WISELEAF SCIENTIFIC VENTURES



CHAPTER-2
PHARMACOLOGY ACROSS THE MENSTRUAL LIFE STAGE: MENSTRUATION, CONTRACEPTION AND REPRODUCTIVE DISORDERS

Dr. Chandralekha N[1], Afsheen Ayesha[2].

1. Professor and HOD, Department of Pharmacology, Father Muller Medical College, Mangaluru.
2. Clinical Nutritionist, Nutrition and Dietetics, Rituals of You.

Email Id- smilekha25@gmail.com , afsheenayesha3@gmail.com

ORCID- 0000-0001-5324-7558, 0009-0001-3923-7553

Abstract

Pharmacology during the menstrual life stage examines the association between physiological, hormonal, and reproductive modifications and the responses to drugs and therapy in women. Topics such as menstruation, reproduction control, and reproductive diseases represent important issues for providing personalized pharmacological approaches as part of women's healthcare. Hormonal changes in the course of menstruation may cause variations in metabolism, distribution, absorption, and elimination of medication in the body and possibly influence the efficacy of therapy and side effects. Pharmacological methods of treatment of menstruation-related problems comprise both hormonal and non-hormonal treatments according to patients' requirements. The pharmacology of contraception includes hormonal and non-hormonal contraceptive methods, and the type of contraception to be used depends on efficacy, safety, contraindications, and reproductive goals. Reproductive problems, such as polycystic ovary syndrome, endometriosis, and uterine fibroids require all-the-round treatment approaches with the focus on symptom relief, hormonal regulation, preserving reproductive function, and maintaining good health in the long run. It is important to know how to regulate drug interaction, determine risk factors, and identify individual hormonal status in a patient to

optimize pharmacological treatment. Modern developments in precision medicine and research that takes into account gender characteristics in pharmacology.

Keywords: Contraception, Menstrual Disorders, Pharmacology, Reproductive Health, Women's Health

1. Introduction

During the reproductive years, numerous intricacies affecting women's reproductive health arise owing to interplay of various factors like hormonal regulation, physiological processes, metabolic processes and personal health status. Area of menstruation, contraception and reproductive disorders involves interrelated branches of health care that either require appropriate use of medicines to achieve reproduction, mitigate symptoms, improve wellbeing, etc. Menstrual cycle, endometrial growths, ovulation and menstruation are influenced by variations of hormones such as estrogen, progesterone, luteinizing hormone and follicle-stimulating hormone. Any failure in these processes may lead to phenomena like menstrual disorders, pelvic pains and uterine bleeding, thus leaving room for learning reproductive physiology for better utilization of pharmacological knowledge [1].

The treatment of menstrual disorders with medications entails the use of various therapeutic methods. These include non-steroidal anti-inflammatory medications (NSAIDs), hormonal birth control, progestational drugs, among other drugs used for specific conditions. The disorders mentioned can affect the physical state of a patient, emotional condition, work, and studies of a person. Furthermore, pathological uterine bleeding can be associated with disorders of ovulation, anatomical changes in the uterus, blood clotting disorders, and other diseases, hence the treatment should be individualized depending on the pathology present, its severity, and reproductive intentions of the patient [2].

Another aspect of the reproductive health care system is contraceptive pharmacology. Combined hormonal contraceptives, progestim medication, intrauterine devices and emergency contraception are some of the means used to accomplish pregnancy prevention, menstrual regulation and treatment of specific gynecological pathologies. To choose a particular method of contraception, its efficiency, contraindications, side effects, preferences of the patient, and possible drug interactions must be taken into consideration. For example,

some medications can change the action of contraceptive medicine, making a good understanding of the case a significant element of practice [3].

The reproductive diseases, such as PCOS and endometriosis, present a greater challenge to deliver effective therapeutics because hormonal imbalance, metabolic disturbances, chronic inflammation, pain, and decreased fertility may be involved. Depending on the clinical manifestation and treatment objective, management options might include hormonal suppression, insulin-sensitizing agents, analgesics, or ovulation-inducing agents. Clinical pharmacotherapy for fertility must involve detailed assessment, proper drug selection, and forecasting with the aim of achieving fertility outcomes without the incidence of adverse drug effects [4].

Emerging in clinical pharmacology and precision medicine are the doors to modern individualized treatment, based on the hormonal status, metabolic indices, comorbidities, medication history, and reproductive intentions. However, it is the differences in treatment responses, safety concerns, drug interactions, and, remarkably, the wide gap that is increasingly becoming apparent in sex-specific research that continue to plague therapeutic decision-making. Yet it remains a necessary principle for optimizing treatment outcomes and rendering a much-needed evidence-based provision of women's healthcare. This chapter discusses the pharmacological considerations on situations within the ambit of menstruation disorders, fertility management, drug-contraceptive interactions, and some personalized therapeutic approaches [5].

2. Menstrual Cycle and Pharmacological Considerations

The menstrual cycle is a process that occurs in the human body and that is regulated through the hypothalamus, pituitary gland, and ovaries. The cycle consists of hormone changes in the body that make the uterus ready for pregnancy and assist in the functioning of the different systems' structures. The changes of hormones affect the activity of drug- metabolizing enzymes and the pharmacokinetics of the body. It is necessary to know the stages of the menstrual cycle for clinical pharmacology as changes in the hormones' levels will have an impact on drug metabolism and effect [6].

2.1 Physiology and Hormonal Regulation of the Menstrual Cycle

The menstrual cycle is stated to last about 21–35 days in women but with a noticeable range from individual to individual. It depends on the hypothalamic–pituitary–ovarian system that functions due to the influence of gonadotropin-releasing hormone (GnRH), which stimulates the gland anterior pituitary to secret follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH is responsible for the ovarian follicles' formation and LH provides the potential maturation of the follicles and provokes ovulation **(Figure 1)**. Hypothalamic–Pituitary–Ovarian Axis and Hormonal Regulation of the Menstrual Cycle. The follicular cycle begins with menstruation until ovulation. It is the time when the ovary makes estrogen hormone in the developing follicles like estradiol, which promotes the growth of the endometrium. The increase in estradiol secretion results in the LH surge happening midway through the cycle with ovulation as a result. When ovulation has occurred, the creation of progesterone continues by the corpus luteum, which helps to prepare the endometrium for implantation and actively participates in the secretory phase. If there is no pregnancy, the corpus luteum will disappear, and the levels of estrogen and progesterone will go down to let the endometrial lining be shed during menstrual periods. The hormones mentioned above are the base for many methods of intervention into the natural processes [7].

