International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Deepthi LBR et al. Int J Reprod Contracept Obstet Gynecol. 2026 Dec;15(12):4996-5003
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20264420

Original Research Article

Role of dominant follicle proportion as a predictor of oocyte maturation and intracytoplasmic sperm injection outcomes – a retrospective study

Deepthi Leelia Betzy R.*, Kundavi Shankar, Geetha Veerasigamani, Yamini Asokan, Rashmi Gingade Vittal, Geovin Ranji G., Hema Niveda K. R., Sandhya Devarajan

Institute of Reproductive Medicine, The Madras Medical Mission, Chennai, Tamil Nadu, India

Received: 05 November 2026
Revised: 24 November 2026
Accepted: 25 November 2026

***Correspondence:**
Dr. Deepthi Leelia Betzy R.,
E-mail: deepthibetzy@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Dominant follicle proportion (DFP) may serve as a practical trigger-day marker of follicular cohort maturity, but its predictive value for oocyte maturation and intracytoplasmic sperm injection (ICSI) outcomes remains insufficiently defined in GnRH antagonist cycles. The aim of the study was to determine the predictive value of DFP on oocyte maturation rate among women undergoing intracytoplasmic sperm injection and evaluate its association with embryological and clinical outcomes.
Methods: This retrospective study included 223 women aged 21-40 years who underwent GnRH antagonist stimulation and ICSI at a tertiary-care reproductive medicine centre, between January 2019 and December 2024. DFP was calculated as the percentage of ≥18 mm follicles among ≥12 mm follicles on trigger day, and its association with oocyte maturation, embryological and pregnancy outcomes was analysed.
Results: Among 223 women, 135 (60.5%) had DFP <40% and 88 (39.5%) had DFP ≥40%. Baseline age, body mass index (BMI), infertility duration and stimulation parameters were comparable, but anti-Müllerian hormone (AMH) and antral follicle count (AFC) were higher in the DFP <40% group. Although DFP<40% had more oocytes retrieved, MII oocytes, 2PN embryos and frozen embryos; higher optical mark recognition (OMR) ≥75% was more common with DFP ≥40% group (67.0% versus 51.1%; p=0.019). Pregnancy outcomes were not statistically different. DFP showed modest predictive accuracy for higher OMR, with AUC 0.609 overall and 0.660 among normoresponders.
Conclusions: Dominant follicle proportion was a useful adjunctive trigger-day marker for predicting higher oocyte maturation, particularly among normoresponders, but it was not independently associated with pregnancy outcomes.

Keywords: Dominant follicle proportion, Oocyte maturation rate, Intracytoplasmic sperm injection, GnRH antagonist protocol, Follicular synchrony, Assisted reproductive technology

INTRODUCTION

Intracytoplasmic sperm injection (ICSI) has become a central component of assisted reproductive technology because it enables fertilization through direct injection of a single spermatozoon into a mature oocyte.[1] The global burden of assisted reproduction has expanded substantially, highlighting the need to refine cycle-level predictors of efficiency and outcome.[2] The success of ICSI depends fundamentally on the availability of metaphase II oocytes, because only mature oocytes are routinely suitable for sperm injection and subsequent embryo development. Parrella et al demonstrated that lower MII proportions were associated with reduced fertilization, implantation, clinical pregnancy and live birth rates.[3] Wang et al further emphasized that incomplete cytoplasmic maturation at the time of ICSI may impair fertilization, early embryo development and pregnancy potential, despite adequate nuclear maturation.[4]

Follicular size on trigger day is commonly used as a surrogate marker of oocyte maturity; however, assessment of individual leading follicles may not adequately reflect the developmental status of the entire follicular cohort. Rosen et al reported that, compared with follicles >18 mm, oocytes from 16-18 mm follicles had 37% lower odds of being mature and 28% lower odds of fertilization.[5] Shapiro et al showed that punctures of follicles ≤12.5 mm rarely resulted in good-quality blastocysts, while good-quality blastocyst yield increased progressively with follicle size up to approximately 19 mm.[6] Therefore, a cohort-based marker such as dominant follicle proportion (DFP) may provide a more integrated assessment of follicular synchrony and maturity. The present study aimed to compare the predictive value of dominant follicle proportion on oocyte maturation, embryological and clinical outcomes in ICSI cycles.

