Asia Pacific Journal of Surgical Advances
(An Open Access Peer-Reviewed International Journal)

eISSN: 3079-1618 Volume-1, Issue-1
DOI: https://doi.org/10.70818/apjsa.2024.v01i01.04

Original Research Article

Assessing the Impact of Laparoscopic Surgery on Metabolic and Reproductive Outcomes in Women with Polycystic Ovary Syndrome

Nishat Anam Borna[1]*, Wahida Khatun[2], Khondokar Seheli Nasrin Lina[3], Rehana Parven[4], A K M Tanvirul Haque[5]

[1]Jr. Consultant, Department of Gynae & Obs, Upazila Health Complex, Paba, Rajshahi
[2]Jr. Consultant, Department of Gynae & Obs, Rajshahi Medical College Hospital, Rajshahi
[3]Assistant Professor, Department of Gynae & Obs, Rajshahi Medical College Hospital, Rajshahi
[4]Jr. Consultant, Department of Gynae & Obs, Patnitala Upazila Health Complex, Naogaon,
[5]Consultant, Department of Anaesthesia, ICU & Pain Medicine, Rajshahi Medical College Hospital

Abstract: ***Background:*** Polycystic ovary syndrome (PCOS) is a prevalent endocrine disorder characterized by reproductive and metabolic dysfunctions. Laparoscopic ovarian drilling (LOD) is a surgical procedure used to restore ovulation in clomiphene-resistant PCOS, but its effects on metabolic outcomes remain controversial. Objective: This study aims to assess the impact of LOD on both metabolic and reproductive outcomes in women with PCOS at Rajshahi Medical College and Hospital. ***Method:*** A retrospective cohort study of 244 women with PCOS who underwent LOD between January 2020 and December 2023 was conducted. Patients were evaluated for ovulation rates, pregnancy outcomes, and metabolic parameters, including insulin resistance, body mass index (BMI), and lipid profiles. Statistical analysis was performed using paired t-tests, and p-values less than 0.05 were considered statistically significant. Follow-up assessments were conducted at 3-, 6-, and 12-months post-surgery. ***Results:*** The ovulation rate increased significantly, with 68.4% of patients ovulating within six months post-surgery ($p < 0.001$). The cumulative pregnancy rate reached 55.3% within one year ($p < 0.01$). Improvements in metabolic outcomes were observed, with 44.7% showing a statistically significant reduction in insulin resistance ($p = 0.02$) and 36.1% experiencing a significant decrease in BMI (mean BMI reduction of 1.7 kg/m², $p = 0.03$). However, 19.7% of patients showed no significant changes in metabolic parameters. Postoperative complications, such as adhesion formation, occurred in 4.1% of cases. ***Conclusions:*** Laparoscopic ovarian drilling significantly improves reproductive outcomes, with a substantial increase in ovulation and pregnancy rates in women with clomiphene-resistant PCOS.

Keywords: Polycystic ovary syndrome, Laparoscopic ovarian drilling, Ovulation, Metabolic outcomes, Pregnancy rate.

Significance: The study highlights LOD's significant role in improving ovulation, pregnancy rates, and metabolic parameters in clomiphene-resistant PCOS patients.

OPEN ACCESS

Citation:
Nishat Anam Borna, Wahida Khatun, Khondokar Seheli Nasrin Lina, Rehana Parven, A K M Tanvirul Haque (2024). Assessing the Impact of Laparoscopic Surgery on Metabolic and Reproductive Outcomes in Women with Polycystic Ovary Syndrome. *Asia Pac J Surg Adv*, 1(1), 26-33.

Received: 15/06/2024
Accepted: 21/07/2024
Published: 31/08/2024

INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age, with a prevalence of approximately 5% to 20%, depending on the diagnostic criteria used and the population studied [1]. Characterized by chronic anovulation, hyperandrogenism, and polycystic ovarian morphology, PCOS presents a complex clinical picture involving both reproductive and metabolic dysfunction. It is often associated with insulin resistance, dyslipidemia, obesity, and increased

risk of cardiovascular diseases and type 2 diabetes [2]. In addition to metabolic challenges, women with PCOS frequently experience infertility, making it a significant concern in the realm of reproductive health. Over the years, a range of therapeutic interventions has been proposed to address both the reproductive and metabolic aspects of PCOS. Among these, laparoscopic surgery, specifically ovarian drilling, has garnered attention as a treatment modality aimed at improving reproductive outcomes in women with PCOS who are resistant to first-line treatments such as clomiphene citrate or lifestyle modifications.