2.2 Hormonal Fluctuations and Drug Response

The levels of estrogen and progesterone change over the menstrual cycle and they affect many physiological processes including liver enzyme activity, body fluid balance, gastroenterological activities, and body temperature. Such fluctuations may change drug response to medication but the extent of these changes and their clinical significance depend on specific drugs. Estrogen is known to impact the level of activity of certain enzymes including particular enzymes from the cytochrome P450 class. In addition, the impact of progesterone and other changes that occur due to the makeup of the cycle has to be considered when explaining changes in drug metabolism and impacts on the body. The particular importance of hormone fluctuations can be seen when it comes to drugs with small therapeutic indices and drugs that are metabolized by hormones-sensitive metabolic pathways. Such changes include the alteration of the metabolism of certain antiepileptic drugs due to estrogens-

containing contraceptives, while some antiepileptic medications induce enzymes that might reduce contraceptive effectiveness. These interactions are clinically important but should not be considered to have a relation to normal variations during the menstrual cycle. Therefore, the choice of medication should take into consideration the specific drug and its metabolic pathway, the clinical status of the patient, and the evidence available; it should not be assumed that all medications will impart different effects for each phase of the menstrual cycle [8].

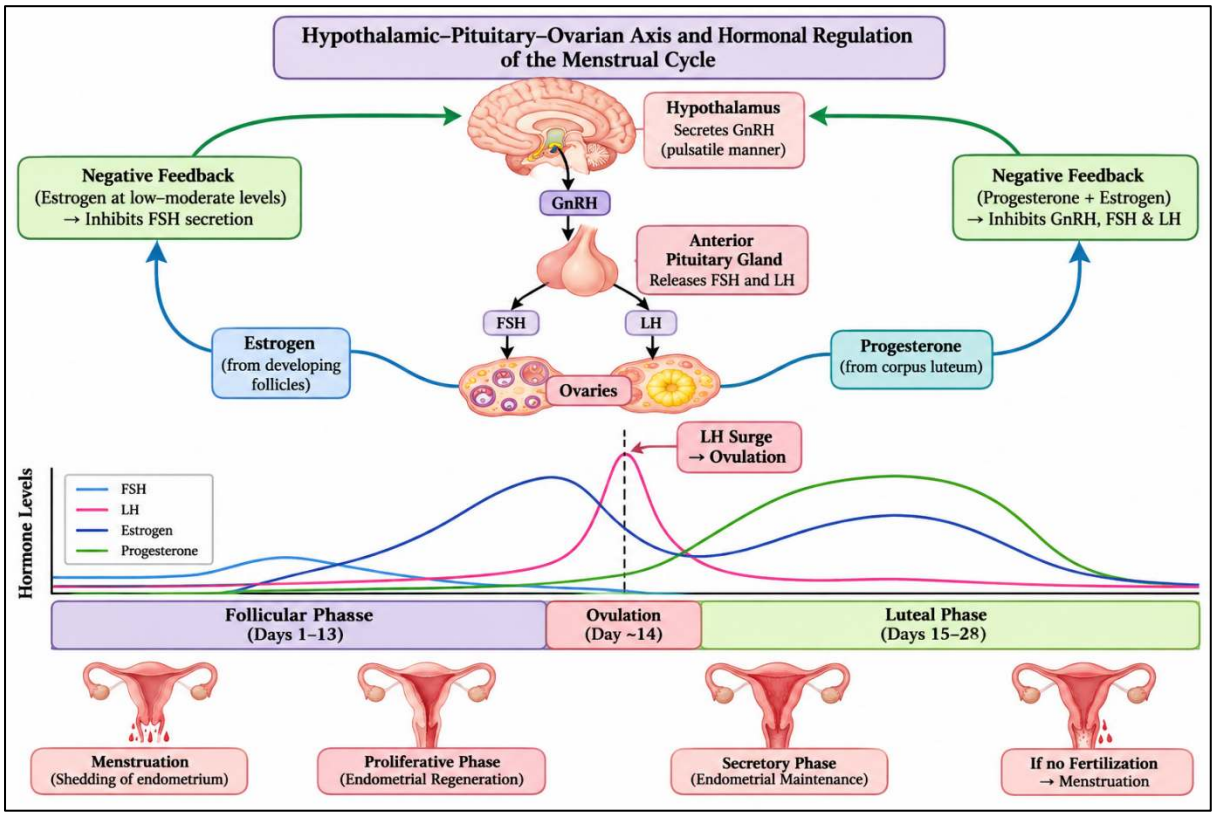

Figure 1. Hypothalamic–Pituitary–Ovarian Axis and Hormonal Regulation of the Menstrual Cycle

2.3 Pharmacokinetic and Pharmacodynamic Considerations

Pharmacokinetics is understood to refer to what happens to a drug in the body, such as how the drug is taken in, goes round the body, metabolized, and excreted from it. On the other hand, pharmacodynamics can be defined as the way in which the drug affects the body, including both good and bad actions. Both terms are essential to know when looking into interaction between reproductive physiology and medication action.

Absorption: Hormones can influence gastrointestinal function and thus the functioning of digestive system. So, it can be said that the absorption of medication can be altered due to the changes in hormonal levels but this was not proven for many medications.

Distribution: It should be taken into account that both temperature of the body and body fluid balance can change during the menstrual cycle. Yet changes in drugs distribution are not expected to go through major changes due to menstrual cycle phases (**Table 1)**.

Metabolism: Hormones may regulate some of drug-metabolizing enzymes. The implications of this fact may depend not only on type of the drug but on hormonal exposure level and personal metabolic features as well.

Excretion: This means that pharmacokinetic principles dictate that the kidney and the state of hydration play critical functions in drug removal from the body. Regardless of this fact, the amount of variation in dosing depending on the phase of the menstrual cycle has no current scientific backing.

Hormones may also affect how people experience pain, feel and how serious their menstrual symptoms are. As a result, effectiveness of painkillers as well as drugs for pain management can be different even if their concentrations don't vary significantly [9].

Table 1. Comparison of Pharmacokinetic and Pharmacodynamic Changes Across the Menstrual Cycle

Parameter	Potential hormonal influence	Pharmacological significance
Drug absorption	Hormonal fluctuations may influence gastrointestinal motility.	May contribute to variability in drug absorption.
Drug distribution	Changes in plasma volume and fluid retention may influence distribution.	May affect apparent drug distribution in selected circumstances.
Hepatic metabolism	Estrogen and progesterone may influence certain drug-metabolizing enzymes.	May alter the metabolism of specific medications.

CYP enzyme activity	Hormonal regulation may affect selected CYP pathways.	Potential changes in drug clearance and exposure.
Renal elimination	Hormonal changes may influence renal haemodynamics and fluid balance.	May contribute to variability in drug elimination.
Receptor sensitivity	Sex hormones may modulate receptor expression and signaling.	May influence pharmacodynamic responses.
Pain perception	Hormonal fluctuations may affect pain sensitivity.	May influence analgesic requirements and perceived treatment response.