METHODS

This was a single-centre, retrospective cohort study conducted at the Institute of Reproductive Medicine, The Madras Medical Mission, Chennai over a period of 3 months with data retrieved over a period of six years (January 2019-December 2024). The study included women who underwent *in vitro* fertilization (IVF) treatment for subfertility, were aged 21-40 years, underwent the GnRH antagonist protocol, had more than three oocytes retrieved, had normal uterine anatomy confirmed by ultrasound or hysteroscopy, and had mild male factor infertility or used donor sperm. Women were excluded if they underwent fresh embryo transfer, had recurrent implantation failure or recurrent miscarriage, abnormal parental karyotype, a history of uterine malformations or intrauterine adhesions, poor ovarian response with fewer than four oocytes retrieved, stage III-IV endometriosis, donor oocyte cycles or severe male factor infertility, including severe oligoasthenoteratozoospermia and azoospermia requiring surgical sperm retrieval.

The sample size for the present study was calculated using Lin et al; the mean oocyte maturation rate in the GnRH antagonist protocol was 0.85±0.14 in the low dominant follicle proportion group and 0.90±0.13 in the high dominant follicle proportion group.[7] Based on these values, the present study assumed a mean difference of 0.05 in oocyte maturation rate between DFP groups, a pooled standard deviation of approximately 0.13, a two-sided alpha error of 5%, and a statistical power of 80%. Using the formula for comparison of two independent means, the minimum required sample size was approximately 212 cycles. After allowing for about 5% incomplete records, the final sample size was 223 women/cycles; enrolled using nonprobability sampling - convenience sampling/complete enumeration. Baseline demographic and infertility characteristics were recorded. Baseline ovarian reserve and endocrine parameters performed on day 2 or day 3 of the menstrual cycle, including serum luteinizing hormone, follicle-stimulating hormone, estradiol and anti-Müllerian hormone levels were obtained from medical records. Antral follicle count was documented.

Details of ovarian stimulation were obtained from the stimulation records. Follicular diameters were measured by transvaginal ultrasonography in two perpendicular planes, and the mean diameter was recorded. In this study, dominant follicles were defined as follicles measuring ≥18 mm and intermediate follicles as those measuring 12-17.9 mm on the trigger day, consistent with the DFP definition described by Xie et al. Ovarian stimulation was initiated on day 2 or day 3 of the menstrual cycle using recombinant follicle-stimulating hormone or human menopausal gonadotropin with individualized dosing based on ovarian reserve and clinical characteristics. Subsequent dose adjustments were made according to serial follicular monitoring and serum estradiol levels. Follicular measurements were performed by experienced reproductive medicine specialists as part of routine clinical care. GnRH antagonist administration was started when the dominant follicle measured at least 14 mm or when serum estradiol was at least 300 pg/ml. Final oocyte maturation was triggered when at least two follicles reached ≥18 mm, using either human chorionic gonadotropin alone or a dual trigger with human chorionic gonadotropin and GnRH agonist. Oocyte retrieval was performed approximately 35 hours after the trigger. Ovarian response was classified according to the number of oocytes retrieved, with normoresponders defined as women with 4-14 oocytes retrieved and hyperresponders as women with 15 or more oocytes retrieved.[8] The number of follicles measuring at least 18 mm and the number of follicles measuring at least 12 mm on the day of ovulation trigger were recorded. Dominant follicle proportion (DFP) was calculated as the number of follicles measuring ≥18 mm divided by the total number of follicles measuring ≥12 mm on the trigger day, expressed as a percentage. Based on the study by Xie et al on dominant follicle proportion, participants were categorized into group A with DFP <40% and group B with DFP ≥40%.[9] The total number of oocytes retrieved, number of metaphase II oocytes, number of two-pronuclear embryos and number of high-quality embryos were documented. The primary study outcomes, oocyte maturation rate (OMR) was calculated as the number of metaphase II oocytes divided by the total number of oocytes retrieved, expressed as a percentage. ICSI was performed approximately four hours after follicular aspiration. Embryo transfer was performed under ultrasound guidance, and luteal phase support was started. Pregnancy outcomes (chemical pregnancy, clinical pregnancy, and live birth) were assessed per started cycle with only the first frozen embryo transfer included for each patient.

Statistical analysis

Data were entered in Microsoft Excel and analysed using international business machines (IBM) statistical package for the social sciences (SPSS) statistics for Windows,

