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Original Article

The Influence of Polycystic Ovary Syndrome (PCOS) on Infertility and Treatment Outcomes

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ABSTRACT

Introduction: *Polycystic ovary syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age, frequently leading to infertility. This study aimed to evaluate the influence of PCOS on infertility treatment outcomes, focusing on ovulation rates, pregnancy rates, live birth rates, miscarriage rates, and pregnancy complications in women undergoing infertility treatments.* ***Methods and Materials:*** *This was a cohort study conducted from January, 2023 to June, 2024 involving 200 women seeking treatment for infertility. Participants included 120 women diagnosed with PCOS and 80 non-PCOS women as controls. Baseline data, hormonal profiles, and treatment outcomes were collected. Participants underwent standard infertility treatments such as ovulation induction, intrauterine insemination (IUI), or in vitro fertilization (IVF). Hormonal markers, including LH/FSH ratios, insulin resistance (HOMA-IR), and testosterone levels, were measured. Treatment outcomes such as ovulation, pregnancy, live birth rates, and complications were analyzed using SPSS version 26.* ***Results:*** *Successful ovulation was achieved in 75% of PCOS women compared to 87.5% in the non-PCOS group. Clinical pregnancy rates were 41.7% in the PCOS group and 56.3% in the control group, while live birth rates were 33.3% in PCOS women compared to 43.8% in non-PCOS participants. Miscarriage rates were higher in the PCOS group (8.3% vs. 6.3%). The PCOS group showed elevated insulin resistance (HOMA-IR: 3.5 ± 1.4) and testosterone levels (80 ± 20 ng/dL) compared to controls.* ***Conclusion:*** *PCOS significantly affects infertility treatment outcomes, resulting in lower ovulation, pregnancy, and live birth rates, alongside higher rates of miscarriage and gestational diabetes.*

Keywords: *Polycystic ovary syndrome, infertility, pregnancy outcomes, ovulation rates, gestational diabetes*

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INTRODUCTION

Polycystic ovarian syndrome (PCOS) is the most common endocrine disorder affecting women of reproductive age, with an estimated prevalence of 4-12% in the general population. It is also the leading cause of anovulatory infertility[1]. PCOS is typically diagnosed based on a combination of clinical or biochemical hyperandrogenism, oligo-ovulation or anovulation, and polycystic ovaries, as outlined by the Rotterdam criteria[2]. Despite its high prevalence, diagnosing PCOS requires the exclusion of other causes of infertility, such as iatrogenic factors (radiation, chemotherapy, surgery) and endocrine disorders like endometriosis, pelvic inflammatory disease, hyperprolactinemia, Cushing's syndrome, and premature ovarian insufficiency[3]. When investigating infertility in women with suspected PCOS, a thorough physical and gynecological examination is essential, complemented by a detailed medical and surgical history, including family history. Additional diagnostic tools such as hysteroscopy, ultrasonography, and blood tests, including anti-Müllerian hormone (AMH) levels, are useful in evaluating ovarian reserve and other fertility parameters[4]. Transvaginal ultrasonography (TVUS) is particularly helpful in identifying uterine anomalies, assessing antral follicle count, and measuring endometrial thickness. Non-pharmacologic interventions, including lifestyle modifications, remain the first-line treatment for managing PCOS-related infertility. Regular physical activity, smoking cessation, and weight loss (particularly for overweight or obese women) have been

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shown to improve reproductive outcomes[5]. For women with a body mass index (BMI) over 35 kg/m^2 who have not achieved success through lifestyle changes after one year, bariatric surgery may be considered[6]. Pharmacologic treatments, such as clomiphene citrate (CC), are well-established for inducing ovulation in women with PCOS. Letrozole, an aromatase inhibitor, is another effective option, particularly for those resistant to clomiphene, as it reduces estrogen levels, thus minimizing the risk of developing multiple follicles[7]. Gonadotropin therapy is considered a second-line treatment and is often used in combination with timed intercourse to further enhance ovulatory response. To prevent ovarian hyperstimulation syndrome (OHSS) and multiple pregnancies, low-dose step-up regimens are generally recommended[8]. For women who do not respond to first- or second-line treatments, advanced reproductive techniques such as in vitro fertilization (IVF) or in vitro maturation (IVM) may be considered. IVF protocols often include the use of gonadotropins along with gonadotropin-releasing hormone (GnRH) agonists or antagonists. Newer treatments, such as myo-inositol, have also shown promise in restoring ovarian function and improving outcomes in PCOS patients by regulating glucose metabolism and follicle-stimulating hormone (FSH) signaling[9]. Ovarian drilling, performed laparoscopically or via transvaginal hydrolaparoscopy (THL), is an alternative for women who do not respond to clomiphene after several cycles but before starting gonadotropin therapy[10]. However, the procedure carries the same risks as any surgical intervention, including the formation of adhesions, and the choice of laparoscopic versus THL techniques may influence safety outcomes[11]. This study aims to evaluate the influence of polycystic ovary syndrome (PCOS) on infertility and treatment outcomes, providing insight into optimal management strategies for improving reproductive health in affected women.