2.4 Clinical Implications of Cycle-Related Drug Variability

Grasping menstrual physiology allows health professionals to differentiate between true drug response variations and those resulting from the normal hormonal variations. Although on-going medication administering based on the menstrual cycle phase is not suggested for the majority of medications, changes that come along through the menstrual cycle can assist in treatment adjustment. Although NSAIDs are typically used at the very beginning of dysmenorrhea, there are different selected hormone medications that might be taken regularly or cyclically in order to regulate menstrual cycles and stop ovulation. Premenstrual symptom monitoring would help identify the link between symptoms and menstrual cycles as well as treatment efficacy. Whenever a reproductive individual is prescribed medications, the medic will also need to reckon with the possibility of pregnancy, use of contraceptives, other diagnosed diseases, and medications taken at the same time. Reconciliation of medications is especially crucial in the case of drugs that induce enzymes or have significant clinically important interactions. Thus, individualized evaluation, efficient counseling regarding drugs, and evidence-based observation are preferred to simple medication dose adjustment based on the menstrual cycle phase [10].

3. Dysmenorrhea

Dysmenorrhea, which is defined as pain during menstruation, is one of the main complaints of women of reproductive age. This condition is known to have a crucial impact on everyday life including school and work performance and quality of life. Dysmenorrhea can be divided into two types depending on the cause of the condition: primary dysmenorrhea, which of course refers to cases of dysmenorrhea in the absence of any pelvic pathology and secondary dysmenorrhea when dysmenorrhea has its underlying cause. The main point of pharmacological treatment is pain relief, elimination of inflammation, and enhancement of daily activities [11].

3.1 Pathophysiology and Clinical Presentation

Nausea, vomiting, diarrhoea, headaches, fatigue, and dizziness may result from primary dysmenorrhea without recognizable pelvic pathology and commonly occur due to elevated levels of prostaglandins in the endometrium. There is the release of prostaglandins by the endometrium to initiate menstruation after a decrease in progesterone levels. This leads to uterine contractions, vasoconstriction, and short-term uterine ischemia causing pain experienced during menstruation (**Figure 2)**. Symptoms involved with primary dysmenorrhea include abdominal cramping which sometimes can radiate to the lumbar region or thighs. Pain usually starts just before menstruation or when it begins and it lasts for a couple of days. In addition, secondary dysmenorrhea is caused by underlying disorders affecting pelvic anatomy like endometriosis, adenomyosis, uterine fibroids, and pelvic inflammation. It typically presents as pain that deteriorates during menstruation, pain that appears even when no menstruation occurs, dyspareunia, or heavy bleeding [12].

3.2 Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

Non-steroidal anti-inflammatory drugs are the first-line drugs for primary dysmenorrhea management in cases with no contraindications. Commonly ibuprofen, naproxen, and mefenamic acid have been used. These drugs inhibit cyclooxygenase enzymes and lessen prostaglandin synthesis, which in turn diminishes uterine contraction and menstrual pain. NSAIDs are generally most effective when taken just before the onset of menstruation or at the onset of first symptoms of pain and used within the recommended dosing schedule throughout

the duration of symptoms experienced. The choice is made according to individual response, medical history, tolerability, and contraindications (**Table 2)**.

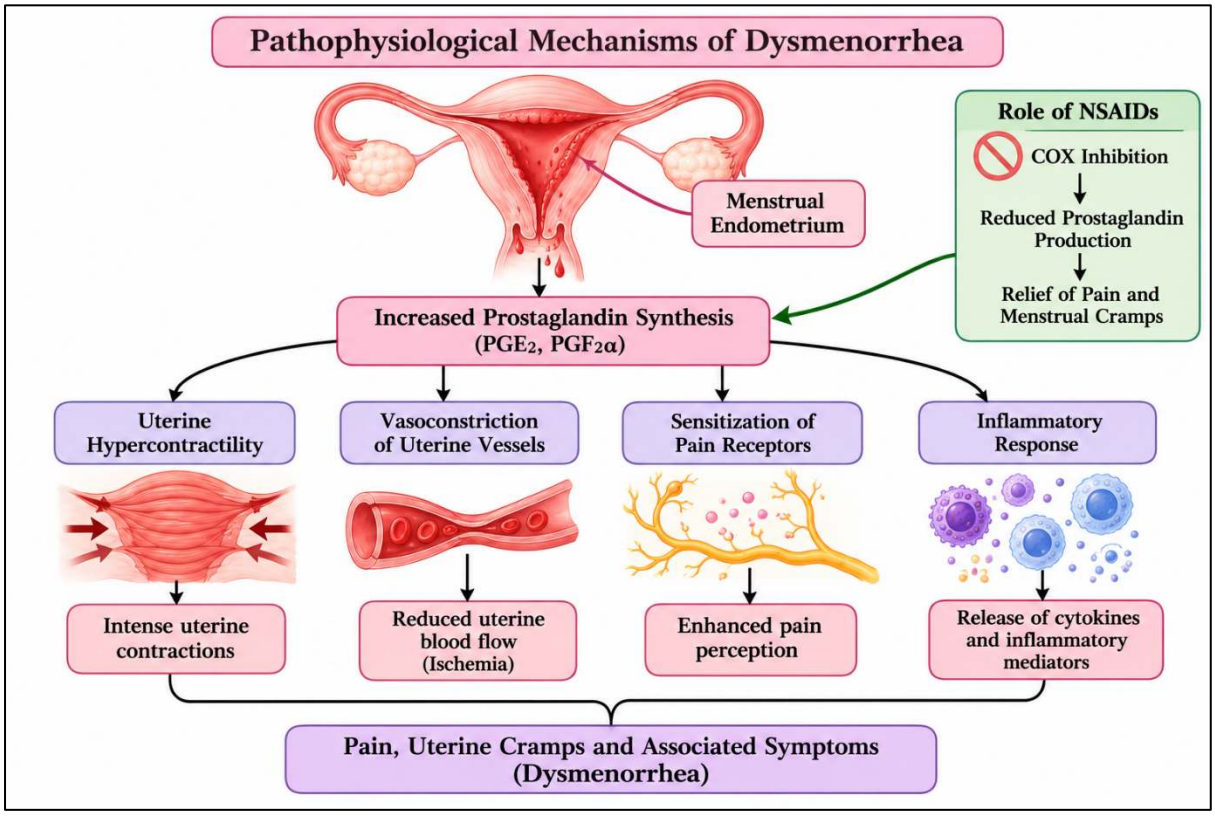

Figure 2. Pathophysiological Mechanisms of Dysmenorrhea

Commonly reported adverse effects are gastrointestinal discomfort, nausea, and dyspepsia. Serious risks include gastrointestinal bleeding, renal impairment, fluid retention, and cardiovascular complications in sensitive individuals. For this reason, one must be conservative in using NSAIDs among patients with peptic ulcer disease, kidney dysfunction, relevant cardiovascular conditions, or hypersensitivity to NSAIDs in the past. There is also a general practice against multiple NSAID use. If pain persists even after an adequate trial of NSAID therapy, the clinician should reassess the patient's adherence to medication, timing of treatment, and the likelihood of secondary dysmenorrhea [13].