version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for distribution and summarized as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Between-group comparisons for continuous variables were performed using the independent samples t-test or Mann-Whitney U test, as appropriate based on data distribution. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Correlation was assessed using spearman's rank correlation coefficient. Predictive accuracy of DFP for identifying higher OMR was evaluated using DFP ≥40% as the test-positive definition and OMR ≥75% as the outcome-positive definition.[9] Sensitivity, specificity, positive predictive value, negative predictive value, overall accuracy, positive likelihood ratio, negative likelihood ratio and diagnostic odds ratio with 95% confidence intervals were calculated. Receiver operating characteristic (ROC) curve analysis was performed using continuous DFP values, and the area under the curve was estimated with bootstrap 95% confidence intervals. The optimal DFP cut-off was identified using the Youden index. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 223 women were analysed, of whom 135 (60.5%) had DFP <40% and 88 (39.5%) had DFP ≥40%. Baseline demographic characteristics were comparable between groups. Primary infertility was more frequent in the DFP <40% group, whereas secondary infertility was more common in the DFP ≥40% group (p=0.005) (Table 1). Baseline hormonal parameters, including day-2 estradiol, basal LH and basal FSH, were comparable; however, AMH and AFC were significantly higher in the DFP <40% group (p=0.033 and p<0.001, respectively). Stimulation characteristics, trigger-day hormonal parameters and trigger type did not differ significantly between groups (Table 2).

Ovarian response differed significantly, with normoresponders being more frequent in the DFP ≥40% group and hyperresponders being more frequent in the DFP <40% group (p=0.008). As expected, women with DFP <40% had more follicles ≥12 mm, while those with DFP ≥40% had more follicles ≥18 mm on trigger day (both p<0.001).

The DFP <40% group had significantly higher oocyte yield, MII oocytes, 2PN embryos and frozen embryos than the DFP ≥40% group (all p<0.01). Mean oocyte maturation rate was higher in the DFP ≥40% group, but the difference was not significant (p=0.082). When oocyte maturation was categorized using the 75% cut-off, higher OMR was significantly more frequent in the DFP ≥40% group than in the DFP <40% group (p=0.019). Pregnancy outcomes, including chemical pregnancy, clinical pregnancy, and live births, were comparable between the groups, with no statistically significant differences (Tables 3 and 4 and Figure 1).

DFP showed significant negative correlations with AMH, AFC, trigger-day estradiol, follicles ≥12 mm, oocytes retrieved, MII oocytes, 2PN embryos and frozen embryos, while demonstrating a strong positive correlation with follicles ≥18 mm (rho=0.591, p<0.001). However, DFP showed a weak positive correlation with oocyte maturation rate (rho=0.164, p=0.014). DFP was not significantly correlated with implantation rate (rho=0.062, p=0.356) (Table 6).

In the overall cohort, for prediction of higher OMR (≥75%), DFP ≥40% demonstrated modest performance, with sensitivity of 46.1%, specificity of 69.5%, overall accuracy of 56.1% and diagnostic odds ratio of 1.95 (95% CI 1.11-3.40; p=0.019). ROC analysis showed modest discrimination, with an AUC of 0.609 (95% CI 0.532-0.685) and an optimal DFP cut-off of 37.5%. Subgroup analysis showed better predictive performance among normoresponders, with sensitivity 53.9%, specificity 68.2%, PPV 77.4%, accuracy 58.6%, diagnostic odds ratio 2.51 (95% CI 1.17-5.36; p=0.016), and ROC AUC 0.660. The best normoresponder cut-off was DFP 41.2%, with 50.6% sensitivity and 77.3% specificity. In contrast, DFP showed poor predictive utility among hyperresponders (AUC 0.500; diagnostic odds ratio 0.94, 95% CI 0.38-2.37; p=0.900) (Table 7 and Figure 2). After adjustment for AMH, AFC, infertility type, and ovarian-response, DFP ≥40% was not independently associated with higher oocyte maturation rate (adjusted OR 1.51, 95% CI 0.83-2.73; p=0.177). Among normoresponders, the association approached statistical significance (adjusted OR 2.19, 95% CI 0.98-4.88; p=0.056), whereas no association was observed among hyperresponders (adjusted OR 0.87, 95% CI 0.33-2.25; p=0.769).

Table 1: Baseline demographic and infertility characteristics according to DFP group.

Characteristics		DFP <40% (n=135)	DFP ≥40% (n=88)	P value
Wife age (years)		31.2 ± 3.9	31.4 ± 4.6	0.807
Husband age (years)		35.7 ± 4.4	35.4 ± 4.5	0.667
Infertility duration (years)		5.6 ± 3.1	4.9 ± 2.8	0.076
Infertility type	Primary	106 (78.5)	54 (61.4)	0.005*
	Secondary	29 (21.5)	34 (38.6)	
Infertility cause	Female factor	57 (42.2)	42 (47.7)	0.631
	Male factor	16 (11.9)	12 (13.6)	
	Both partners	25 (18.5)	11 (12.5)	

Continued.

Characteristics		DFP <40% (n=135)	DFP ≥40% (n=88)	P value
	Unexplained	37 (27.4)	23 (26.1)	
BMI (kg/m^2)		27.6±5.0	27.5±5.2	0.875

Continuous variables presented as mean±SD; categorical variables presented as N (%); *p value statistically significant

Table 2: Baseline hormonal, ovarian reserve and stimulation characteristics according to DFP group.

