Attrition rates of in vitro fertilization in patients with male factor infertility using testicular sperm

SiWon Lee, M.D.,[a] Lauren M. Kendall Rauchfuss, M.D.,[a] Sevann Helo, M.D.,[b] Alessandra J. Ainsworth, M.D., M.S.,[a] Samir Babayev, M.D.,[a,c] and Chandra C. Paff Shenoy, M.D.[a]

[a] Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Mayo Clinic, Rochester, Minnesota; [b] Department of Urology, Mayo Clinic, Rochester, Minnesota; and [c] Karabakh University, Khankendi, Azerbaijan

Objective: To assess the oocyte to blastocyst attrition rate in patients undergoing in vitro fertilization (IVF) with male factor infertility (MFI) using testicular sperm.
Design: Retrospective cohort study.
Subjects: Patients who underwent IVF using testicular sperm for MFI between January 1, 2017, and March 23, 2023.
Intervention: Testicular sperm extraction (TESE) with intracytoplasmic sperm injection.
Main Outcome Measures: The fertilization and blastulation outcomes.
Results: A total of 120 IVF cycles using testicular sperm were identified. For comparison, 122 IVF cycles in patients with unexplained infertility who had normal semen analysis and used ejaculated sperm for intracytoplasmic sperm injection were reviewed as a control group. Testicular sperm cycles were further grouped by prognosis on the basis of the indication for TESE: good prognosis (n = 42, obstructive azoospermia); moderate prognosis (n = 67, increased deoxyribonucleic acid fragmentation, prior failed IVF, and recurrent pregnancy loss); and poor prognosis (n = 11, cryptozoospermia or nonobstructive azoospermia). Female baseline characteristics were similar among the groups except for body mass index. The fertilization rate was lower in all TESE groups than in the control group; however, no differences in fertilization rates were noted within the TESE groups (good vs. moderate vs. poor). The blastulation rates were similar between the good-prognosis TESE and control groups. However, the moderate- and poor-prognosis TESE groups had lower blastulation rates than the control group.
Conclusion: This model may help practitioners counsel patients with MFI using testicular sperm to appropriately set expectations for blastocyst outcomes on the basis of the diagnosis. (F S Rep® 2025;6:31–8. ©2024 by American Society for Reproductive Medicine.)

Key Words: Male factor infertility, fertilization rate, blastulation rate, testicular sperm (TESE)

Male factor infertility (MFI) accounts for 50% of couples with infertility. Risk factors for MFI include reduced semen quantity and/or quality because of impairments in the hypothalamic-pituitary axis, congenital or acquired anomalies of the male genital tract, and genetic conditions (i.e., Klinefelter syndrome, Y chromosomal microdeletion, and CFTR gene mutation) (1). Azoospermia is defined as the absence of identifiable sperm in the ejaculate and is classified as the most severe form of MFI, accounting for up to 10%–20% of MFI. Azoospermia is broadly categorized as obstructive and nonobstructive azoospermia (NOA), with NOA accounting for 60% of all azoospermia cases (2). Before 1995, donor sperm was the only option for the treatment of severe MFI, specifically NOA. However, the introduction of testicular sperm extraction (TESE) in conjunction with in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) has provided opportunities for patients with severe MFI to become biologic fathers (3–5). Since then, TESE with ICSI has become a viable option for patients with severe MFI. More recently, TESE with ICSI has also been used for nonazospermic men to find higher quality sperm with less deoxyribonucleic acid (DNA) fragmentation.

Current sperm collection methods for use in IVF include ejaculated sperm, TESE, microdissection TESE (micro-TESE), testicular sperm aspiration, microepididymal sperm aspiration, and percutaneous epididymal sperm aspiration. Historically, most patients with mild MFI have used ejaculated sperm as the initial method of sperm collection for assisted reproductive technology (ART). However, in recent years,

Received July 1, 2024; revised November 16, 2024; accepted November 19, 2024.
Correspondence: SiWon Lee, M.D., Ph.D., Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Mayo Clinic, 200 First Street SW, Rochester, Minnesota 55905 (E-mail: SiWonLee.MD@gmail.com).

