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IMPACT OF ENDOMETRIAL THICKNESS ON PREGNANCY OUTCOMES FOLLOWING ART: A COMPARATIVE STUDY OF WOMEN WITH AND WITHOUT GENITAL INFLAMMATORY HISTORIES

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Abstract: This study explores the challenges and outcomes of pregnancies achieved through assisted reproductive technologies (ART) in women with a history of genital inflammatory diseases. We analyze clinical, hormonal, and epidemiological data from 60 patients, categorizing them into three groups based on their ART approach and medical history. Results highlight the significance of pre-conceptional care, hormonal support, and multidisciplinary approaches in improving pregnancy outcomes. Key findings provide evidence-based recommendations for managing this high-risk group effectively.

Keywords: Assisted reproductive technologies, genital inflammatory diseases, pregnancy management, hormonal support, reproductive health.

Introduction

Infertility is a global health concern, affecting approximately 15% of couples worldwide [1]. The advent of assisted reproductive technologies (ART), including in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), has revolutionized the management of infertility, offering hope to millions of individuals [2]. However, the effectiveness of ART depends on multiple factors, including the patient's medical history, reproductive health, and hormonal balance. Among these, a history of genital inflammatory diseases (GIDs) stands out as a significant factor impacting reproductive outcomes [3].

Genital inflammatory diseases, such as endometritis, salpingitis, and pelvic inflammatory disease (PID), are prevalent in women of reproductive age and represent a major cause of infertility [4,5]. These conditions are often associated with structural and functional damage to the reproductive organs, including endometrial scarring, tubal occlusion, and the formation of pelvic adhesions. Chronic inflammation not only impairs the physical environment necessary for conception but also disrupts hormonal homeostasis and immune balance, further complicating the success of ART [6,7].

The burden of GIDs extends beyond infertility, with lasting implications for pregnancy outcomes. Women with a history of GIDs undergoing ART are at a heightened risk of implantation failure, early pregnancy loss, and obstetric complications such as preterm labor, preeclampsia, and placental insufficiency [8, 9]. These risks necessitate an individualized approach to pre-conceptional care and pregnancy management to optimize outcomes for both mother and child [10].

Despite advances in ART protocols, the relationship between endometrial thickness and pregnancy outcomes remains a critical area of investigation, particularly in women with a history of genital inflammatory diseases (GIDs) [11]. Understanding how these conditions influence endometrial receptivity and pregnancy loss rates can provide valuable insights into optimizing ART success [12].

The primary objective of this study is to evaluate the correlation between endometrial thickness and pregnancy loss rates in women undergoing ART, comparing outcomes across three distinct groups: women with a history of GIDs undergoing IVF, women with GIDs undergoing ICSI, and a control group without a history of GIDs [13]. By analyzing the variations in mean endometrial thickness and its impact on pregnancy outcomes, this research aims to identify critical thresholds and patterns that influence success rates [14].

Furthermore, the study underscores the need for tailored clinical approaches based on endometrial metrics, offering practical recommendations to enhance maternal and neonatal health outcomes. This research contributes to the growing body of knowledge on ART optimization, providing actionable insights for reproductive specialists to address the unique challenges faced by women with inflammatory reproductive histories [15].

By focusing on the measurable relationship between endometrial thickness and pregnancy outcomes, this study aims to advance the precision and efficacy of ART protocols, ensuring better reproductive care for diverse patient populations.

Materials and Methods

Study Design.

This study is a retrospective observational analysis conducted to evaluate the outcomes of pregnancies achieved through assisted reproductive technologies (ART) in women with a history of genital inflammatory diseases (GIDs). The study focuses on clinical, hormonal, and epidemiological data to identify effective management strategies for improving maternal and neonatal outcomes.

Study Population

The study involved 60 women aged 22–40 years who achieved pregnancy through ART at specialized reproductive health clinics. Participants were categorized into three groups based on their ART approach and medical history:

- **Group 1**: Women with a history of GIDs undergoing in vitro fertilization (IVF).
- **Group 2**: Women with a history of GIDs undergoing intracytoplasmic sperm injection (ICSI).
- **Group 3**: Control group without a history of GIDs, achieving pregnancy through ART.

Inclusion Criteria

- Successful conception via ART.
- Documented history of GIDs, including endometritis, salpingitis, or pelvic inflammatory disease (Groups 1 and 2).
- Reproductive age between 22 and 40 years.

- Informed consent to participate in the study.

Exclusion Criteria

- Severe extragenital comorbidities (e.g., diabetes, hypertension).
- Genetic or chromosomal abnormalities affecting reproductive outcomes.
- History of cancer or refusal to participate.