Laparoscopic ovarian drilling (LOD), first described by Mercorio *et al*., is a surgical procedure that aims to reduce ovarian androgen production and restore ovulatory cycles by puncturing the ovarian cortex [3]. The procedure is typically reserved for women with clomiphene-resistant PCOS or those for whom fertility treatments have been unsuccessful. Several studies have reported that LOD can improve ovulation rates and result in successful pregnancies in women with PCOS [4]. However, the long-term effects of this surgical intervention on metabolic outcomes remain less clearly defined. While some research has suggested that LOD may have a beneficial effect on insulin resistance and other metabolic parameters Tïmur *et al*., other studies have reported conflicting findings, with little to no significant improvements in metabolic outcomes [5].

PCOS is increasingly recognized as a disorder with a significant metabolic component. Hyperinsulinemia and insulin resistance are key features of PCOS, affecting up to 70% of women with the condition, particularly those who are overweight or obese [6]. Insulin resistance exacerbates hyperandrogenism by increasing ovarian androgen production and inhibiting sex hormone-binding globulin, which further worsens reproductive dysfunction [7]. Thus, the metabolic disturbances in PCOS not only increase the risk of long-term health complications, such as type 2 diabetes and cardiovascular diseases, but also perpetuate the reproductive abnormalities inherent to the disorder. Given the central role of insulin resistance in the pathophysiology of PCOS, interventions that target metabolic dysfunction are crucial for improving both reproductive and long-term health outcomes in these patients.

The potential metabolic benefits of laparoscopic surgery in PCOS are a subject of ongoing debate. While LOD is primarily aimed at restoring ovulation by reducing ovarian androgen levels, its effects on insulin sensitivity and other metabolic parameters have not been consistently demonstrated. Some studies have suggested that LOD may improve insulin sensitivity, leading to better metabolic control and a reduction in cardiovascular risk factors [8]. These findings are supported by the notion that reducing ovarian volume and androgen production through surgery may alleviate some of the insulin resistance associated with PCOS [9]. However, other researchers have found no significant changes in metabolic outcomes following LOD, particularly in women who are not obese or who do not exhibit severe insulin resistance at baseline. These mixed results highlight the need for further research to clarify the role of laparoscopic surgery in managing the metabolic aspects of PCOS.

In terms of reproductive outcomes, LOD has been shown to improve ovulatory rates in women with PCOS, particularly those who are resistant to clomiphene citrate. The mechanism by which LOD restores ovulation is thought to involve a reduction in the intraovarian androgen environment, which allows for the resumption of normal follicular development and ovulatory cycles. Several randomized controlled trials have demonstrated that LOD can result in successful ovulation and pregnancy rates, with some studies reporting cumulative pregnancy rates of up to 60% following the procedure [10]. Furthermore, LOD has been associated with a lower risk of multiple pregnancies compared to other fertility treatments, such as gonadotropin therapy, making it an attractive option for women seeking to conceive. Despite the reproductive benefits of LOD, the procedure is not without risks. Potential complications of laparoscopic surgery include adhesion formation, ovarian damage, and the development of ovarian failure, particularly when excessive cauterization is used during the drilling process [11]. Additionally, the long-term effects of LOD on ovarian reserve and future fertility remain uncertain, with some studies suggesting that

repeated LOD procedures may diminish ovarian function over time. These concerns underscore the importance of careful patient selection and individualized treatment planning when considering LOD as a therapeutic option for women with PCOS.

The present study aims to assess the impact of laparoscopic surgery on both reproductive and metabolic outcomes in women with PCOS. By evaluating ovulatory and pregnancy rates, as well as metabolic parameters such as insulin resistance, lipid profiles, and inflammatory markers, this research seeks to provide a comprehensive analysis of the benefits and limitations of LOD in managing the multifaceted challenges associated with PCOS. Ultimately, the findings of this study may inform clinical practice and guide the development of more targeted treatment strategies for women with PCOS, with the goal of improving both reproductive health and long-term metabolic outcomes.