F S Rep® Vol. 6, No. 1, March 2025 2666-3341

https://doi.org/10.1016/j.xfre.2024.11.007

several studies have recommended the use of TESE sperm to mitigate the risk of damage from oxidative stress during sperm transit from the testicle to the ejaculate (6, 7). There are no clear guidelines supporting the use of ejaculated vs. surgically retrieved sperm in patients with oligospermia. Providers may still prefer the use of ejaculated sperm when possible because of the risks and sperm retrieval rates associated with various sperm retrieval techniques (8–10).

During the ART cycle, there is anticipated attrition of viable embryos at each step. Typically, 70%–75% of the retrieved oocytes are mature and can be inseminated with sperm. Of those, approximately 70% fertilize successfully to become an embryo (11). Because not all fertilized embryos become good-quality blastocysts, the ability to predict the number of good-quality blastocysts during an IVF cycle is vital in patient counseling and may aid in decision-making regarding the choice for the use of autologous or donor sperm and the number of cycles that may be needed to achieve desired family size. The effect of severe MFI on blastulation rate in IVF is poorly understood. Although some studies show that severe MFI negatively affects both fertilization and blastulation rates, others have found no effect. Similarly, data on sperm source (ejaculate vs. testicular vs. epididymal and fresh vs. frozen) are mixed (12–14).

The aim of this study was to assess the oocyte to blastocyst attrition rate in patients undergoing IVF with MFI using testicular sperm. We hypothesized that the patients who used TESE would be associated with higher attrition rates and worse IVF outcomes.

MATERIALS AND METHODS

Study design and participants

This study was deemed exempt by our institutional review board, and patients were identified retrospectively from our clinical database, which includes all ART cycles completed at our institution. We completed a retrospective chart review of all patients who underwent IVF cycle at our academic medical center from January 1, 2017, to March 23, 2023. Couples with a female partner aged 18–44 years, either with MFI using testicular sperm or with unexplained infertility, were included and compared; our study group comprised those who used TESE or microTESE sperm with ICSI for IVF, whereas those with unexplained infertility used fresh or frozen ejaculated sperm for ICSI. We excluded patients undergoing oocyte cryopreservation for deferred reproduction, those who used donor sperm, those who used conventional insemination, and those who underwent cleavage-stage embryo transfer. Patients who declined chart use for research purposes were also excluded.

Couples who used testicular sperm were further classified into 3 groups according to prognosis and indication for TESE on the basis of prior studies (15, 16). The good-prognosis group included patients diagnosed with obstructive azoospermia. The moderate-prognosis group included patients who underwent surgical sperm extraction on the basis of increased DNA fragmentation (severe oligospermia or partner diagnosis of recurrent pregnancy loss) or prior failed IVF (e.g., poor fertilization, poor blastulation with the presence of MFI, or anejaculation because of spinal cord injury) (17, 18). Finally, the poor-prognosis group consisted of patients with cryptozoospermia (defined as the presence of isolated sperm cells in the ejaculate only identified after an extended microscopic search or after being pelleted) or NOA. We assessed the fertilization rate (i.e., number of fertilized oocytes/number of inseminated oocytes) and blastulation rate (i.e., number of blastocysts obtained/number of fertilized oocytes) for all groups.

Surgical sperm extraction and insemination techniques

Conventional TESE and microTESE were performed using the technique in the Department of Urology as described previously (19). After obtaining 5 × 5-mm–sized single or multiple specimens, the specimen was placed in Sperm Washing Medium with Human Serum Albumin and pentoxifylline (SWM-P, a motility stimulant). In the laboratory, for processing, the tubules were dissected and rinsed in fresh media and further emulsified to release mature sperm from the tightly packed Leydig and Sertoli cells. After removing the cellular solution with the emulsified tubules, the remaining solution was centrifuged, resuspended, incubated, and centrifuged again to obtain a 0.2-mL pellet. Approximately 20 μL from the pellet was distributed across an elongated droplet of SWM-P under oil to search for motile or twitching sperm, which were then collected using an ICSI needle, immobilized by breaking the tail membrane, and rinsed through 3 droplets of a 10% polyvinylpyrrolidone solution to remove any residual pentoxifylline. This immobilized sperm were used for ICSI.