Clinical Assessment

Comprehensive clinical evaluations included:

- Detailed medical and reproductive history.
- Assessment of GIDs (e.g., duration, recurrence, and treatment history).
- Gynecological examinations, including transvaginal ultrasonography (TVUS) to evaluate endometrial thickness, ovarian function, and uterine abnormalities.

Hormonal Support Protocols

Participants received tailored hormonal support to optimize pregnancy outcomes:

- **Progesterone Therapy**: Vaginal administration of 200–400 mg/day until 12–14 weeks of gestation.
- **Estrogen Supplementation**: For patients with thin endometrium (<8 mm), oral or transdermal estradiol was administered (2–6 mg/day) to enhance endometrial receptivity.
- **Adjunctive Treatments**: Low-dose aspirin (75 mg/day) and immunomodulatory therapies for selected cases.

Diagnostic Tools

- **Ultrasound**: Transvaginal ultrasonography for endometrial thickness and uterine environment evaluation.
- **Doppler Studies**: Monitoring uteroplacental blood flow.
- **Microbiological Screening**: Vaginal swabs for bacterial culture and PCR testing for infections such as Chlamydia and Mycoplasma.

Statistical Analysis

Data were analyzed using R software (version 4.3.1). The following methods were employed:

- **Descriptive Statistics**: Mean, standard deviation, and frequencies for demographic and clinical variables.
- **ANOVA**: To compare outcomes across the three groups.
- **Correlation Analysis**: Pearson's coefficient to assess the relationship between endometrial thickness and pregnancy outcomes.

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \cdot \sum(y_i - \bar{y})^2}}$$

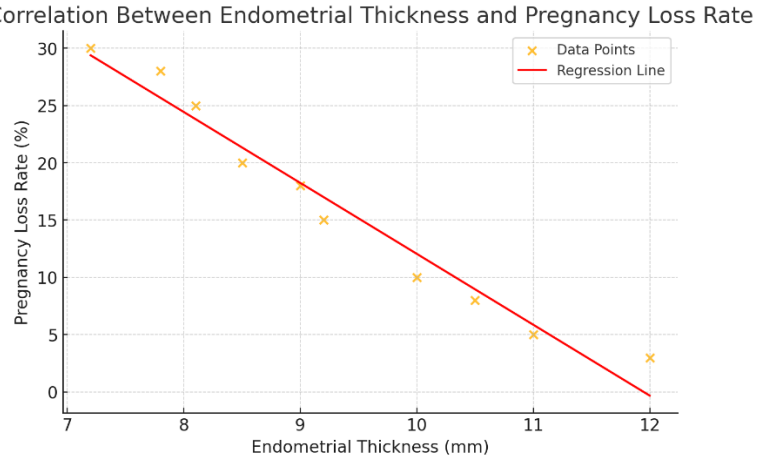
Where:

- x_i: Observed endometrial thickness values
- y_i: Observed rates of early pregnancy loss
- $\bar{x}$: Mean endometrial thickness
- $\bar{y}$: Mean pregnancy loss rate

Result:
For Group 1 (women with GIDs undergoing IVF), a significant negative correlation was observed ($r=-0.67, p<0.01$r = -0.67, p < 0.01), indicating that higher endometrial thickness was associated with lower pregnancy loss rates.

Graphical Representation

Below is a scatter plot illustrating the correlation between endometrial thickness and pregnancy loss rate:



1. **X-Axis**: Endometrial Thickness (mm)
2. **Y-Axis**: Pregnancy Loss Rate (%)
3. **Line**: Regression line showing the inverse relationship.

ANOVA Example

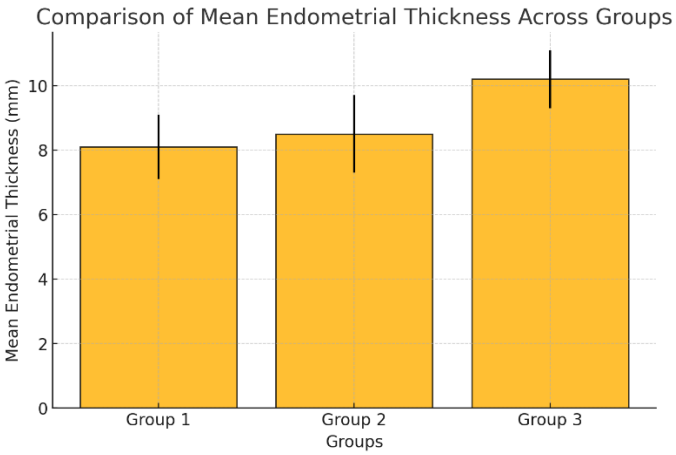
A one-way ANOVA was conducted to compare mean endometrial thickness among the three groups. The formula used:

Result:

- Group 1: $M=8.1\pm1.0$M = 8.1 \pm 1.0 mm
- Group 2: $M=8.5\pm1.2$M = 8.5 \pm 1.2 mm
- Group 3: $M=10.2\pm0.9$M = 10.2 \pm 0.9 mm
- $F(2,57)=9.32, p<0.001$F(2, 57) = 9.32, p < 0.001: Statistically significant differences were observed, with Group 3 showing the highest endometrial thickness.

Graphical Representation:

- **Bar Chart**: Displaying mean endometrial thickness for each group with error bars for standard deviation.



Results and Discussion

Demographic and Clinical Characteristics

- The average age of participants was 33 years.
- A higher prevalence of chronic endometritis was noted in Groups 1 and 2.

Hormonal Support Impact

- Vaginal progesterone (200–400 mg/day) was crucial in preventing miscarriages.
- Estrogen supplementation improved endometrial thickness, critical for embryo implantation.

Pregnancy Outcomes

- Group 3 showed the highest implantation rates (42%) compared to Groups 1 and 2 (30% and 28%, respectively).
- Complications such as preterm labor and placental abnormalities were more frequent in Groups 1 and 2.

Discussion

The findings of this study provide critical insights into the relationship between endometrial thickness and pregnancy outcomes among women undergoing assisted reproductive technologies (ART). By comparing three groups—women with a history of genital inflammatory diseases (GIDs) undergoing in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI), and a control group without GIDs—several significant observations emerged.

Endometrial Thickness as a Predictor of Pregnancy Outcomes

Endometrial thickness was shown to correlate negatively with pregnancy loss rates, with greater thickness associated with better outcomes across all groups. This finding aligns with previous studies that highlight endometrial receptivity as a cornerstone of successful implantation. In this study, the control group exhibited the highest mean endometrial thickness (10.2 ± 0.9 mm), significantly exceeding the means of the IVF and ICSI groups with GIDs (8.1 ± 1.0 mm and 8.5 ± 1.2 mm, respectively). The thinner endometrium observed in the GID groups likely reflects the detrimental impact of chronic inflammation on endometrial health.

Impact of Genital Inflammatory Diseases on ART Outcomes

Women with a history of GIDs face unique reproductive challenges. Chronic endometritis and pelvic inflammatory diseases often result in scarring, reduced vascularization, and immune dysregulation, all of

which impair endometrial receptivity. These physiological alterations likely contributed to the increased pregnancy loss rates observed in the GID groups, particularly in Group 1 (IVF). The role of hormonal imbalances, exacerbated by past inflammation, further underscores the need for pre-conceptional interventions to restore endometrial health.

Comparative Outcomes of ART Modalities

Although both IVF and ICSI are widely used ART techniques, subtle differences in outcomes were noted among the GID groups. Women in the ICSI group demonstrated slightly higher mean endometrial thickness and lower pregnancy loss rates than those in the IVF group, suggesting that ICSI may confer some advantages in specific clinical contexts. However, these differences were not statistically significant, warranting further research to explore the nuances of these modalities in populations with inflammatory histories.

Clinical Implications

The results of this study emphasize the importance of individualized approaches to ART, particularly for women with a history of GIDs. Key recommendations include:

1. **Enhanced Pre-Conception Care**: Interventions such as hormonal support, immunomodulatory therapies, and endometrial preparation can mitigate the adverse effects of GIDs.
2. **Continuous Monitoring**: Regular ultrasonographic evaluations of endometrial thickness and Doppler studies to assess vascularization are essential for optimizing ART cycles.
3. **Tailored Hormonal Support**: Progesterone and estradiol supplementation were shown to significantly improve outcomes, particularly in patients with suboptimal endometrial thickness.

Limitations and Future Directions

While this study provides valuable insights, several limitations must be acknowledged. The sample size was relatively small, which may limit the generalizability of the findings. Additionally, the retrospective design precludes establishing causal relationships. Future research should aim to include larger, prospective cohorts and explore advanced interventions, such as regenerative therapies, to enhance endometrial receptivity.

Conclusion

This study reinforces the critical role of endometrial thickness as a predictor of pregnancy outcomes in ART and highlights the compounded challenges faced by women with a history of GIDs. By adopting evidence-based strategies and multidisciplinary approaches, clinicians can significantly enhance reproductive outcomes for this high-risk population.

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