Table 2. Pharmacological Agents Used in the Management of Common Menstrual Disorders

Drug class	Examples	Mechanism of action	Therapeutic application
NSAIDs	Ibuprofen, naproxen, mefenamic acid	Inhibit cyclooxygenase enzymes and reduce prostaglandin synthesis.	Primary dysmenorrhea
Combined hormonal contraceptives	Ethinylestradiol with levonorgestrel	Suppress ovulation and reduce endometrial proliferation.	Dysmenorrhea and menstrual regulation
Progestins	Medroxyprogesterone acetate, norethisterone	Produce endometrial suppression and alter hormonal activity.	Menstrual disorders and abnormal uterine bleeding
SSRIs	Fluoxetine, sertraline	Increase serotonin availability by inhibiting serotonin reuptake.	PMS and PMDD
Antifibrinolytics	Tranexamic acid	Inhibits plasminogen activation and reduces fibrinolysis.	Heavy menstrual bleeding
GnRH analogues	Leuprolide	Suppress pituitary gonadotropin	Endometriosis and selected refractory

		secretion following initial stimulation.	menstrual disorders

3.3 Hormonal Treatment Strategies

Hormonal therapies are effective means of alleviating dysmenorrhea, especially when NSAIDs are not sufficiently effective or contraception is needed. Estrogen-plus-progestin combination hormonal contraceptives block ovulation and lead to reduction in endometrial growth and in production of prostaglandins during menstruation. Their administration can be cyclic or continuous depending on the needs and preferences of the patient. Progestin-only methods (including oral progestins, levonorgestrel-releasing intrauterine devices, etc.) can be effective in alleviating menstrual pain due to their ability to inhibit the endometrium and ovulation. The intrauterine levonorgestrel-releasing system can be particularly effective when dysmenorrhea is combined with heavy menstrual bleeding. The choice of the therapy requires analyzing contraindications and adverse effects and other factors related to the methods and the pregnancy intention of the patients. In certain cases, estrogen administration may be contraindicated due to thromboembolic risk and other illnesses. Progestin-only methods can be useful but their applicability will depend on the patients' individual circumstances. In the case of suspected secondary dysmenorrhea, it is important to treat the underlying disease and not only the pain symptoms [14].

3.4 Emerging and Non-Pharmacological Approaches

The use of non-pharmaceutical methods will support available medications and contribute to better symptom management. For example, the heat locally applied will alleviate painful menstruation. Regular physical exercises may decrease pain and improve well-being. Some people would find benefits in applying relaxation methods, sleeping well, and following stress management techniques. Transcutaneous electrical nerve stimulation (TENS) has been explored as an additional technique for treating menstrual pain. Acupuncture won't be unwarranted and some nutrition therapy may help, although the strength of evidence is varied. The use of these methods does not replace good medical evaluation in case of difficult

symptoms. New research is aimed at improving drug delivery methods and other ways of treating menstrual pain [15].

4. Premenstrual Syndrome (PMS)

It includes irregular physical, emotional, and behavioural symptoms that crop up during the luteal phase of the menstrual cycle. Depending on the individual, these can interfere very differently with personal relationships, academic involvement, and occupational functioning. The effective management of PMS would include recognition of the pattern of symptoms and an assessment of severity, along with provision of pharmacological and supportive intervention. This information has been extracted from the U.S. Department of Health and Human Services Bureau of Maternal and Child Health Report [16]].

4.1 Pathophysiology and Clinical Features

In the present time, it cannot be asserted that the pathophysiology of PMS is entirely known. Evidence available so far indicates that individuals suffering from PMS exhibit greater sensitivity to variations in ovarian hormones and to their effects on the neurotransmitters (including serotonin and gamma-aminobutyric acid (GABA)). Therefore, PMS is not so much regulated by the pathology of hormones in the human body but by individuals' differences in the reactions to these hormones. The symptoms of the disease involve physical symptoms (including breast tenderness, bloating, headache, fatigue, appetite disturbances, fluid retention, etc.) as well as behavioural symptoms (including irritability, mood changes, anxiety, inability to concentrate, trouble sleeping, etc.). Symptoms start appearing in the luteal phase and disappear after a few days after the completion of menstruation. Keeping a record of symptoms for at least 2 menstrual cycles allows establishing their periodicity and the difference between PMS and such medical conditions as depression, anxiety disorders, problems with thyroid, etc [17].

4.2 Pharmacological Management

The pharmacological approach is predicated on the severity of symptoms, thereby implying specific clinical symptoms and the extent of impairment of functionality in psychosocial performance. Among the important medications, selective serotonin reuptake inhibitors (SSRIs), like fluoxetine, sertraline, or escitalopram, are among the most prevalent medications

used to treat intense emotional and behavioural reactions, particularly when such reactions lead to severe limitations in daily activities. SSRIs can be taken throughout the whole cycle or restricted to the second half of the cycle depending on the type of drugs prescribed, the symptoms, and clinical judgments. When administered, SSRIs demonstrate improvement stemming from their ability to influence serotonin levels. Among possible side effects, nausea, disturbances during sleep, headaches, and sexual problems may be pointed out. However, the treatment should be individualized accordingly to its effects on the patient. Should hormonal contraceptives be desired, one may make use of the combined hormonal contraceptives. NSAID administration may also help to relieve headaches, soreness in the breast area, and other symptoms of pain associated with PMS. However, no sexual and behavioural symptoms of PMS may be taken care of by merely prescribing medications [18].

4.3 Hormonal and Non-Hormonal Treatment Options

Hormonal methods and non-hormonal methods represent complementary approaches for PMS treatment. Combined hormonal contraceptives can help in diminishing cyclical changes occurring in hormone levels in the body by inhibiting ovulation. Some formulations, such as those containing drospirenone or ethinyl estradiol, are beneficial for some patients experiencing premenstrual symptoms. However, their applicability is conditioned by factors such as contraindications, risk factors, and contraceptive choice. SSRIs represent significant non-hormonal solutions, above all for mood-related symptoms. Cognitive behavioural therapy is also effective in dealing with psychological conditions. NSAIDs can be applied for pain-relief purposes while treatment of other symptoms is performed only when indicated. Evidence in support of supplements varies, while safety of usage must be considered beforehand. Hormonal therapy cannot be prescribed based on the assumption that every woman suffering from premenstrual symptoms suffers from hormonal deficiency. Treatment must be tailored according to the severity of symptoms, comorbidities, medication tolerance, pregnancy intention, and the preferences of the patient [19].

