, Morris JK, Parslow W, Factors that affect outcome of in-vitro fertilization treatment, Lancet. 348:9034 (1996) 1402-6. DOI: 10.1016/S0140-6736(96)05291-9.PMID: 8937279.
[12] McLernon DJ, Te Velde ER, Steyerberg EW, Mol BW, Bhattacharya S, Clinical prediction models to inform individualized decision-making in subfertile couples: a stratified medicine approach, Hum Reprod. 29:9 (2014) 1851-8. DOI: 10.1093/humrep/deu173.PMID: 25061025.
[13] Sunkara SK, Rittenberg V, Raine-Fenning N, Bhattacharya S, Zamora J, Coomarasamy A, Association between the number of eggs and live birth in IVF treatment: an analysis of 400,135 treatment cycles, Hum Reprod. 26:7 (2011) 1768-74. DOI: 10.1093/humrep/der106.PMID: 21558332.
[14] Shingshetty L, Cameron NJ, McLernon DJ, Bhattacharya S, Predictors of success after in vitro fertilization, Fertil Steril. 121:5 (2024) 742-51. DOI: 10.1016/j.fertnstert.2024.03.003. PMID: 38492930.
[15] Thomson F, Shanbhag S, Templeton A, Bhattacharya S, Obstetric outcome in women with subfertility, BJOG. 112:5 (2005) 632-7. DOI: 10.1111/j.1471-0528.2004. 00489.x.PMID: 15842289.
[16] Gunby J, Bissonnette F, Librach C, Cowan L, Assisted reproductive technologies (ART) in Canada: 2007 results from the Canadian ART Register, Fertil Steril.95:2 (2011) 542-7. DOI: 10.1016/j.chroma. 2010.07.013.PMID: 20688333.
[17] Fechner AJ, Brown KR, Onwubalili N, Jindal SK, Weiss G, Goldsmith LT, et al., Effect of single embryo transfer on the risk of preterm birth associated with in vitro fertilization, J Assist Reprod Genet. 32:2 (2015) 221-4. DOI: 10.1007/s10815-014-0381-2.PMID: 25374396.