METHODS & MATERIALS

This study was conducted at Sheikh Fazilatunnessa Mujib Memorial Kpj Specialized Hospital & Nursing College, Gazipur, Bangladesh from January, 2023 to June, 2024. A cohort of 200 women diagnosed with PCOS and a control group of women without PCOS, all seeking infertility treatment, were recruited. Participants were aged 18-40 years and selected based on the Rotterdam criteria for the PCOS group, with exclusion criteria including other endocrine disorders, unrelated hormonal treatments, and severe comorbidities affecting fertility. Baseline data on medical histories, infertility duration, menstrual irregularities, and metabolic profiles were collected. Participants underwent infertility treatments, including ovulation induction, intrauterine insemination (IUI), or in vitro fertilization (IVF). Treatment outcomes—ovulation rates, pregnancy rates, live birth rates, and complications—were recorded and compared between the two groups. Hormonal levels (LH, FSH) and insulin resistance markers were measured at various stages to evaluate the impact of PCOS on treatment efficacy. Data analysis was performed using SPSS version 26.

RESULTS

Table – I: Age Distribution of Study Participants (*n*=200)

Age Range (Years)	Frequency (*n*)	Percentage (%)
18-25	30	15.0
26-30	60	30.0
31-35	70	35.0
36-40	40	20.0

The age distribution of the study participants shows that the majority of women were between 31 and 35 years old, accounting for 35.0% (n=70) of the total cohort. This was followed by 30.0% (n=60) of participants in the 26-30 age range. Participants aged 36-40 comprised 20.0% (n=40), while those in the youngest age group, 18-25 years, made up the smallest portion at 15.0% (n=30).

Table – II: PCOS and Non-PCOS Participant Distribution(*n*=200)

Group	Frequency (n)	Percentage (%)
PCOS	120	60.0
Non-PCOS	80	40.0

The participant distribution between the two groups shows that 60.0% (n=120) of the study cohort were diagnosed with PCOS, while the remaining 40.0% (n=80) were non-PCOS participants.

Table – III: Infertility Treatment Outcomes by Group(*n*=200)

Treatment Outcome	PCOS Group (*n* = 120)		Non-PCOS Group (*n* = 80)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Successful Ovulation	90	75.0	70	87.5
Clinical Pregnancy	50	41.7	45	56.3
Live Birth	40	33.3	35	43.8
Miscarriage	10	8.3	5	6.3

The infertility treatment outcomes showed that successful ovulation occurred in 75.0% (n=90) of women in the PCOS group, compared to 87.5% (n=70) in the non-PCOS group. Clinical pregnancy rates were lower in the PCOS group at

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41.7% (n=50), whereas 56.3% (n=45) of non-PCOS participants achieved clinical pregnancy. Live birth rates followed a similar trend, with 33.3% (n=40) of PCOS women giving birth, compared to 43.8% (n=35) in the non-PCOS group. Miscarriage rates were slightly higher in the PCOS group at 8.3% (n=10), compared to 6.3% (n=5) in the non-PCOS group.

Table – IV: Hormonal Levels and Insulin Resistance Markers(*n*=200)

Marker	PCOS Group (Mean ± SD)	Non-PCOS Group (Mean ± SD)
LH/FSH Ratio	2.8 ± 1.1	1.2 ± 0.5
Insulin Resistance (HOMA-IR)	3.5 ± 1.4	1.8 ± 0.7
Testosterone (ng/dL)	80 ± 20	45 ± 15

The hormonal levels and insulin resistance markers revealed significant differences between the PCOS and non-PCOS groups. The PCOS group had a higher LH/FSH ratio (2.8 ± 1.1) compared to the non-PCOS group (1.2 ± 0.5). Insulin resistance, as measured by HOMA-IR, was also markedly elevated in the PCOS group (3.5 ± 1.4) compared to the non-PCOS group (1.8 ± 0.7). Additionally, testosterone levels were significantly higher in the PCOS group (80 ± 20 ng/dL) compared to the non-PCOS group (45 ± 15 ng/dL).

Table – V: Treatment Complications(*n*=200)

Complication	PCOS Group (*n* = 120)		Non-PCOS Group (*n* = 80)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Ovarian Hyperstimulation	15	12.5	5	6.3
Multiple Pregnancies	10	8.3	7	8.8
Gestational Diabetes	20	16.7	8	10.0

The treatment complications data indicated that ovarian hyperstimulation occurred more frequently in the PCOS group, with 12.5% (n=15) of cases, compared to 6.3% (n=5) in the non-PCOS group. The incidence of multiple pregnancies was similar between the two groups, with 8.3% (n=10) in the PCOS group and 8.8% (n=7) in the non-PCOS group. Gestational diabetes was notably more common in the PCOS group, affecting 16.7% (n=20), while it occurred in 10.0% (n=8) of the non-PCOS participants.