4.4 Lifestyle Modification and Supportive Care

Lifestyle changes can help with treating PMS especially when combined with medication. Getting regular physical activity may have a positive impact on sleep, mood and physical

health. For some individuals, sticking to a certain sleeping routine, eating well and managing stress can help with their symptoms. Cutting down on caffeine and alcohol contributes to the control of the condition if it aggravates sleep, anxiety or tenderness of breasts. Drinking enough fluids and eating right contributes to good health but does not necessarily help manage PMS symptoms. Keeping track of the menstrual cycle and the symptoms may help with recognizing the pattern, evaluating the efficiency of treatment and making decisions together with healthcare providers. Cognitive behavioural therapy and other approaches may be useful. The health specialist should make it clear that PMS is something recognized and that it varies in severity in different patients. Patients should consult with doctors, if the symptoms are severe, regular and with the associated mood disorders. The comprehensive approach including education, lifestyle change, psychological support and scientific-based treatment should be used in order to help with treatment [20].

5. Premenstrual Dysphoric Disorder (PMDD)

Premenstrual dysphoric disorder can be described as extreme form of the premenstrual disorder. The condition involves considerable changes in one's emotional behaviour and physical well-being. The most common symptoms include severe mood swings, irritability, anxiety, depression, fatigue, and poor concentration. The patient may experience much more distress than in the case with PMS. The recovery process involves evaluating the symptoms and choosing the best individualized treatment. The treatment may include the use of selective serotonin reuptake inhibitors as well as hormonal therapy if appropriate for a particular case [21].

5.1 Diagnostic Features and Pathophysiology

The main features of PMDD include the occurrence of the same symptoms that begin occurring during the last week preceding menstruation, become less severe after a few days from the beginning of menstruation, and practically disappear during the post-menstrual week. The diagnostic guidelines require at least five symptoms to be observed, but at least one symptom must be a mood symptom that can be represented by emotional lability, irritability or anger, depressed mood, and anxiety. Alongside mood symptoms, such symptoms as lack of interest in everyday life, inability to focus on something, fatigue, change in appetite, and sleep

problems can be symptomatic for a patient. It should be noted, however, that the symptoms of PMDD must be recorded prospectively during at least two menstrual cycles to corroborate the cyclical nature of the disease. Although the pathophysiology of PMDD is still unclear, it is believed that some people suffering from this disorder become more sensitive to ovarian hormones (especially estrogen and progesterone) as well as to neuroactive metabolites of progesterone due to their influence on GABA receptors. Howeverit s, eems that disorders in serotonin activity may also result in behavioural symptoms of this disorder [22].

5.2 Selective Serotonin Reuptake Inhibitors (SSRIs)

SSRIs are often the first choice for PMDD treatment given their effectiveness in alleviating all PMDD symptoms. Common drugs in this category include fluoxetine, sertraline, and escitalopram. The SSRIs work by blocking the reabsorption of serotonin into presynaptic neurons which increases serotonin levels and regulates receptors responsible for mood. SSRIs can be used throughout the menstrual cycle or just during the luteal phase. Continuous use might be warranted in case the patient has PMDD symptoms beyond the premenstrual phase or suffers from another psychiatric disorder. Luteal phase use of SSRIs might be indicated in patient's whose PMDD symptoms are restricted only to the premenstrual period. Also, there are cases when SSRIs might be used at the onset of the symptoms depending on the physician. The side effects include nausea, headache, insomnia, tiredness, and sexual problems. Some patients might even experience increased anxiety or stomach problems while starting to take SSRIs. Therefore, the choice of the medication needs to be individualized with an appropriate monitoring of the side effects, treatment efficiency, and compatibility with other medications. SSRIs should be used after the patient has undergone necessary clinical assessment. The patients should be counselled on taking the drugs and on what changing or discontinuing treatment [23].

5.3 Hormonal Treatment Approaches

Medical professionals may suggest utilizing hormone therapies for patients struggling with PMDD under certain conditions. The menstrual cycle must be considered when making this decision—especially when contraception is also required. Hormonal contraceptives prevent ovulation and help regulate the fluctuations in hormones during the women’s menstrual cycle.

Specific protocols involving the use of drospirenone and ethinyl estradiol medications have shown to have advantageous effects on specific patients with PMDD. The patient's history of headache attacks, severity of the symptoms, as well as whether the patient is in need of contraception should be taken into consideration when selecting the protocol, as well as individual wishes, medical eligibility issues, etc. Continuous or extended cycle protocols aim at minimizing the breaks from using the medications, however, it is important to understand that there may be no response at all and there may be experienced certain malfunctions such as irregular bleeding. In cases of severe symptoms not responding to standard treatment, specialist may prescribe gonadotropin-releasing hormone therapy. This type of medication should not be used too frequently due to side effects. The patients needing such treatment should undergo the evaluation process and be opened to treatment options [24].

5.4 Individualized Management Strategies

The individualized PMDD management plan starts with making the diagnosis, assessing the severity of the symptoms, and recognizing comorbid physical or psychiatric illnesses. Tracking the symptoms prospectively is helpful in correlating the symptoms with the menstrual cycle and in getting a reference point for assessment of treatment response. Choosing the best treatment option should be based on the main symptomatology, previous treatment experience, need for contraception, pregnancy plans, other medical problems present, and the patient's needs regarding medications. SSRIs may be very effective in case of significant mood symptoms being present, while hormonal birth control can be chosen if menstrual cycle suppression/ contraception is needed. In addition to pharmacotherapy, people may benefit from psychological treatment like cognitive behavioural therapy. Regular follow-ups are important to assess patients for symptom improvement, side effects, compliance, and changes in everyday life. If the patient has the symptoms of constant depression, severe anxiety, or suicidal thinking, mental health assessment and appropriate measures are needed immediately [25].

6. Abnormal Uterine Bleeding

Abnormal uterine bleeding (AUB) as a condition means bleeding which comes from the body of the uterus, but which differs from normal menstruation in either frequency or regularity of occurrence, duration or volume, of bleeding. It is a common problem among gynecological

patients and may have effects on their health and life in general. Prolonged bleeding can lead to iron deficiency and anemia. Repeated episodes of bleeding might be a signal of a gynecological or systemic conditions. The aim of treatment is controlling bleeding and providing appropriate treatment of other disorders connected with this condition, including the underlying problem, taking into consideration reproductive wishes of the patient [26].

6.1 Classification, Causes, and Clinical Assessment

The International Federation of Gynecology and Obstetrics (FIGO) identifies different causes of abnormal uterine bleeding in patients who are not pregnant using a classification system known as PALM–COEIN. PALM stands for issues related to the structure itself, which are polyps, adenomyosis, leiomyomas, and malignancy or endometrium hyperplasia; COEIN, on the other hand, focuses on non-structural issues such as coagulopathy, ovulatory dysfunction, endometrial dysfunction, iatrogenic factors, and any other causes (**Figure 3)**. The clinical evaluation consists of assessing the hemodynamic stability that is determined based on the bleeding level and symptoms such as fatigue, dizziness, pelvic pain, or shortness of breath associated with the bleeding episode. When dealing with women of reproductive age, it is essential to rule out a pregnancy; hence, it is vital to take the medical history properly, which must contain details on menstrual cycles, medication used, contraceptives used, bleeding disorders or any other symptoms related to hormonal abnormalities. The investigation may include blood tests, pregnancy testing, thyroid tests, coagulation tests in certain patients, and ultrasonography of the pelvis area [27].