Statistical analysis

Descriptive statistics were calculated for all variables. For continuous variables, data were compared between groups using analysis of variance and post hoc pairwise analyses and were presented as means (standard deviations) or medians (interquartile ranges). For categorical variables, data were compared using the chi-square test or Fisher exact test and were presented as counts and percentages. Bonferroni correction was used to adjust for multiple comparisons. To compare the mean fertilization and blastulation rates across the groups while adjusting for potential confounding factors, analysis of covariance was conducted. Statistical significance was set at a P value of $< .05$, and all tests were 2-sided. All statistical analyses were performed using BlueSky Statistics software version 10.3.1-Pro and SPSS version 29.0 (IBM Corp., Armonk, NY).

RESULTS

We analyzed 205 couples (91 couples in the TESE group and 114 couples in the control group) who underwent 242 cycles (120 IVF cycles in the TESE group and 122 IVF cycles in the control group). Of those using testicular sperm, 42 cycles were subcategorized as good prognosis, 67 as moderate prognosis, and 11 as poor prognosis on the basis of the indications for TESE. The baseline characteristics of the study groups are presented in Table 1. Statistically significant differences were

TABLE 1

Patient demographics and clinical characteristics.

Characteristic	Prognostic groups				
	Good (N = 42)	Moderate (N = 67)	Poor (N = 11)	Control (N = 122)	*P* value[a]
Female					
Age, y	33.9 (4.7)	33.1 (3.9)	31.8 (3.7)	33.2 (3.9)	.485
BMI, kg/m^2	25.7 (4.9)	28.9 (7.2)	29.2 (4.1)	26.4 (5.5)	.008[b]
AMH, ng/mL	3.9 (2.7)	3.9 (3.2)	3.4 (2.2)	3.5 (2.5)	.758
AFC, n (%)	23.0 (12.6)	22.7 (11.4)	19.0 (10.9)	20.6 (10.4)	.445
PGT, n (%)	5 (11.9)	12 (17.9)	0 (0.0)	1 (0.8)	< .001[b]
Male					
Age, y	43.0 (10.4)	35.7 (5.1)	32.5 (4.5)	34.8 (5.3)	< .001[b]
BMI, kg/m^2	28.5 (6.2)	30.7 (6.4)	32.7 (4.1)	30.0 (7.0)	.194
Fresh sperm, n (%)	2 (4.8)	14 (20.9)	5 (45.5)	121 (99.2)	< .001[b]
MicroTESE, n (%)	0 (0.0)	0 (0.0)	10 (90.9)	0 (0.0)	
TMS, million motile per Ejaculate	0 (0–0)	1.5 (0.3–14.0)	0 (0–0.1)	99.8 (53.7–174.3)	< .001[b]
Motility, %	5.0 (11.6)	28.3 (20.1)	1.5 (2.3)	61.3 (15.7)	< .001[b]
Strict morphology, %	0 (0–0)	2.8 (0.5–6.9)	0 (0–0)	7.3 (5.0–11.0)	< .001[b]
Total testosterone, ng/dl	377.5 (185.5)	448.5 (219.6)	354.9 (132.7)		.166
Testosterone level < 300 ng/dL, n(%)	10/30 (33.3)	19/62 (30.6)	6/11 (54.5)		.303
FSH, IU/L	5.3 (2.5)	8.2 (9.7)	18.4 (12.0)		< .001[b]
LH, IU/L	4.8 (2.0)	5.4 (2.5)	9.8 (5.5)		< .001[b]
Abnormal FSH or LH, n (%)	1/29 (3.4)	12/66 (18.2)	7/11 (63.6)		< .001[b]
Right testicular volume, mL	16.9 (3.5)	15.6 (4.3)	11.5 (5.0)		< .001[b]
Left testicular volume, mL	15.6 (4.2)	15.8 (5.0)	9.7 (5.0)		< .001[b]
Low testicular volume ≤ 12 mL, n(%)	5/39 (12.8)	13/61 (21.3)	7/11 (63.6)		.002[b]
Prior treatment with clomiphene or hCG before TESE, n (%)	4 (9.5)	37 (55.2)	8 (72.7)		< .001[b]