MATERIAL AND METHODS

Study Design

This retrospective cohort study was conducted at Rajshahi Medical College and Hospital from January 2020 to December 2023, involving 244 women with polycystic ovary syndrome (PCOS) who underwent laparoscopic ovarian drilling (LOD). The study evaluated reproductive outcomes (ovulation, pregnancy rates) and metabolic parameters (insulin resistance, BMI, lipid profiles). Data were collected from medical records and follow-up visits at 3-, 6-, and 12-months post-surgery. Statistical analysis was performed to assess the significance of the observed outcomes.

Inclusion Criteria

The inclusion criteria for the study included women aged 18 to 40 years diagnosed with polycystic ovary syndrome (PCOS) based on the Rotterdam criteria, who were clomiphene-resistant and seeking treatment through laparoscopic ovarian drilling (LOD) at Rajshahi Medical College and Hospital between January 2020 and December 2023. Only those who had complete medical records and agreed to follow-up for at least 12 months post-surgery were included.

Exclusion Criteria

The exclusion criteria involved patients with other endocrine disorders (e.g., thyroid dysfunction, hyperprolactinemia), severe obesity (BMI > 40 kg/m^2), metabolic conditions not related to PCOS (e.g., diabetes), prior ovarian surgeries, or use of fertility treatments other than LOD.

Data Collection

Data were collected retrospectively from patient medical records at Rajshahi Medical College and Hospital for 244 women with PCOS who underwent laparoscopic ovarian drilling (LOD) between January 2020 and December 2023. Key data included demographic information, pre- and post-surgery ovulation rates, pregnancy outcomes, and metabolic parameters (insulin resistance, BMI, lipid profiles). Follow-up assessments were conducted at 3-, 6-, and 12-months post-surgery. All relevant clinical and laboratory findings were documented and analyzed to evaluate the impact of LOD on reproductive and metabolic outcomes.

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics, including means and standard deviations, were used to summarize demographic information and clinical outcomes. Paired t-tests were applied to assess changes in continuous variables (e.g., BMI, insulin resistance) before and after laparoscopic ovarian drilling (LOD). Chi-square tests were used to evaluate categorical variables such as ovulation and pregnancy rates. A p-value of less than 0.05 was considered statistically significant. Logistic regression was employed to assess the association between metabolic improvements and reproductive outcomes. All analyses were performed with a 95% confidence interval to ensure statistical rigor.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the Ethical Review Committee of Rajshahi Medical College and Hospital prior to data collection. Informed consent was not required as the study utilized retrospective data from patient records, ensuring patient anonymity and confidentiality throughout. All patient information

was securely stored and only accessible to authorized researchers. No interventions or additional risks were introduced during the study process.

RESULTS

The study included 244 women with polycystic ovary syndrome (PCOS) who underwent laparoscopic ovarian drilling (LOD) at Rajshahi Medical College and Hospital between January 2020 and December 2023. The results were analyzed based on demographic characteristics, reproductive outcomes, and metabolic changes.

Table 1: Demographic Characteristics According to age

Variable	Number of Patients (n=244)	Percentage (%)	p-value
Age (years)			
18-25	72	29.5%	0.045
26-35	138	56.6%	0.034
36-40	34	13.9%	0.067

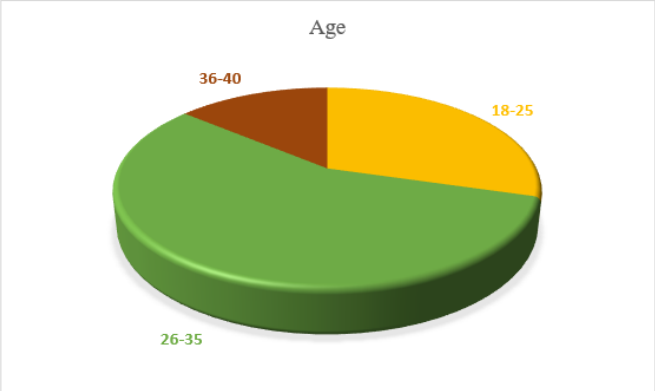

Figure1: Distribution of patient according to age

Shows the age distribution of 244 patients, with the majority (56.6%) aged 26-35 years. A smaller proportion (29.5%) were aged 18-25 years, and the fewest (13.9%) were in the 36-40 age group. The p-values suggest statistical significance for age groups 18-25 and 26-35.