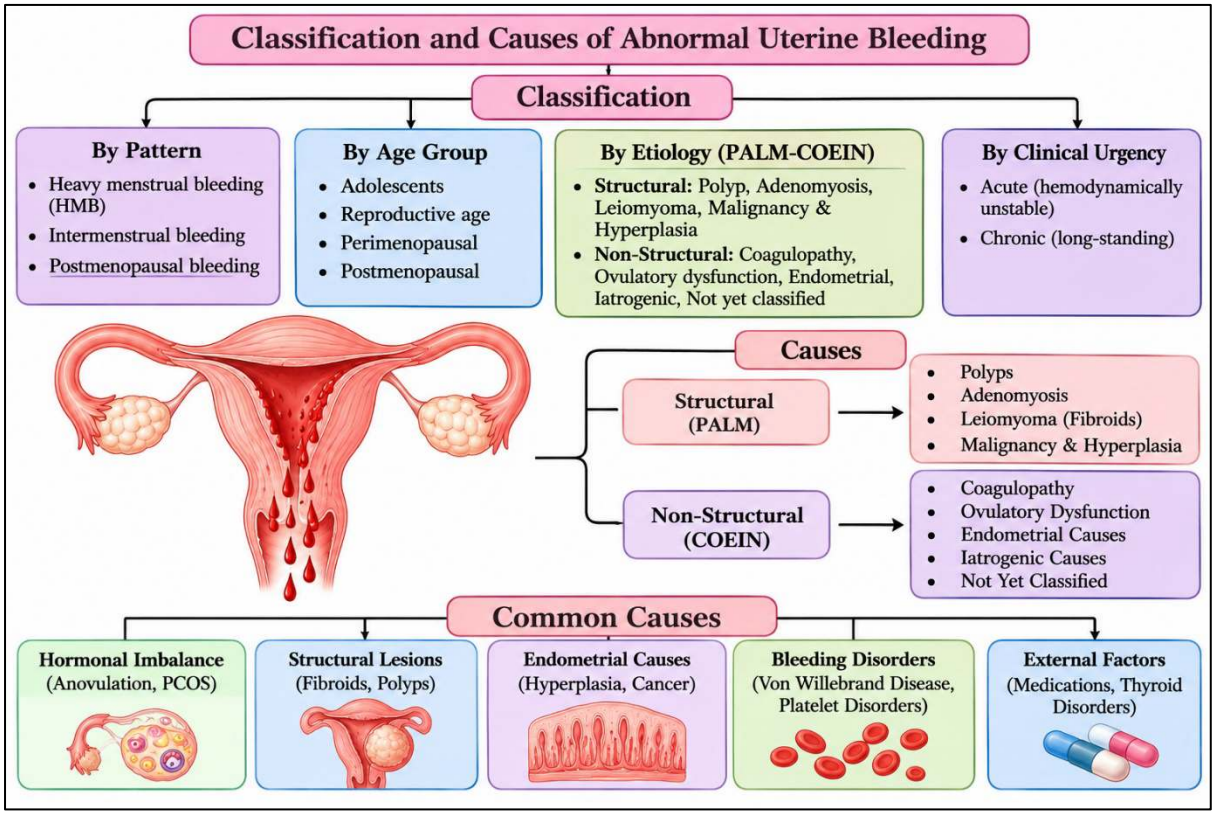

Figure 3. Classification and Causes of Abnormal Uterine Bleeding

6.2 Hormonal Pharmacotherapy

Hormonal therapy is often applied to treat AUB that is caused by ovulatory disorders and other relevant medical conditions. Birth control pills are made of estrogen in combination with progestin and are used to manage menstrual cycles and keep the lining of the uterus in place. These pills can also lessen blood flow during the menstruation and act as contraceptives if needed. Progestin is often used in a situation when estrogen is contraindicated, or when protection of the lining of the uterus is recommended for people who have chronic anovulation. Treatment can include cycles or be continuous depending on the cause and purposes of treatments. Another variant for treatment of heavy bleeding is having a levonorgestrel-releasing IUS inserted. However, in this case, proper selection of the patients should be made. Additionally, hormone therapy treatment must be tailored based on individual medical background, thrombosis risk, reproductive plans and preferences concerning the treatment. Hormones that include estrogen may have contraindications due to some cardiovascular or

thromboembolism restrictions. Hormones cannot generally solve all structural reasons causing AUB. Thus, those patients who suffer from endometrial diseases, giant fibroids or constant bleeding must undergo further diagnostic procedures and surgical treatment [28].

6.3 Non-Hormonal Treatment Options

Non-hormonal medications can be alternatives for the treatment of AUB especially in situations where contraception is not needed or hormonal treatment is not an option.

Tranexamic Acid: Tranexamic acid is an antifibrinolytic that lowers menstrual blood loss due to the inhibition of the degradation of fibrin clots. It is routinely used when bleeding occurs in patients who suffer from heavy menstrual bleeding. Proper assessment must be made in individuals with past history of thromboembolic conditions or other contraindications.

NSAIDs such as ibuprofen and naproxen are non-steroidal anti-inflammatory drugs. They inhibit synthesis of prostaglandins and may lead to less menstrual blood loss while alleviating the dysmenorrhea.

Iron supplementation must be done in cases where there is iron deficiency or iron deficiency anemia due to excessive or prolonged menstruation. The mode of iron supplementation depends on the extent of deficiency, tolerability and other circumstances.

Since bleeding needs to be controlled and its consequences fixed, patients with persistent symptoms must be reassessed in terms of circumstances behind the symptoms [29].

6.4 Management of Acute and Chronic Abnormal Uterine Bleeding

In the case of acute AUB, treatment plans will depend on the current state of the condition, so the level of bleeding and the stability of the patient are very important. For patients suffering severe pain, tiredness, breath difficulties, or who are showing that their body is not functioning properly, immediate help is needed. Treating patients might start with stabilizing their condition, intravenous infusion, tests and possible blood transfusion. After the patient becomes stable, the doctors will use certain hormones, progestines or tranexamic acid to treat the situation (only if the condition is not related to pregnancy). If necessary, more complicated methods will be used, especially if the medication fails to give the needed results. In chronic AUB cases patients will have to go through an advantage procedure to find out the cause and create a long-term adjustment plan. Possible treatment ways include combined hormonal

methods, progestins and other things. When needed, iron supplements should be added to treatment. The patient should be monitored for the bleeding and possible adverse effects of the treatment [30].