Characteristics	DFP <40% (n=135)	DFP >=40% (n=88)	P value
Day-2 estradiol (pg/ml)	34.6±9.8	34.5±12.9	0.924
Basal LH (IU/l)	4.7±3.0	4.3±2.3	0.272
Basal FSH (IU/l)	5.4±1.6	5.6±1.5	0.551
AMH (ng/ml)	4.5±3.3	3.6±2.6	0.033*
AFC	23.5±10.7	19.0±9.1	<0.001*
Gonadotropin starting dose (IU)	323.7±60.4	334.4±73.3	0.257
Total gonadotropin dose (IU)	3738.0±879.4	3772.2±957.7	0.788
Gonadotropin stimulation days	10.9±1.1	10.6±1.3	0.152
Total antagonist dose	1.7±0.5	1.6±0.4	0.410
Antagonist days	6.2±1.4	6.0±1.4	0.428

Data are presented as mean±SD; *p value statistically significant

Table 3: Trigger-day, follicular profile and ovarian response characteristics according to DFP group.

Characteristics		DFP <40% (n=135)	DFP ≥40% (n=88)	P value
Trigger-day estradiol (pg/ml)		4644.2±2553.1	4196.8±2540.9	0.201
Trigger-day LH (IU/l)		1.5±1.2	1.8±1.3	0.118
Trigger type	HCG	8 (5.9)	11 (12.5)	0.168
	GnRH agonist	12 (8.9)	10 (11.4)	
	Dual trigger	115 (85.2)	67 (76.1)	
Ovarian response	Normoresponder	71 (52.6)	62 (70.5)	0.008*
	Hyperresponder	64 (47.4)	26 (29.5)	
Follicles ≥12 mm on trigger day		18.8±8.7	14.7±7.5	<0.001*
Follicles ≥18 mm on trigger day		4.4±2.0	7.6±4.1	<0.001*

Continuous variables presented as mean±SD; categorical variables presented as N (%); *p value statistically significant

Table 4: Oocyte maturation and embryological outcomes according to DFP group.

Characteristics		DFP <40% (n=135)	DFP ≥40% (n=88)	P value
Oocytes retrieved		14.9±8.0	11.6±6.3	<0.001*
MII oocytes		10.8±5.7	8.8±4.5	0.004*
Oocyte maturation rate (%)		74.2±15.8	78.3±17.6	0.082
Oocyte maturation, N (%)	Lower OMR (<75%)	66 (48.9)	29 (33.0)	0.019*
	Higher OMR (≥75%)	69 (51.1)	59 (67.0)	
2PN embryos		9.7±5.5	8.0±4.3	0.008*
Frozen embryos		8.9±5.2	7.1±3.9	0.004*

Continuous variables presented as mean±SD; categorical variables presented as N (%); *p value statistically significant

Table 5: Embryo transfer outcomes according to DFP group.

Characteristics		DFP <40% (n=135)	DFP ≥40% (n=88)	P value
Transfer day	Cleavage	54 (40.0)	39 (44.3)	0.684
	Morula	59 (43.7)	38 (43.2)	
	Blastocyst	22 (16.3)	11 (12.5)	
Implantation rate (%)		32.7±36.6	38.0±35.4	0.286

Continuous variables presented as mean±SD; categorical variables presented as N (%)

Table 6: Correlation of DFP with ovarian stimulation, embryological and clinical outcome variables.

Characteristics	Spearman rho	P value
AMH	-0.223	<0.001*
AFC	-0.308	<0.001*
Trigger-day estradiol	-0.147	0.028*
Follicles ≥12 mm	-0.348	<0.001*
Follicles ≥18 mm	0.591	<0.001*
Oocytes retrieved	-0.274	<0.001*
MII oocytes	-0.214	0.001*
Oocyte maturation rate	0.164	0.014*
2PN embryos	-0.185	0.006*
Frozen embryos	-0.198	0.003*
Implantation rate	0.062	0.356

*P value statistically significant

Table 7: Predictive accuracy of DFP for higher oocyte maturation rate.