Note: Data represent means (SDs) or medians (IQRs) unless otherwise specified. Only patients with available laboratory results and testicular volume data were included in the analysis. AMH = antimüllerian hormone; AFC = antral follicle count; BMI = body mass index; FSH = follicle-stimulating hormone; hCG = human chorionic gonadotropin; IQR = interquartile range (25th and 75th percentiles); LH = luteinizing hormone; PGT = preimplantation genetic testing; SD = standard deviation; TESE = testicular sperm extraction; TMS = total motile sperm.

[a] Comparisons between the groups were performed using analysis of variance for the continuous variables and the chi-square or Fisher exact test for categorical variables.

[b] A *P* value < .05 was considered statistically significant.

Lee. IVF attrition rates using TESE. F S Rep 2025.

noted for female body mass index (BMI) and male age; however, there were no differences in female age, male BMI, antimüllerian hormone level, and antral follicle count among the groups. As expected, sperm parameters were significantly worse in the testicular sperm group than those in the control group (Table 1).

Nearly all (99.3%) of the couples in the control group used fresh ejaculated sperm. In the TESE group, there was a mix of fresh and frozen testicular sperm. The use of fresh testicular sperm was lowest in the good-prognosis group, and the use of fresh sperm was higher in the moderate- and poor-prognosis groups (4.8% vs. 20.9% vs. 45.5%, respectively; $P<.001$; Table 1). Within the TESE group, we had 20 patients who used fresh sperm and 100 patients who used frozen sperm. There were no differences between the groups with regard to fertilization rate (48.7 ± 21.2% vs. 54.9 ± 18.7%, $P=.186$) and blastulation rate (30.1 ± 20.9% vs. 39.5 ± 25.4%, $P=.143$; Table 2).

A total of 27 patients (18.7%) were excluded from the study because of cleavage-stage embryo transfer, comprising 11 patients from the good-prognosis group, 9 from the moderate-prognosis group, and 7 from the poor-prognosis group. Additionally, 27 patients from the unexplained infertility group were excluded because they used conventional insemination instead of ICSI.

Laboratory findings and other clinical characteristics of male patients who underwent TESE are also presented in Table 1. Although no significant differences were observed in the total testosterone levels across the groups, the poor-prognosis group exhibited higher levels of follicle-stimulating hormone (FSH) and luteinizing hormone (LH). Similarly, a higher proportion of patients in the poor-prognosis group had a lower testicular volume and received treatment with clomiphene or human chorionic gonadotropin before undergoing TESE.

Table 3 shows IVF cycle outcomes stratified according to indication for TESE. There was no difference in the total number of oocytes retrieved or the number of mature oocytes. However, the number of pronuclear-stage embryos created, mean fertilization rate, number of blastocysts, and mean blas-

TABLE 2

Fertilization and blastulation rates on the basis of male laboratory values, testicular volume, use of fresh or frozen testicular sperm, and prior treatment.