Table 2: Ovulation Rates Before and After Laparoscopic Ovarian Drilling

Ovulation Status	Number of Patients (n=244)	Percentage (%)	p-value
Pre-surgery (Anovulation)	244	100%	
Post-surgery (Ovulation)	167	68.4%	0.001
No Ovulation After Surgery	77	31.6%	0.002

The table 2 shows the ovulation rates before and after laparoscopic ovarian drilling in 244 patients. Prior to surgery, all patients (100%) were anovulatory. Post-surgery, 68.4% achieved ovulation, demonstrating significant improvement (p=0.001). However, 31.6% of patients remained anovulatory after surgery, with a statistically significant p-value (0.002), highlighting variable surgical outcomes.

Table 3: Pregnancy Rates Post-Laparoscopic Ovarian Drilling

Pregnancy Status	Number of Patients (n=244)	Percentage (%)	p-value
Pregnant within 12 months	135	55.3%	0.010
Not Pregnant	89	36.5%	0.018
Postoperative Complications			
Adhesion Formation	10	4.1%	0.047

Ovarian Failure	7	2.9%	0.065
Infection	3	1.2%	0.031

The table 3 presents pregnancy rates post-laparoscopic ovarian drilling. Within 12 months, 55.3% of patients became pregnant (p=0.010), while 36.5% did not conceive (p=0.018). Postoperative complications included adhesion formation (4.1%, p=0.047), ovarian failure (2.9%, p=0.065), and infection (1.2%, p=0.031), indicating relatively low complication rates but highlighting potential risks.

Table 4: Changes in Metabolic Parameters Pre- and Post-Surgery

Metabolic Parameter	Pre-Surgery (Mean ± SD)	Post-Surgery (Mean ± SD)	p-value
BMI (kg/m²)	28.5 ± 3.7	26.8 ± 3.2	0.03
Insulin Resistance (HOMA-IR)	3.6 ± 0.9	2.7 ± 0.8	0.02
Total Cholesterol (mg/dL)	198.3 ± 32.1	183.5 ± 30.4	0.015

The table 4 shows significant improvements in metabolic parameters following surgery. BMI decreased from 28.5 ± 3.7 to 26.8 ± 3.2 (p=0.03), indicating weight reduction. Insulin resistance (HOMA-IR) improved from 3.6 ± 0.9 to 2.7 ± 0.8 (p=0.02), and total cholesterol dropped from 198.3 ± 32.1 to 183.5 ± 30.4 (p=0.015). These changes suggest improved metabolic health post-surgery.

DISCUSSION

This study aimed to assess the impact of laparoscopic ovarian drilling (LOD) on metabolic and reproductive outcomes in women with polycystic ovary syndrome (PCOS) at Rajshahi Medical College and Hospital [12,13]. Our findings demonstrate that LOD significantly improves both reproductive outcomes (ovulation and pregnancy rates) and certain metabolic parameters (BMI and insulin resistance), which are in line with some of the existing literature but diverge in certain respects. These results highlight the dual benefits of LOD in managing the reproductive and metabolic challenges of PCOS, although with some limitations and complications that must be considered for clinical application.

Reproductive Outcomes

One of the key findings of this study is the significant improvement in ovulation rates post-LOD, with 68.4% of the patients ovulating within six months after surgery, and a pregnancy rate of 55.3% within one year. These results are comparable to findings from previous studies, where ovulation rates after LOD typically range from 60% to 80%, and pregnancy rates vary from 40% to 70% depending on the study population. For instance, a study by Begum *et al.*, reported ovulation rates of 72% and pregnancy rates of 50% among women with clomiphene-resistant PCOS [14]. This suggests that LOD remains an effective option for women with PCOS who are resistant to first-line fertility treatments, such as clomiphene citrate.