Variables	Result (overall)	Result (normoresponder)	Result (hyperresponder)
Outcome definition	Higher OMR ≥75% (study median)	Higher OMR ≥75% (study median)	Higher OMR ≥75% (study median)
Test-positive definition	DFP ≥40%	DFP ≥40%	DFP ≥40%
Sensitivity	46.1% (37.7-54.7)	53.9% (43.6–63.9)	28.2% (16.5–43.8)
Specificity	69.5% (59.6-77.8)	68.2% (53.4–80.0)	70.6% (57.0–81.3)
Positive predictive value	67.0% (56.7-76.0)	77.4% (65.6–86.0)	42.3% (25.5–61.1)
Negative predictive value	48.9% (40.6-57.2)	42.3% (31.5–53.8)	56.2% (44.1–67.7)
Overall accuracy	56.1% (49.5-62.4)	58.6% (50.1–66.7)	52.2% (42.0–62.2)
Positive likelihood ratio	1.51	1.70	0.96
Negative likelihood ratio	0.78	0.68	1.02
Diagnostic odds ratio	1.95 (95% CI 1.11-3.40); p=0.019	2.51 (95% CI 1.17–5.36); p=0.016	0.94 (95% CI 0.38–2.37); p=0.900
Adjusted odds ratio	1.51 (95% CI 0.83–2.73); p=0.177	2.19 (95% CI 0.98–4.88); p=0.056	0.87 (95% CI 0.33–2.25); p=0.769
ROC AUC using continuous DFP	0.609 (95% bootstrap CI 0.532-0.685)	0.660 (95% bootstrap CI 0.558–0.760)	0.500 (95% bootstrap CI 0.383–0.625)
Best ROC cut-off by Youden index	DFP 37.5%; sensitivity 53.1%, specificity 66.3%	DFP 41.2%; sensitivity 50.6%, specificity 77.3%	DFP 26.7%; sensitivity 61.5%, specificity 45.1%

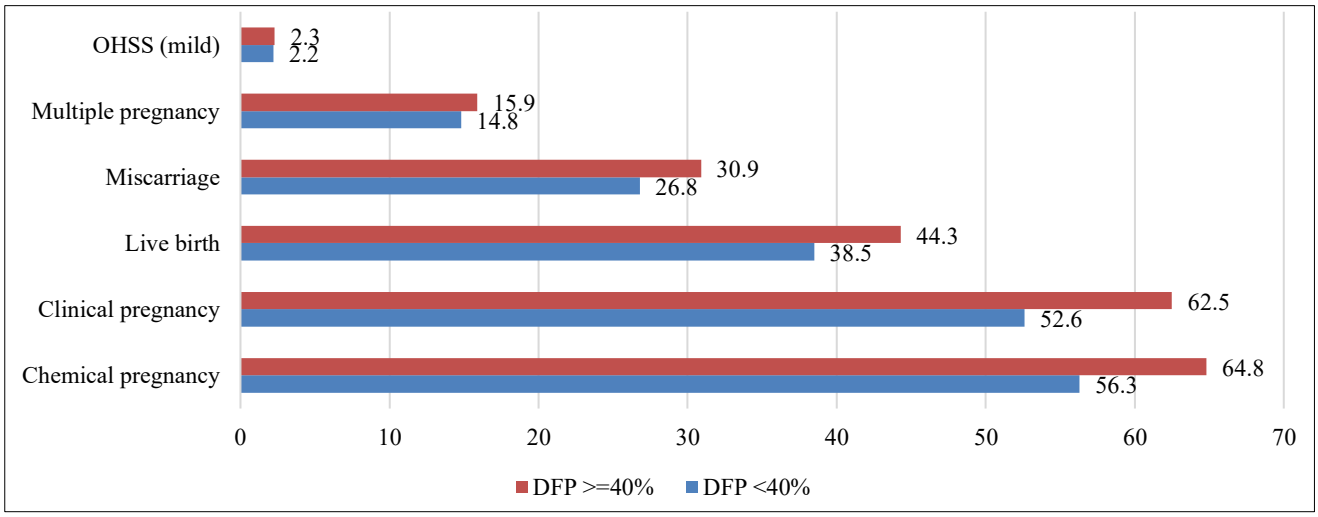


Figure 1: Pregnancy outcomes according to DFP group.

Chemical pregnancy, p value=0.207; Clinical pregnancy, p value=0.145; Live birth, p value=0.389; Miscarriage, p value=0.298; Multiple pregnancy, p value=0.824; OHSS (mild), p value=1.000.

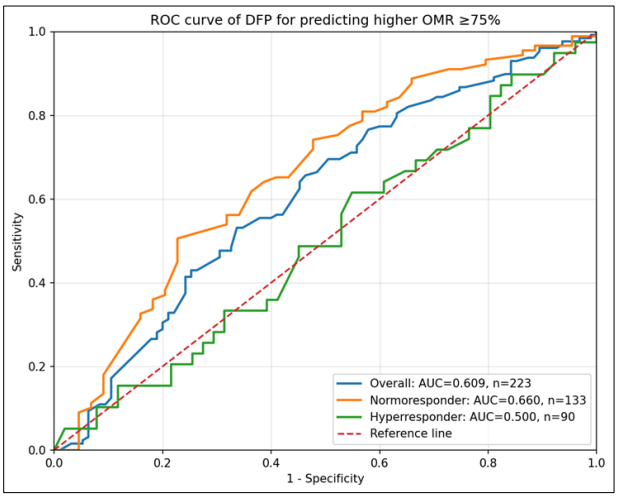


Figure 2: Predictive accuracy of DFP for higher oocyte maturation rate.