7. Hormonal Contraception

Hormonal contraception is one of the instruments in reproductive health, an important tool for effective prevention of pregnancy, which in selected patients additionally regulates menses and improves certain gynecological symptoms. These methods contain estrogen and progestin alone or progestin and can be taken orally or injected, transdermally, implanted, or intrauterinely. Patient selection should adequately consider contraceptive effectiveness, medical eligibility criteria, adverse effects, patient adherence, drug interactions, and the reproductive intentions of the patient [31].

7.1 Combined Hormonal Contraceptives

Combined hormonal contraceptives are those that include estrogen (ethinyl estradiol or estradiol) and progestin in their formulation. They come in the forms of pills, patches and vaginal rings. Their main mechanism of action is to prevent ovulation by inhibiting gonadotropins. In addition, they also increase the viscosity of cervical mucus and modify the environment of the endometrium. The benefits of these contraceptives include a predictable menstrual bleeding pattern, a decrease in menstrual flow, and relief of dysmenorrhea. Moreover, the treatment can improve acne and treat pain associated with endometriosis. The drawback of the method is that it can produce adverse reactions such as nausea, breast sensitivity, headache, and breakthrough bleeding, which is especially common at the beginning of beginning of use of this type of contraception. The use of estrogen may increase the risk of venous disease and is contraindicated in patients with cardiovascular problems, who suffer from migraine with aura, have severe hypertension, and other contraindications. The method should be selected following the assessment of the patient and her blood pressure and risk factors. The patient should be counselled on how to use the method correctly, what to do in the event of missed doses, and possible drug interactions [32].

7.2 Progestin-Only Contraceptives

Progestin-based contraceptives are free of estrogen and come in pills, injections, and implants. Progestin is beneficial for those who are unable to have estrogen-based contraceptives or those who prefer the progestin method. The contraceptives mostly prevent the fertilization of sperm by thickening the cervical mucus. Also, they may help suppress ovulation and may invoke some changes in the endometrium as well. Progestin-only pills need to be taken strictly as prescribed because the intake time may vary between different types of pills. The injectable contraceptives will enable you to maintain contraception for a long period of time, while the implants can provide you with reversible contraceptives for a few years, depending on the type of implant used. The disadvantages include unpredictable bleeding or alteration of the menstrual cycle. The injectable medroxyprogesterone may be responsible for weight gain in women as well, along with the possible development of reduced bone density. Always consider side effects before making a decision regarding the method [33].

7.3 Long-Acting Reversible Contraception

Long-acting reversible contraception (LARC) comprises contraceptive implants and intra-uterine devices. These techniques can help to prevent unwanted pregnancy effectively without requiring hardships for their users. LARC can also be removed at any time when pregnancy is planned.

Contraceptive implants: These appliances work through releasing progestin that suppresses ovulation and thickens cervical mucus. A special medical professional should put this device under the skin of the arm. The duration of operation can differ depending on the product.

Levonorgestrel-releasing intrauterine systems: These devices release progestin directly into the body, thickening the cervical mucus and changing endometrial structure to prevent pregnancy. Such devices can decrease the menstrual bleeding and could be applied successfully for treating menstrual disorders.

Copper intra-uterine devices: Copper IUDs are hormonal materials but belong to LARC due to the effectiveness and long-lasting effect. The copper ions affect sperm and help to avoid fertilization. Some women face the problem of bleeding, and pain after insertion of the item.

LARC methods require the proper insertion of the device, as consultation and monitoring are needed if they are indicated [34].

7.4 Mechanisms of Action, Efficacy, and Safety

Hormonal contraceptive methods serve various functions in preventing conception. For instance, the combined hormonal method hampers ovulation while the only progestin method may make ovulation difficult, depending on the method. The hormonal IUD also affects the local environment of the endometrium and has its own efficacy. The contraceptive method used and the degree of discipline determine the effectiveness. For instance, devices like IUDs and implants can reduce the failure rates significantly since their use is not dependent on user actions. Oral contraceptives, patches, and vaginal rings provide good results as well if used consistently. Nevertheless, they require proper usage and adherence to be effective that could present a challenge for some users. The safety assessment should take into consideration the history of medical conditions, blood pressure (when necessary), smoking habits, history of migraines, risks of cardiovascular illnesses, postpartum state, and different medications taken. Some categories of drugs, like anti-epileptics and some kinds of antibiotics, interfere with the effectiveness of some contraceptives. The importance of the problem depends on the specific medication and method [35].

7.5 Benefits, Risks, and Contraindications

The advantages of hormonal contraception are not only confined to pregnancy prevention. Depending on the usage method, hormonal contraceptives can also reduce menstrual volume and discomfort, regulate the menstrual cycle, and treat some cases of endometriosis-associated pain, acne, and premenstrual symptoms. Certain combined oral contraceptives are also said to reduce the risk of endometrial and ovarian cancers (**Table 3)**. However, the risk associated with this type of contraceptive differs based on the kind of formulation and patient. In most cases, doctors should avoid the use of estrogen-containing contraceptives in patients suffering from certain conditions like migraine with aura or severe hypertension. Alternatively, progestin-only contraception may lead to bleeding and other side effects that are characteristic of this type of contraception. During the choice of drugs, burning of breasts and the postpartum period should also be taken into consideration, as well as the liver condition of the patient and the fact of their

smoking. Different drug types may come with different contraindications, and eligibility should be established based on the latest clinical guidelines. Each of the professionals should introduce the necessary background information for patients to understand the advantages and disadvantages of the chosen contraceptive method and its side effects [36].

Table 3. Benefits, Risks, and Contraindications of Different Hormonal Contraceptive Methods

Contraceptive method	Major benefits	Potential risks or adverse effects	Important contraindications or precautions
Combined oral contraceptives	Effective contraception, menstrual regulation and reduced dysmenorrhea.	Nausea, breast tenderness, breakthrough bleeding and increased thromboembolic risk.	Migraine with aura, current or previous thromboembolic disease, severe hypertension and certain cardiovascular conditions.
Progestin-only pills	Suitable for many individuals who cannot use estrogen-containing contraception.	Irregular bleeding, spotting and menstrual changes.	Breast cancer and selected severe liver disorders.
Injectable contraceptives	Long-acting contraception and reduced menstrual bleeding in some users.	Weight changes, irregular bleeding and reversible reduction in bone mineral density.	Breast cancer and selected conditions requiring caution with bone health.
Subdermal implants	Long-term contraception with	Irregular or unpredictable	Current breast cancer and relevant drug interactions.

	high effectiveness and rapid reversibility after removal.	bleeding, headache and acne.	
Hormonal intrauterine devices	Long-term contraception and reduced menstrual bleeding.	Irregular bleeding initially, cramps and occasional expulsion.	Active pelvic infection, unexplained uterine bleeding and certain uterine abnormalities.
Copper intrauterine devices	Long-term, hormone-free contraception.	Increased menstrual bleeding and dysmenorrhea.	Pregnancy, active pelvic infection and certain uterine abnormalities.