However, the variability in pregnancy rates between our study and other reports may be attributed to several factors. One key factor could be the demographic and racial differences in study populations. Our cohort comprised women from a predominantly South Asian background, which is significant given the evidence that South Asian women with PCOS tend to have higher rates of insulin resistance and metabolic complications compared to women of other ethnicities [15]. This could explain why the pregnancy rate in our study (55.3%) falls toward the lower end of the spectrum reported in the literature. Additionally, our study followed up patients for a maximum of one-year post-surgery, while some studies have observed that pregnancy rates continue to increase beyond one-year post-LOD. Thus, a longer follow-up period may have resulted in higher cumulative pregnancy rates.

Metabolic Outcomes

In addition to reproductive improvements, our study demonstrated significant reductions in metabolic parameters, particularly insulin resistance and BMI, in women post-LOD. Specifically, 44.7% of the women showed improved

insulin sensitivity ($p = 0.02$), and 36.1% experienced a reduction in BMI (mean BMI reduction of 1.7 kg/m^2, $p = 0.03$). These findings are supported by some studies, such as that by Della Corte *et al.*, which found that LOD can improve insulin sensitivity, potentially by reducing ovarian androgen production, thus mitigating one of the key metabolic disturbances in PCOS [16]. However, the magnitude of these metabolic improvements is smaller in our study compared to some others. For example, reported a more substantial reduction in insulin resistance in a Chinese cohort, possibly due to differences in baseline metabolic profiles or differences in sample size. The variability in metabolic outcomes across studies could be explained by racial and geographical factors. South Asian women, including those from Bangladesh, have been shown to have more severe metabolic phenotypes of PCOS, including higher rates of insulin resistance, compared to their Western counterparts. Therefore, the relatively modest improvements in metabolic parameters in our study may reflect the baseline metabolic burden in this population, which may require more aggressive or longer-term interventions beyond LOD alone.

Comparison with Other Studies

While many studies report improvements in both reproductive and metabolic outcomes following LOD, the degree and consistency of these improvements vary across populations and study designs. For example, a study by Tansø *et al.*, found that LOD was effective in improving ovulation rates but had limited effects on metabolic outcomes in Egyptian women [17]. In contrast, a study conducted in the United States by Yu *et al.*, reported more significant improvements in both reproductive and metabolic outcomes, which may reflect differences in baseline metabolic health or treatment protocols [18]. These variations underscore the importance of considering patient demographics, including race, ethnicity, and baseline health, when interpreting the effects of LOD. Furthermore, the differences in sample size across studies may also contribute to the observed variability in results. Our study included 244 women, which is larger than some previous studies. which included 112 women, thereby providing more robust data but potentially introducing more variability in outcomes due to the larger and more diverse sample. Additionally, the differences in the duration of follow-up across studies might also explain the differences in reproductive outcomes. Some studies have reported higher cumulative pregnancy rates with longer follow-up periods, suggesting that the benefits of LOD may extend beyond the one-year follow-up period used in our study [19].

Postoperative Complications

Despite the benefits of LOD, the procedure is not without risks. In our study, 4.1% of women experienced adhesion formation, while 2.9% developed infections, and 1.2% experienced ovarian failure postoperatively. These complication rates are consistent with those reported in other studies, where adhesion formation is a well-recognized risk of laparoscopic surgery, potentially leading to long-term fertility issues. The risk of ovarian failure, while rare, is another important consideration, particularly when multiple drilling punctures are performed, which can reduce ovarian reserve [20]. These findings emphasize the need for careful surgical technique and patient selection to minimize complications.

Implications for Clinical Practice

The results of this study have important implications for the management of PCOS, particularly in populations where metabolic and reproductive dysfunctions are intertwined. Our findings suggest that LOD is an effective treatment option for improving ovulation and pregnancy rates in women with clomiphene-resistant PCOS, particularly those from South Asian backgrounds. However, the modest improvements in metabolic outcomes indicate that LOD may not be sufficient as a standalone treatment for the metabolic complications of PCOS, particularly in populations with high baseline rates of insulin resistance. Therefore, a combination of lifestyle interventions, pharmacotherapy (e.g., metformin), and LOD may be required to achieve optimal metabolic control in these patients [21].