Testosterone levels	**Normal (N = 68)**	**Low (N = 35)**	***P* value[a]**
Fertilization rate, %	53.5 (17.5)	55.0 (23.0)	.716
Blastulation rate, %	37.9 (22.4)	34.6 (26.4)	.515
FSH and LH levels	**Normal (N = 86)**	**Abnormal (N = 20)**	***P* value[a]**
Fertilization rate, %	53.5 (20.6)	56.2 (14.1)	.583
Blastulation rate, %	39.0 (24.7)	33.3 (23.6)	.353
Testicular volume	**Normal (N = 86)**	**Abnormal (N = 25)**	***P* value[a]**
Fertilization rate, %	54.3 (19.2)	52.2 (20.8)	.636
Blastulation rate, %	42.4 (28.8)	37.7 (22.6)	.285
Use of fresh or frozen sperm	**Fresh (N = 20)**	**Frozen (N = 100)**	***P* value[a]**
Fertilization rate, %	48.7 (21.2)	54.9 (18.7)	.186
Blastulation rate, %	30.1 (20.9)	39.5 (25.4)	.143
Prior treatment with clomiphene or hCG	**No treatment (N = 71)**	**Treatment (N = 49)**	***P* value[a]**
Fertilization rate, %	55.5 (18.5)	51.5 (20.0)	.266
Blastulation rate, %	41.5 (26.9)	32.7 (20.6)	.063

Note: Data represent means (standard deviations) unless otherwise specified. FSH = follicle-stimulating hormone; hCG = human chorionic gonadotropin. A total testosterone level of <300 ng/dL was considered low. A testicular volume of <12 mL was considered abnormal.
[a] Comparisons between the groups were performed using the t-test. A *P* value of < .05 was considered statistically significant.

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tulation rate were significantly different between the TESE and control groups ($P<.05$). The fertilization rate was lower in all TESE groups (49.8%–54.7%) than in the control group using ejaculated sperm (72.6%, $P<.001$). However, subgroup analysis between the 3 TESE groups did not reveal any statistically significant difference (good, 54.7%, vs. moderate, 54.0%, vs. poor, 49.8%, $P=.749$; Fig. 1A and Table 3).

The blastulation rates were similar between the good-prognosis (42.4%) and control (50.6%, $P=.18$) groups; however, the moderate- and poor-prognosis TESE groups had lower blastulation rates (37.7% and 22.1%, respectively) than the control group ($P<.001$). No statistically significant difference was noted in the blastulation rates between the 3 prognostic groups ($P=.067$; Fig. 1A and Table 3).

After adjusting for BMI and partner age, the results of fertilization rate ($F = 19.447$, $P<.001$) and blastulation rate ($F = 9.585$, $P<.001$) still showed significance between the groups. Additionally, further analysis were conducted to evaluate the fertilization and blastulation rates on the basis of various factors, including the total testosterone, FSH, and LH levels, testicular volume, use of fresh or frozen TESE sperm, and history of treatment with clomiphene or human

TABLE 3

In vitro fertilization cycle characteristics.

	Prognostic groups				
	Good (N = 42)	**Moderate (N = 67)**	**Poor (N = 11)**	**Control (N = 122)**	
Characteristic	**Mean (SD) or median (IQR) or N (%)**				***P* value[a]**
Total oocytes, n	17.0 (12.0–25.0)	16.0 (10.0–24.0)	12.0 (9.0–19.5)	16.0 (11.0–21.0)	.440
Mature oocytes, n	12.0 (8.0–19.8)	13.0 (8.5–18.5)	10.0 (6.5–13.0)	11.0 (8.0–16.0)	.381
Maturation rate, %	73.7 (13.8)	79.5 (15.3)	73.5 (22.2)	76.2 (14.8)	.222
PN stage embryos, n	7.0 (4.0–9.8)	7.0 (4.5–10.0)	5.0 (3.5–7.0)	8.5 (6.0–12.0)	.013[b]
Fertilization rate, %	54.7 (18.2)	54.0 (19.5)	49.8 (21.9)	72.6 (18.6)	< .001[b]
Blastocyst embryos, n	3.0 (1.0–4.0)	3.0 (1.0–4.0)	1.0 (1.0–1.8)	4.0 (2.0–6.0)	< .001[b]
Blastulation rate, %	42.4 (28.8)	37.7 (22.6)	22.1 (14.8)	50.6 (23.4)	< .001[b]

Note: Data represent means (SDs) unless otherwise specified. IQR = interquartile range (25th and 75th percentiles); PN = pronuclear; SD = standard deviation.
[a] Comparisons between the groups were performed using analysis of variance.
[b] A *P* value of < .05 was considered statistically significant.