ROC curve analysis demonstrated modest predictive performance overall, with better discrimination among normoresponders than hyperresponders

DISCUSSION

The present study assessed DFP as a trigger-day marker of follicular cohort maturity in GnRH antagonist ICSI cycles, using the clinically relevant threshold of 40%. The rationale for this approach was supported by Xie et al, who defined DFP as the ratio of ≥18-mm follicles to ≥12-mm follicles and evaluated DFP≤40% versus >40% in 1156 low-prognosis women undergoing GnRH antagonist IVF/ICSI cycles.[10] In that study, DFP>40% was associated with fewer oocytes retrieved, cleaved embryos and available embryos, indicating that a higher proportion of dominant follicles may reflect delayed or excessive cohort advancement rather than uniformly better follicular competence.[10] The need for a cohort-based trigger marker is also supported by Su et al, who stated that conventional trigger timing based on a few leading follicles may not represent the development of the target follicular cohort; in their 1925-cycle depot GnRH agonist study, DFP was defined as ≥18-mm follicles divided by ≥14-mm follicles and increasing DFP was negatively associated with frozen blastocyst number and blastocyst formation rate.[11] In the present study, baseline wife age, husband age, infertility duration and BMI were comparable between the DFP groups, suggesting that group-wise differences in ovarian and embryological outcomes were not primarily driven by demographic imbalance. However, AMH and AFC were significantly higher in the DFP <40% group, while DFP showed significant negative correlations with AMH and AFC. This finding indicates that lower DFP in this cohort reflected a larger recruitable follicular pool and a larger denominator of ≥12-mm follicles, rather than poor follicular development. This interpretation is consistent with the ASRM committee opinion that AMH and AFC are well-demonstrated predictors of oocyte yield and ovarian responsiveness in IVF, while they are weaker predictors of qualitative outcomes such as pregnancy and live birth.[12] Majumder et al similarly reported that both AMH and AFC were significantly correlated with oocytes retrieved and fertilized oocytes ($p<0.001$), and were also associated with top-quality and frozen embryos ($p<0.001$).[13]

The follicular profile in the present study showed that DFP <40% was associated with a greater number of follicles ≥12 mm, whereas DFP ≥40% was associated with a greater number of follicles ≥18 mm. The strong positive correlation between DFP and follicles ≥18 mm, together with the negative correlation with follicles ≥12 mm, illustrates the mathematical and biological duality of DFP: it increases either when more follicles become dominant or when the intermediate follicle pool becomes smaller. This is important because follicular size is related to oocyte maturity, but not always linearly related to embryo competence or pregnancy. Abbara et al found that follicle size influenced mature oocyte yield, with maturation increasing across larger follicular categories, and reported that follicles 12-19 mm on the morning of trigger were most likely to yield mature oocytes after hCG, GnRHa or kisspeptin triggers.[14] The present study found that the DFP <40% group produced significantly more oocytes, MII oocytes, 2PN embryos and frozen embryos than the DFP ≥40% group. This pattern closely agrees with Xie et al., who observed that DFP>40% was associated with reduced oocyte retrieval and fewer embryos among POSEIDON groups 3 and 4 in antagonist cycles.[10] It also parallels Su et al, who reported that increasing DFP was negatively associated with frozen blastocyst number, with β values of -0.319 for DFP 30-60% and -0.432 for DFP ≥60% compared with DFP <30%.[11] In another earlier study, Li et al evaluated the association between dominant follicle proportion and oocyte developmental competence and reported that a high proportion of dominant follicles was closely associated with impaired oocyte developmental competence and lower pregnancy rate.[15]