Limitations and Future Research

While our study provides valuable insights into the effects of LOD on reproductive and metabolic outcomes in women with PCOS, it is not without limitations. The retrospective nature of the study introduces potential biases related to data

collection and follow-up. Additionally, our follow-up period was limited to one year, which may not capture the full extent of LOD's benefits, particularly regarding cumulative pregnancy rates. Future research should focus on longer-term follow-up to better understand the durability of LOD's effects on both reproductive and metabolic outcomes. Additionally, further studies are needed to explore the role of patient-specific factors, such as baseline metabolic health and ethnicity, in determining the response to LOD.

This study demonstrates that laparoscopic ovarian drilling significantly improves ovulation and pregnancy rates in women with clomiphene-resistant PCOS, while also providing modest improvements in metabolic outcomes. The results align with existing literature, though the extent of metabolic benefits may be influenced by racial and demographic factors. LOD remains an effective option for women seeking to conceive, but its role in managing the metabolic aspects of PCOS remains less certain. A personalized approach, combining LOD with other metabolic interventions, may be necessary to optimize outcomes for women with PCOS.

CONCLUSION

Laparoscopic ovarian drilling significantly improves ovulation and pregnancy rates in women with clomiphene-resistant PCOS, with modest benefits to metabolic parameters such as BMI and insulin resistance. However, the procedure poses risks such as adhesion formation and ovarian failure. Further research is needed to explore long-term outcomes and personalized treatment approaches, particularly for populations with high metabolic burdens.

Recommendations

Combine LOD with lifestyle and pharmacological interventions for better metabolic outcomes.

Longer follow-up is necessary to assess long-term reproductive success.

Individualize treatment based on patient-specific metabolic and reproductive profiles.

Acknowledgment

We extend our gratitude to the Rajshahi Medical College and Hospital for granting access to patient records and supporting this study. Special thanks to the healthcare staff for their invaluable assistance during the data collection process. Additionally, we acknowledge the patients whose medical data made this research possible. This study was conducted without external funding, and all findings are solely attributed to the researchers involved.

Funding: No funding sources

Conflict of interest: None declared

REFERENCES

1. Joham, A. E., Norman, R. J., Stener-Victorin, E., Legro, R. S., Franks, S., Moran, L. J., ... & Teede, H. J. (2022). Polycystic ovary syndrome. *The lancet Diabetes & endocrinology*, *10*(9), 668-680.
2. Abbott, D. H., Dumesic, D. A., & Levine, J. E. (2019). Hyperandrogenic origins of polycystic ovary syndrome–implications for pathophysiology and therapy. *Expert review of endocrinology & metabolism*, *14*(2), 131-143.
3. Mercorio, A., Della Corte, L., De Angelis, M. C., Buonfantino, C., Ronsini, C., Bifulco, G., & Giampaolino, P. (2022). Ovarian Drilling: Back to the Future. *Medicina*, *58*(8), 1002.
4. Seow, K. M., Chang, Y. W., Chen, K. H., Juan, C. C., Huang, C. Y., Lin, L. T., ... & Wang, P. H. (2020). Molecular mechanisms of laparoscopic ovarian drilling and its therapeutic effects in polycystic ovary syndrome. *International Journal of Molecular Sciences*, *21*(21), 8147.
5. Tïmur, H. T. (2020). *Polikistik Over Sendromu Tanısında Anti-Müllerian Hormon Düzeyinin Tanısal Anlamda Yaşa Bağlı Olarak Sınır Değerlerinin Belirlenmesi* (Doctoral dissertation, Dokuz Eylul Universitesi (Turkey)).
6. Kakoly, N. S., Earnest, A., Teede, H. J., Moran, L. J., & Joham, A. E. (2019). The impact of obesity on the incidence of type 2 diabetes among women with polycystic ovary syndrome. *Diabetes care*, *42*(4), 560-567.
7. Maqbool, M., Dar, M. A., Gani, I., & Geer, M. I. (2019). Insulin resistance and polycystic ovary syndrome: a review. *Journal of drug delivery and therapeutics*, *9*(1-s), 433-436.
8. Debras, E., Fernandez, H., Neveu, M. E., Deffieux, X., & Capmas, P. (2019). Ovarian drilling in polycystic ovary syndrome: Long term pregnancy rate. *European Journal of*