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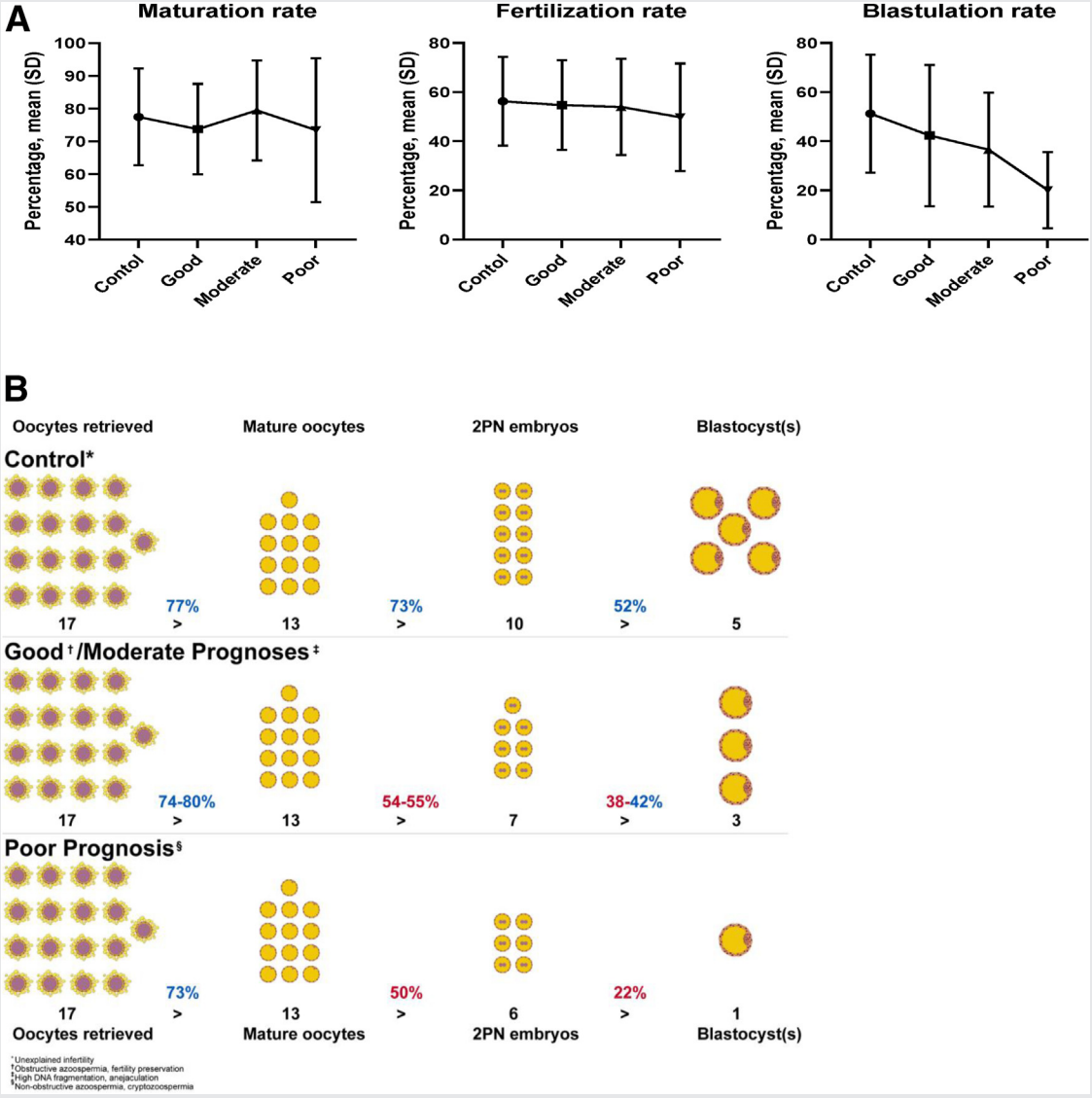
FIGURE 1



(**A**) Maturation, fertilization, and blastulation in good-, moderate-, and poor-prognosis groups compared with the control group. (**B**) Illustration for patient counseling. In vitro fertilization attrition rates in patients using testicular sperm.