A distinctive finding in the present study was that although mean OMR did not differ significantly between groups, DFP ≥40% was associated with a significantly higher proportion of cycles achieving OMR ≥75%, despite lower absolute oocyte and embryo yield. This suggests a trade-off between oocyte maturity proportion and total cohort yield. Lin et al reported a similar pattern in PCOS antagonist cycles, where matured oocyte rate increased across PDF groups from 0.85±0.14 to 0.89±0.11 and 0.90±0.13, while normally fertilized oocytes, available embryos, implantation and clinical pregnancy rates did not significantly differ.[7] A higher proportion of ≥18-mm follicles may increase the fraction of mature oocytes, whereas a lower DFP may include more intermediate follicles contributing to total oocyte yield but contain a higher proportion of immature oocytes. Xie et al reported that in GnRH antagonist protocols, the trigger is commonly administered when ≥3 follicles reach ≥17 mm or ≥2 follicles reach ≥18 mm.[10] Maghraby et al emphasized that trigger timing remains controversial and that delaying hCG trigger by 1-2 days in agonist ICSI cycles may

increase oocyte yield but may also increase the risk of premature progesterone rise.[16] Yang et al further showed that stimulation duration may influence oocyte maturation and pregnancy outcomes differently in poor and normal responders undergoing antagonist cycles.[17] These observations support the present finding that a single DFP threshold cannot be interpreted independently of ovarian response.

Pregnancy outcomes including chemical pregnancy, clinical pregnancy and live birth, did not differ significantly between the DFP groups. This is compatible with the ASRM position that ovarian reserve markers and response markers predict oocyte quantity better than embryo quality, pregnancy or live birth.[12] The low OHSS rate in the present study, with only mild OHSS in 2.2%, is clinically relevant because the cohort included 40.4% hyperresponders and most women received dual trigger. Al-Inany et al's Cochrane review reported that GnRH antagonist protocols reduced any-grade OHSS compared with long GnRH agonist protocols, with OR 0.61 and 95% CI 0.51-0.72, without reducing live birth likelihood.[18]

The predictive analysis in the present study showed that DFP ≥40% had modest overall performance for predicting higher OMR. This indicates that DFP functioned better as a rule-in marker than a rule-out marker for higher OMR, but its overall discrimination was limited. The normoresponder subgroup showed better performance, with AUC 0.660 and diagnostic odds ratio 2.51, while hyperresponders had no meaningful discrimination, with AUC 0.500. This subgroup pattern is consistent with the POSEIDON framework, which emphasizes that prognosis in ART depends on age, ovarian reserve markers and oocyte number, rather than a single stimulation parameter.[19] The Bologna consensus also established that ovarian response requires multiple criteria rather than one isolated marker, reinforcing why DFP should be interpreted alongside AMH, AFC, response category and embryo yield.[20]

Limitations

The present study had certain limitations. As it was a retrospective single-centre study, the possibility of selection bias or unmeasured confounding could not be excluded. The findings are limited to GnRH antagonist ICSI cycles and may not be generalizable to other stimulation protocols or IVF populations. Trigger type was not uniform, hence variations in trigger type may also have influenced oocyte maturation and embryo outcomes. The observational design also prevented determination of whether modifying trigger timing based on DFP would improve outcomes. Finally, embryo competence and pregnancy outcomes are influenced by multiple factors such as oocyte quality, sperm parameters, embryo culture conditions and endometrial preparation, which may not have been fully captured or adjusted for in the present analysis.

CONCLUSION

The present study demonstrated that dominant follicle proportion was significantly associated with ovarian response, embryological outcomes and oocyte maturation in GnRH antagonist ICSI cycles. A DFP ≥40% was associated with a higher proportion of cycles achieving higher oocyte maturation rate, although it was also associated with fewer oocytes retrieved, MII oocytes, 2PN embryos and frozen embryos, suggesting a trade-off between oocyte maturity proportion and total oocyte yield. DFP showed only modest overall predictive accuracy for higher OMR, with better discriminatory performance among normoresponders than hyperresponders. However, DFP was not significantly associated with pregnancy outcomes. These findings suggest that DFP may be a useful adjunctive marker for assessing follicular cohort maturity and predicting oocyte maturation, particularly in normoresponders, but should not be used as an isolated determinant of trigger timing.

ACKNOWLEDGEMENTS

Authors would like to thank the Head of the Department, as well as to the consultants and the embryology team at the institute for their support and assistance during the study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Palermo G, Joris H, Devroey P, Van Steirteghem AC. Pregnancies after intracytoplasmic injection of single spermatozoon into an oocyte. Lancet. 1992;340(8810):17-8.
2. Adamson GD, Zegers-Hochschild F, Dyer S. Global fertility care with assisted reproductive technology. Fertil Steril. 2023;120(3):473-82.
3. Parrella A, Irani M, Keating D, Chow S, Rosenwaks Z, Palermo GD. High proportion of immature oocytes in a cohort reduces fertilization, embryo development, pregnancy and live birth rates following ICSI. Reproductive BioMed Online. 2019;39(4):580-7.
4. Wang X, Xiao Y, Sun Z, Zhen J, Yu Q. Effect of the time interval between oocyte retrieval and ICSI on embryo development and reproductive outcomes: a systematic review. Reprod Biol Endocrinol. 2021;19(1):34.
5. Rosen MP, Shen S, Dobson AT, Rinaudo PF, McCulloch CE, Cedars MI. A quantitative assessment of follicle size on oocyte developmental competence. Fertil Steril. 2008;90(3):684-90.
6. Shapiro BS, Rasouli MA, Verma K, Raman A, Garner FC, Aguirre M, et al. The effect of ovarian follicle size on oocyte and embryology outcomes. Fertil Steril. 2022;117(6):1170-6.