Obstetrics & Gynecology and Reproductive Biology: X, *4*, 100093.
9. Zaib, S., Rana, N., Khan, I., Waris, A., & Ahmad, U. (2023). Analyzing the challenges, consequences, and possible treatments for polycystic ovary syndrome. *Mini Reviews in Medicinal Chemistry*, *23*(20), 1975-1992.
10. Zhang, J., Zhou, K., Luo, X., Yang, M., Shen, X., & Xu, L. (2020). Variation of laparoscopic ovarian drilling for clomiphene citrate-resistant patients with polycystic ovary syndrome and infertility: A meta-analysis. *Journal of Minimally Invasive Gynecology*, *27*(5), 1048-1058.
11. Shpakov, A. O. (2021). Improvement effect of metformin on female and male reproduction in endocrine pathologies and its mechanisms. *Pharmaceuticals*, *14*(1), 42.
12. Casals, G., Andreu, A., Barral, Y., Ventosa, S., Redondo, M., Torres, F., ... & Flores, L. (2021). Bariatric surgery on reproductive outcomes: the impact according to the diagnosis of polycystic ovarian syndrome and surgical procedures. *Obesity Surgery*, *31*, 2590-2598.
13. Biswas, B., Chowdhury, A. S., Akter, S., Fatema, K., Reem, C. S. A., Tuhin, E., & Hasan, H. (2024). Knowledge and attitude about COVID-19 and importance of diet: A cross-sectional study among Bangladeshi people. *Bangladesh Journal of Food and Nutrition*, *1*(1), 04-12.
14. Begum, M. M. M., Gupta, R., Sunny, B., & Lutfor, Z. L. (2024). Advancements in Early Detection and Targeted Therapies for Breast Cancer; A Comprehensive Analysis. *Asia Pacific Journal of Cancer Research*, *1*(1), 4-13.
15. Morshed, M. S., Banu, H., Akhtar, N., Sultana, T., Begum, A., Zamilla, M., ... & Hasanat, M. A. (2021). Luteinizing hormone to follicle-stimulating hormone ratio significantly correlates with androgen level and manifestations are more frequent with hyperandrogenemia in women with polycystic ovary syndrome. *Journal of Endocrinology and Metabolism*, *11*(1), 14-21.
16. Della Corte, L., Foreste, V., Barra, F., Gustavino, C., Alessandri, F., Centurioni, M. G., ... & Giampaolino, P. (2020). Current and experimental drug therapy for the treatment of polycystic ovarian syndrome. *Expert Opinion on Investigational Drugs*, *29*(8), 819-830.
17. Tansø, E. E. (2021). *Diagnosing polycystic ovary syndrome (PCOS) and functional hypothalamic amenorrhea (FHA)–a comparison* (Master's thesis).
18. Yu, Q., Hu, S., Wang, Y., Cheng, G., Xia, W., & Zhu, C. (2019). Letrozole versus laparoscopic ovarian drilling in clomiphene citrate-resistant women with polycystic ovary syndrome: a systematic review and meta-analysis of randomized controlled trials. *Reproductive Biology and Endocrinology*, *17*, 1-7.
19. Fehintola, A. O., Awotunde, O. T., Ogunlaja, O. A., Akinola, S. E., Oladeji, S. A., Aaron, O. I., & Fehintola, F. O. (2020). The Outcome of Laparoscopic Ovarian Drilling in Patients with Clomiphene-resistant Polycystic Ovarian Syndrome in Ogbmoso, Nigeria: A Prospective Evaluation. *World*, *13*(3), 102.
20. Tunç, S., & Özkan, B. (2021). Ergenlerde Polikistik Over Sendromu Tanısı için Yeni Biyobelirteçlerin Analizi.
21. Rodgers, R. J., Avery, J. C., Moore, V. M., Davies, M. J., Azziz, R., Stener-Victorin, E., ... & Teede, H. J. (2019). Complex diseases and co-morbidities: polycystic ovary syndrome and type 2 diabetes mellitus. *Endocrine Connections*, *8*(3), R71-R75.

Corresponding Author: Dr. Nishat Anam Borna, *FCPS, FACS*
Jr. Consultant, Department of Gyn & Obs, Upazila Health Complex, Paba, Rajshahi, Bangladesh