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chorionic gonadotropin. These analyses revealed no significant differences in the fertilization and blastulation rates across these variables (Table 2).

Figure 1B was created on the basis of the aforementioned findings by the Mayo Clinic production design services to facilitate patient counseling.

DISCUSSION

In this study, the use of testicular-derived sperm, regardless of indication, resulted in lower fertilization rates than that in the control group. We also found a trend toward a decreasing blastulation rate sequentially from control (50.6%) to good-prognosis TESE (42.4%), moderate-prognosis TESE (37.7%), and poor-prognosis TESE (22.1%). However, each TESE group was not statistically significantly different from each other. This may be because of the relatively small sample size. Further studies with larger sample sizes are necessary to clarify true differences between groups; however, these findings suggest that sperm quality affects embryo attrition and provides important information for counseling. This study confirms findings that have been reported in prior studies and highlights the need for customized counseling tools (1, 20, 21).

The results of this study reaffirm other studies that found both lower fertilization and blastulation rates in patients using TESE sperm than in those using ejaculated sperm (10, 13, 22,

23). The reasons underlying these observations are speculative. The number of sperm cells visualized/identified after a testicular procedure is much lower than after an ejaculated sample is delivered to the laboratory; therefore, we can hypothesize that there is less opportunity for ideal sperm selection. Additionally, it is hypothesized that the factors leading to the need for TESE may lower sperm quality and that laboratory processing or additional handling of the sperm during the testicular extraction process may further damage sperm quality for ART. Therefore, the baseline sperm quality and the procedure itself may both contribute to less favorable outcomes.

Although the implantation, pregnancy, and live birth rates are arguably the most important clinical outcomes, these outcomes often exclude patients with very poor IVF outcomes who make few, if any, blastocyst-stage embryos. These patients with such guarded prognoses may be better counseled initially on embryo fertilization and attrition rates. Given the financial burden of IVF/ICSI and sperm retrieval, information regarding attrition rates is vital for couples to make evidence-based decisions because it may influence their decision to pursue the use of donor sperm. Our findings suggest that despite similar baseline female characteristics and successful sperm retrieval with sufficient sperm to inseminate all mature eggs, the underlying indications for using testicular sperm affect the fertilization and blastulation rates, which are significant factors to consider for future clinical pregnancy and live birth rates.

There are increasing indications for using of testicular sperm, making this topic important to patients and providers alike. There is evidence that DNA fragmentation is lower in testicular sperm than in the ejaculated sperm, and this may potentially improve sperm and embryo quality. However, the impact of using testicular sperm on embryo attrition rates should also be considered because this will eventually determine embryo quantity (19). Likely both quality and quantity of blastocysts are important in overall cumulative success rates. Studies comparing testicular and ejaculated sperm for IVF have produced mixed results (9, 10, 24, 25). A meta-analysis reported that testicular sperm was superior to ejaculated sperm in patients with cryptozoospermia in terms of embryo quality, implantation, and pregnancy rate (9). However, more recent studies illustrated no significant difference between ejaculated and TESE sperm in the mild form of MFI, and because TESE did not seem to improve outcomes, a more selective use of TESE for mild MFI is suggested (10, 13). The study by Lewin et al. (13) is one of the largest studies to date to compare ejaculated sperm with surgically retrieved sperm but did not include etiology of MFI. The heterogeneity of the results in previous literature may be because of the variety of indications for TESE in addition to different extraction techniques, protocols, and some confounders related to patient history (e.g., recurrent pregnancy loss, DNA fragmentation index, and etiology of male factors).