7. Lin HY, Li Y, Wang WJ, Qiu Q, Zhang QX, Li Y. Role of the proportion of dominant follicles in patients with polycystic ovary syndrome undergoing in vitro fertilization-embryo transfer. Chin Med J (Engl). 2019;132(12):1448-53.
8. Steward RG, Lan L, Shah AA, Yeh JS, Price TM, Goldfarb JM, et al. Oocyte number as a predictor for ovarian hyperstimulation syndrome and live birth: an analysis of 256,381 in vitro fertilization cycles. Fertil Steril. 2014;101(4):967-73.
9. ESHRE Special Interest Group of Embryology and Alpha Scientists in Reproductive Medicine. The Vienna consensus: report of an expert meeting on the development of ART laboratory performance indicators. Reprod Biomed Online. 2017;35(5):494-510.
10. Xie Q, Jiang W, Wei Y, Ni D, Yan N, Yang Y, et al. Increasing dominant follicular proportion was associated with adverse IVF/ICSI outcomes in low-prognosis women undergoing GnRH antagonist protocol: a retrospective cohort study. J Ovarian Res. 2024;17(1):179.
11. Su H, Lai Y, Li J, Liao T, Ji L, Hu X, et al. Increasing dominant follicular proportion negatively associated with good clinical outcomes in normal ovarian responders using the depot GnRH agonist protocol: a large-sample retrospective analysis. J Ovarian Res. 2022;15(1):44.
12. Testing and interpreting measures of ovarian reserve: a committee opinion. Fertil Steril. 2020;114(6):1151-7.
13. Majumder K, Gelbaya TA, Laing I, Nardo LG. The use of anti-Müllerian hormone and antral follicle count to predict the potential of oocytes and embryos. Eur J Obstet Gynecol Reprod Biol. 2010;150(2):166-70.
14. Abbara A, Vuong LN, Ho VNA, Clarke SA, Jeffers L, Comninos AN, et al. Follicle Size on Day of Trigger Most Likely to Yield a Mature Oocyte. Front Endocrinol (Lausanne). 2018;9:193.
15. Li Y, Li RQ, Ou SB, Ren L, Zhang NF, Wei LN, et al. Association between the proportion of dominant follicles and oocyte developmental competence. J Assist Reprod Genet. 2014;31(12):1599-604.
16. Maghraby H, Saleh H, Fourtia IL, Rasheed S, Elmahdy M, Abdelbadie AS, et al. The dilemma of the trigger timing in IVF: a review. Middle East Fertil Soc J. 2024;29(1):8.
17. Yang Y-C, Li Y-P, Pan S-P, Chao K-H, Chang C-H, Yang J-H, et al. The different impact of stimulation duration on oocyte maturation and pregnancy outcome in fresh cycles with GnRH antagonist protocol in poor responders and normal responders. Taiwanese J Obstet Gynecol. 2019;58(4):471-6.
18. Al-Inany HG, Youssef MA, Ayeleke RO, Brown J, Lam WS, Broekmans FJ. Gonadotrophin-releasing hormone antagonists for assisted reproductive technology. Cochrane Database Syst Rev. 2016;4(4):CD001750.
19. Esteves SC, Alviggi C, Humaidan P, Fischer R, Andersen CY, Conforti A, et al. The POSEIDON Criteria and Its Measure of Success Through the Eyes of Clinicians and Embryologists. Front Endocrinol. 2019;10:2019.
20. Ferraretti AP, La Marca A, Fauser BC, Tarlatzis B, Nargund G, Gianaroli L. ESHRE consensus on the definition of 'poor response' to ovarian stimulation for in vitro fertilization: the Bologna criteria. Hum Reprod. 2011;26(7):1616-24.

Cite this article as: Deepthi LBR, Shankar K, Veerasigamani G, Asokan Y, Vittal RG, Geovin RG, et al. Role of dominant follicle proportion as a predictor of oocyte maturation and intracytoplasmic sperm injection outcomes – a retrospective study. Int J Reprod Contracept Obstet Gynecol 2026;15:4996-5003.