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Impact of Progesterone Levels on the Day of Ovulation Trigger and Progesterone Ratios on Oocyte Quality and Pregnancy Outcomes: A Retrospective Study

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INTRODUCTION

Premature elevation of serum progesterone (Pg) on trigger day reduces IVF success. However, the impact of elevated levels on oocyte quality remains unclear in the current literature. Moreover, the predictive value of hormonal ratios, such as Pg to mature oocyte count (Pg/MII) or Pg to the number of follicles ≥14 mm (Pg/F), in relation to the number of blastocytes or pregnancy outcomes is still not well established. Clarifying these associations could help refine clinical decision-making.

AIM

This study aims to evaluate the impact of serum Pg levels and Pg-related ratios on oocyte quality and pregnancy outcomes.

METHOD

- **Design:** Retrospective, single-center study
- **Population:** 1,687 patients aged 18-45 who underwent a single autologous IVF cycle (Feb 2018-Dec 2023)
- **Inclusion:** Patients with a recorded serum Pg level on the day of ovulation trigger
- **Exclusion:** Fertility preservation cycles
- **Outcomes:**
  - Number of usable blastocytes
  - Clinical pregnancy rate *(presence of fetal heartbeat on viability ultrasound)*
- **Statistical analysis:** Conducted with SPSS version 29

RESULTS

Table 1. Descriptive characteristics of the study population

Variable	Value
Mean age	35.3 ± 4.6 years
AMH	3.3 ± 3.1 ng/mL
Number of follicles ≥14 mm	13.3 ± 7.1
Progesterone	3.7 ± 1.8 nmol/L
Pg/F ratio	0.36 ± 0.26
Number of usable blastocysts	4.1 ± 3.4
Pregnancy outcomes[1]	• Positive β-hCG : 61.2% (834/1362) • Clinical pregnancy: 54.8% (746/1362) • Live birth: 40.3% (549/1362) • Miscarriage: 13.5% (101/746)[2]
Number of empty follicle aspirations	14 • Average Pg/F ratio: 1.14 ± 0.59 • Minimal value: 0.46

[2]Biochemical pregnancies are not included

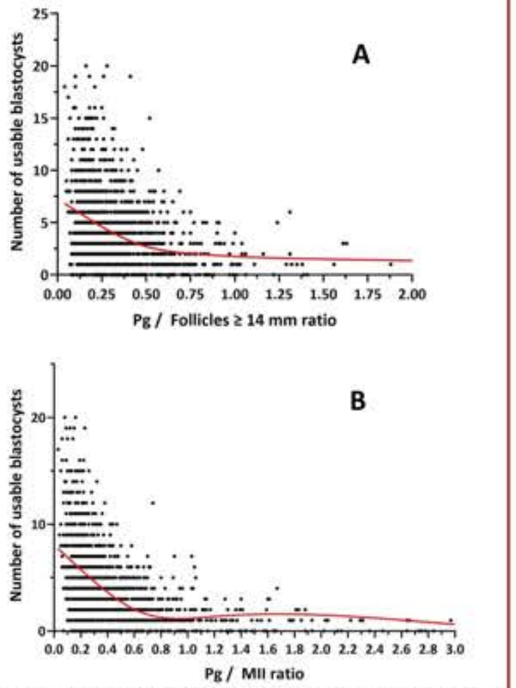

Figure 1. A: Relationship between progesterone-to-follicle ≥14 mm ratio and number of usable blastocysts. B: Relationship between progesterone-to-MII ratio and number of usable blastocysts.

Key findings

Pg/F ratio

- A moderately strong negative correlation with usable blastocyst (Spearman's **r = -0.366, p < 0.001**)
- Each unit increase corresponded to a ~70% lower chance of clinical pregnancy[1] (**β = −1.2, p < 0.001**).
- Multivariable regression showed that each unit increase was associated with 1.1 fewer usable blastocysts (**β = −1.1, p < 0.001**) (see Table 2).

Pg/MII ratio

- A moderately strong negative correlation with usable blastocysts (Spearman's **r = -0.531, p < 0.001**).
- Higher Pg/MII was associated with fewer usable blastocysts (Figure 1A) and reduced clinical pregnancy rates[1].

Predictive performance

- ROC analysis for Pg/F gave:
  - AUC = **0.667**
  - Optimal cut-off of **0.40**
  - Sensitivity of **48.5%**
  - Specificity of **78.2%**
  - Youden index = **0.268**
- The ROC threshold of **≥ 2 usable blastocysts** was chosen as a realistic benchmark, balancing clinical realism with live birth rates (~34-46%).

[1]Results are based on the first embryo transfer only and should be interpreted with caution

Table 2. Multiple regression analysis of the association between progesterone-to-follicle ≥14 mm ratio and number of usable blastocysts

Variables in the equation	Beta Coefficient	Standard Error	P-value
Pg/F ratio	-1.068	0.276	<0.001
Total number of stimulation days	-0.108	0.047	0.023
E2 level	0.023	0.410	<0.001
AMH	0.098	0.026	<0.001
Age	-0.159	0.015	<0.001
Constant	8.403	0.765	<0.001

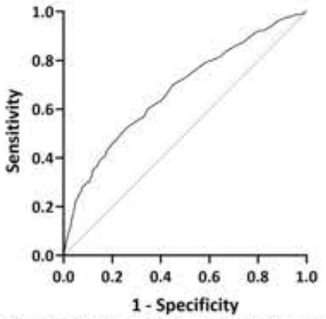

Figure 2. ROC curve of the progesterone-to-follicle ≥14 mm ratio for predicting ≥2 usable blastocysts.

CONCLUSIONS

Our findings suggest that progesterone ratios, particularly Pg/F, serve as relevant predictors of the number of usable blastocysts, as well as of clinical pregnancy outcomes. A **Pg/F ratio of 0.40** was identified as having the optimal threshold (sensitivity **48.5%**, specificity **78.2%**) to predict the likelihood of obtaining ≥ 2 usable blastocysts. These results could help optimize IVF cycle management by guiding decisions on embryo vitrification or cycle cancellation.

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