When looking at patients with NOA, there is no debate on how to retrieve sperm: surgical extraction is the only choice to obtain autologous sperm. However, it is still important to consider embryo attrition in this group for patient expectations and counseling. Previous studies using TESE with ICSI in patients with NOA showed a fertilization rate of approximately 45%–50% and blastulation rate of approximately 60%–65% with a clinical pregnancy rate of approximately 21%–27% (8, 21). In our study, the fertilization rates were similar (49.8%); however, the blastulation rates were considerably lower (22.1%) for the corresponding patient population. Our number of poor-prognosis patients was low (n = 11), and most needed more invasive microTESE procedures; this could account for the disparate findings.

The uniqueness of this study is that we attempted to establish a prognostic group in patients using testicular sperm for MFI to anticipate IVF attrition rates. Additionally, the strength of this study lies in the fact that all laboratory procedures were conducted in a single institution. We used our clinical database that contains comprehensively collected information with minimal missing data. Furthermore, all patients with MFI in our study underwent TESE for sperm retrieval, whereas a previous study has included the use of epididymal sperm (13). An additional strength of this study is the comprehensive analysis on the basis of male clinical data, including the total testosterone, FSH, and LH levels, testicular volume, and use of medications before TESE. Interestingly, our findings revealed no significant differences in the fertilization and blastulation rates on the basis of these clinical parameters.

The limitations of this study include the small sample size, the risk of selection bias because of its retrospective nature, and the fact that this study was performed in a tertiary care center where many patients were referred from other places because of their poor fertility and ART history. Therefore, it may not be representative of all patients who undergo TESE. Additionally, most testicular sperm in the good-prognosis group used frozen samples for convenience, whereas more fresh samples were used in the moderate-/severe-prognosis group on the basis of the clinical decision-making aimed at improving IVF outcomes. This study did not reveal any significant differences in the fertilization or blastulation rates between the uses of fresh and frozen TESE sperm similar to other previous studies (14, 26–28). It is difficult to determine whether the blastulation rates would have changed if fresh TESE was performed for good-prognosis patients. In our practice, we almost exclusively perform TESE for sperm retrieval. However, we are aware that according to the American Urological Association/American Society for Reproductive Medicine infertility guidelines, epididymal sperm is an acceptable alternative in patients with obstructive azoospermia (29). Another limitation of this study is that we excluded patients who underwent cleavage-stage embryo transfer because we could not calculate an accurate blastulation rate and we may have excluded poor-prognosis patients. Additionally, we adjusted for female BMI and male age, which were significantly different between the groups; however, we did not correct for all confounding factors,

such as female factor infertility, environmental factors, or smoking status, which could have affected egg quality, sperm quality, fertilization rate, and blastulation rate. Future directions may focus on transfer outcomes, including clinical pregnancy and live birth rates. Because many of these patients completed several cycles and are still undergoing care, these longitudinal outcomes have not yet been assessed.

CONCLUSION

In conclusion, patients who underwent TESE for any reason had lower fertilization rates than controls. Compared with the controls, lower blastulation rates were also observed in patients with moderate- or poor-prognosis patients who used testicular sperm. This model may guide practitioners in patient counseling when undergoing IVF for MFI using testicular sperm by predicting the chance of obtaining blastocysts on the basis of their diagnosis.

Acknowledgment

The authors thank Senior Project Designer at Mayo Clinic, Michael Chichanowski, for figure creation.

CRediT Authorship Contribution Statement

SiWon Lee: Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. Lauren M. Kendall Rauchfuss: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. Sevann Helo: Conceptualization, Methodology, Validation, Resources, Writing – review & editing. Alessandra J. Ainsworth: Validation, Resources, Writing – review & editing. Samir Babayev: Methodology, Validation, Resources, Writing – review & editing, Supervision. Chandra C. Paff Shenoy: Conceptualization, Validation, Resources, Data curation, Writing – review & editing, Supervision.

Declaration of Interests

S.L. reports travel support from Mayo Clinic outside the submitted work. L.M.K.R. reports travel support from Mayo Clinic outside the submitted work. S.H. has nothing to disclose. A.J.A. has nothing to disclose. S.B. has nothing to disclose. C.C.P.S. has nothing to disclose.

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