DISCUSSION

The findings of this study provide significant insight into the influence of polycystic ovary syndrome (PCOS) on infertility treatment outcomes, with clear differences observed between women with and without PCOS. The age distribution of the participants revealed that the majority were aged between 31-35 years, with 35% falling within this range. This distribution aligns with previous studies, which have identified a similar concentration of reproductive-aged women seeking treatment for infertility in their early 30s, emphasizing the age-related decline in fertility potential, particularly among women with PCOS [12]. Additionally, the participant distribution in our study, with 60% of the cohort diagnosed with PCOS, reflects the high prevalence of this condition among women presenting with infertility, consistent with findings in large population-based studies [13]. Regarding ovulation outcomes, our study observed that successful ovulation was achieved in 75% of PCOS women, compared to 87.5% in non-PCOS participants. This discrepancy highlights the ovulatory dysfunction commonly associated with PCOS, which has been previously documented in numerous studies. For example, a meta-analysis comparing ovulation induction with letrozole and clomiphene citrate found that PCOS patients consistently exhibited lower ovulation rates [14]. Moreover, clinical pregnancy rates in our PCOS cohort (41.7%) were lower than those in the non-PCOS group (56.3%), which is also in line with previous findings that emphasize the reduced fertility potential in PCOS patients despite treatment[15]. The live birth rate in our study was similarly lower in the PCOS group (33.3%) compared to non-PCOS participants (43.8%), a trend observed in other studies evaluating the reproductive outcomes of women with PCOS undergoing assisted reproductive technologies[16]. Miscarriage rates were slightly higher in our PCOS group (8.3%) compared to non-PCOS women (6.3%). This finding is consistent with research indicating that PCOS patients are at an increased risk of miscarriage, potentially due to insulin resistance and hyperinsulinemia, which are prevalent in this population[17]. The elevated LH/FSH ratio observed in our PCOS cohort (2.8 ± 1.1) compared to the non-PCOS group (1.2 ± 0.5) supports the hormonal imbalances associated with PCOS, where excessive LH relative to FSH contributes to anovulation [18]. This hormonal imbalance has been a key diagnostic marker of PCOS and has been well documented in studies evaluating the endocrinological profile of PCOS patients[19]. Insulin resistance, a hallmark of PCOS, was also evident in our study, with the PCOS group exhibiting higher HOMA-IR scores (3.5 ± 1.4) than non-PCOS participants (1.8 ± 0.7). This finding is consistent with studies that show PCOS women have

significantly elevated insulin resistance compared to non-PCOS controls, even after adjusting for BMI[20]. Insulin resistance exacerbates reproductive issues by impairing ovulation and contributing to hyperandrogenism, as evidenced by the elevated testosterone levels in our PCOS group (80 ± 20 ng/dL), compared to the non-PCOS group (45 ± 15 ng/dL)[21]. These findings align with previous studies that have consistently reported hyperandrogenism and its association with insulin resistance in PCOS patients[22]. Our study also revealed a higher incidence of ovarian hyperstimulation syndrome (OHSS) in the PCOS group (12.5%) compared to non-PCOS participants (6.3%). This increased risk of OHSS in PCOS patients is well-established in the literature, particularly among those undergoing ovulation induction or in vitro fertilization (IVF) treatments[23]. Furthermore, while the incidence of multiple pregnancies was similar between the two groups, the PCOS group had a slightly lower incidence (8.3%) compared to non-PCOS participants (8.8%), a finding that mirrors previous reports that associate PCOS with a higher risk of multiple pregnancies due to ovarian hyperstimulation[9]. Gestational diabetes mellitus (GDM) was notably more prevalent in our PCOS group, affecting 16.7% of participants, compared to 10.0% in the non-PCOS group. This is consistent with the growing body of evidence that suggests women with PCOS are at an increased risk of GDM due to underlying insulin resistance and hyperinsulinemia[24]. Previous studies have shown that women with PCOS have nearly double the risk of developing GDM compared to non-PCOS women, even after controlling for other confounding factors such as obesity[25]. In summary, the findings of this study corroborate the existing literature on the adverse reproductive outcomes associated with PCOS. Women with PCOS face significantly lower ovulation, pregnancy, and live birth rates, as well as higher risks of miscarriage, OHSS, and GDM. These findings underscore the importance of individualized treatment approaches for PCOS patients, focusing not only on ovulation induction but also on managing metabolic and hormonal imbalances to improve reproductive outcomes. Further research is necessary to explore more targeted interventions to mitigate the heightened risks of pregnancy complications in PCOS patients, such as the use of insulin-sensitizing agents and lifestyle modifications to reduce insulin resistance.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The findings of this study demonstrate the significant impact of polycystic ovary syndrome (PCOS) on infertility treatment outcomes. Women with PCOS face lower ovulation, pregnancy, and live birth rates, along with a higher risk of miscarriage, ovarian hyperstimulation, and gestational diabetes compared to their non-PCOS counterparts. Hormonal imbalances, particularly elevated LH/FSH ratios, insulin resistance, and hyperandrogenism, play a critical role in the reduced reproductive outcomes in PCOS patients. These findings emphasize the need for individualized treatment strategies that address both metabolic and hormonal imbalances to optimize fertility outcomes and minimize pregnancy complications. Further research into more targeted therapies for PCOS-related infertility is warranted to improve long-term reproductive health in this population.

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Ethical Approval: The study was approved by the Institutional Ethics Committee

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