8. Emergency Contraception

Emergency contraception is defined as methods that are used to prevent pregnancy after having sexual intercourse without using any method to prevent pregnancy or suffering from contraceptive failure, such as forgetting a pill or breaking a condom. In this way, emergency contraception is important, as it allows people to reduce the chances of becoming pregnant when they have not been able to use a regular method of contraception due to various reasons. There are a few types of emergency contraception, which are hormonal medications and a copper IUD. The right option will depend on several factors, such as time that has passed since unprotected intercourse, availability of various methods, their clinical effectiveness, and your personal preferences. It should be noted that emergency contraception cannot terminate a pregnancy and needs to be distinguished from medical abortion [37].

8.1 Types and Mechanisms of Action

The methods of emergency contraception have been categorized into two major areas, namely medications in oral form and intrauterine options. Well-known oral methods include ulipristal acetate and levonorgestrel, while the copper IUD method represents a non-hormonal alternative. Levonorgestrel is a type of progestin that inhibits or delays ovulation before the

luteinizing hormone surge has started. In cases of ulipristal acetate, it works as a selective progesterone receptor modulator which makes it possible to delay the follicular rupture at a time closer to ovulation than the case with levonorgestrel. Neither of the two aforementioned agents is capable of bringing about the needed level of effectiveness after ovulation. In the matter of the copper IUD, the latter creates a condition preventing sperm from functioning as well as fertilization. The method is highly effective when the copper device is placed in accordance with the timeline. The same cannot be said about other emergency contraception methods that do not prevent STIs. Patients need to be informed about remaining types of contraception, STIs, and pregnancy testing [38].

8.2 Oral Emergency Contraceptive Agents

Levonorgestrel and ulipristal acetate are the most important oral agents for emergency contraception. Their efficacy is based on the timing of their administration concerning intercourse and ovulation.

Levonorgestrel: Levonorgestrel is usually given as a single oral dose of 1.5 mg, which is most effective when taken immediately after unprotected sexual intercourse, and the best evidence indicates the need to be taken as soon as possible, ideally within 72 hours. There might be some advantages associated with its later intake, but usefulness decreases as the time passes, so that other methods might be used. Ulipristal acetate: Ulipristal acetate is usually given in a single dose of 30 mg orally and can be administered up to 120 hours after unprotected sexual intercourse. It usually remains more effective than levonorgestrel in later stages. However, its effectiveness can be influenced by enzyme-inducing drugs.

The commonly experienced side effects of emergency contraceptive pills include vomiting, headaches, abdominal discomfort, exhaustion, and even slight changes in a woman's next menstrual cycle. In case of vomiting soon after taking the pills, the patient must consult a healthcare practitioner or follow any product directions regarding the necessity of taking an additional dose. It is advised that a progestin contraceptive method should only be initiated 5 days after taking ulipristal acetate; this is because the progestin contraceptive could interfere with ulipristal's mechanism of action. During these 5 days, it is crucial to use some other method of non-hormonal contraception or a barrier method. In the case of taking

levonorgestrel, however, one should be able to use the method of hormonal contraception straight away [39].

8.3 Copper Intrauterine Devices for Emergency Contraception

The copper intrauterine device is a highly successful emergency contraceptive method that can usually be applied within five days after the sexual intercourse not protected by contraception. However, if the moment of ovulation can be calculated, it can be inserted even later than five days after the sexual act, as long as the device is inserted no later than five days after ovulation. Copper ions and the local immune response disrupt sperm function lessening the chances of fertilization. It does not work by preventing egg release and this makes it effective when the oral contraceptive fails due to imminent ovulation. A high benefit of the copper IUD is ongoing contraception after its placement, as well as no interaction with the medications inducing liver enzymes. Many people look for long-lasting, reversible and hormonal-free birth control. The insertion needs a qualified doctor to evaluate the patient. Possible side effects include cramps, pain during insertion and heavier menstruations. In some cases, putting it in will not be possible due to pregnancy or definite reproductive tract infections that require treatment [40].

8.4 Timing, Effectiveness, and Safety Considerations

Emergency contraception is best used at the earliest possible time after having unprotected intercourse. Copper IUD is considered the most reliable emergency contraceptive method, whereas ulipristal acetate is the ideal oral emergency contraceptive option when emergency contraception is needed in the period between 72 and 120 hours after intercourse. Levonorgestrel continues as one of the alternatives, especially if taken as soon as possible. Body mass index and body weight affect the effectiveness of oral emergency contraceptive methods especially levonorgestrel, although the evidence for the effect and the effect size remains unclear. Copper IUD or ulipristal acetate can be used based on specific clinical indications. Some enzyme-inducing medicines such as certain anti-epileptic drugs and rifampicin may have a negative effect on oral emergency contraceptive methods. Copper IUD does not cause that interaction. Emergency contraception does not provide protection against subsequent unprotected intercourse. Patients must be informed about general contraceptive methods, barrier method protection, and follow up. Pregnancy test is needed in case of

substantial menstrual delay, pregnancy symptoms, or after three weeks after the last unprotected intercourse [41].

9. Polycystic Ovary Syndrome (PCOS)

The syndrome of polycystic ovaries is regarded as a frequent disorder of metabolic and hormonal nature in women of childbearing age. This is connected with the problems in the hormonal cycle, occurrence of high levels of androgens in a human body, and peculiarities in the structure of the ovaries. PCOS causes disturbances in menstrual cycle, fertility, metabolism, and mental health of an individual. As the clinical picture varies widely from one case to another, the treatment must take into account the symptoms, metabolic state, and the goals of a specific individual [42].

9.1 Pathophysiology and Clinical Manifestations

The pathophysiology of polycystic ovary syndrome (PCOS) is the result of the functioning of the ovarian androgen production system, hypothalamic-pituitary regulation, insulin resistance, genetic factors, as well as environmental influences. Excess androgen production causes symptoms like hirsutism and acne, whereas improper follicular growth leads to irregularities in ovulation. Insulin resistance and excess insulin may cause the ovaries to make more androgens and lower levels of sex hormone-binding globulin in the liver thus ensuring the presence of more active androgens in the body (**Figure 4)**. The most frequently seen symptoms are irregular monthly bleeding, oligomenorrhea, amenorrhea, infertility, acne, hirsutism, and hair loss in the head as well as some weight gain, dyslipidemia, and impaired glucose tolerance in some cases. When one does not ovulate for a long time, this might lead to endometrial hyperplasia due to insufficient level of progesterone in the body. For diagnosis purposes one should assess the patient's condition and exclude alternatives. In adults the criteria for diagnosis are that the patient should have two of three: presence of hyperandrogenism, ovulatory dysfunction, and polycystic ovaries or some hormones in the body. In the case of teenager’s ultrasound and anti-Müllerian hormone are unacceptable for diagnosis [43].

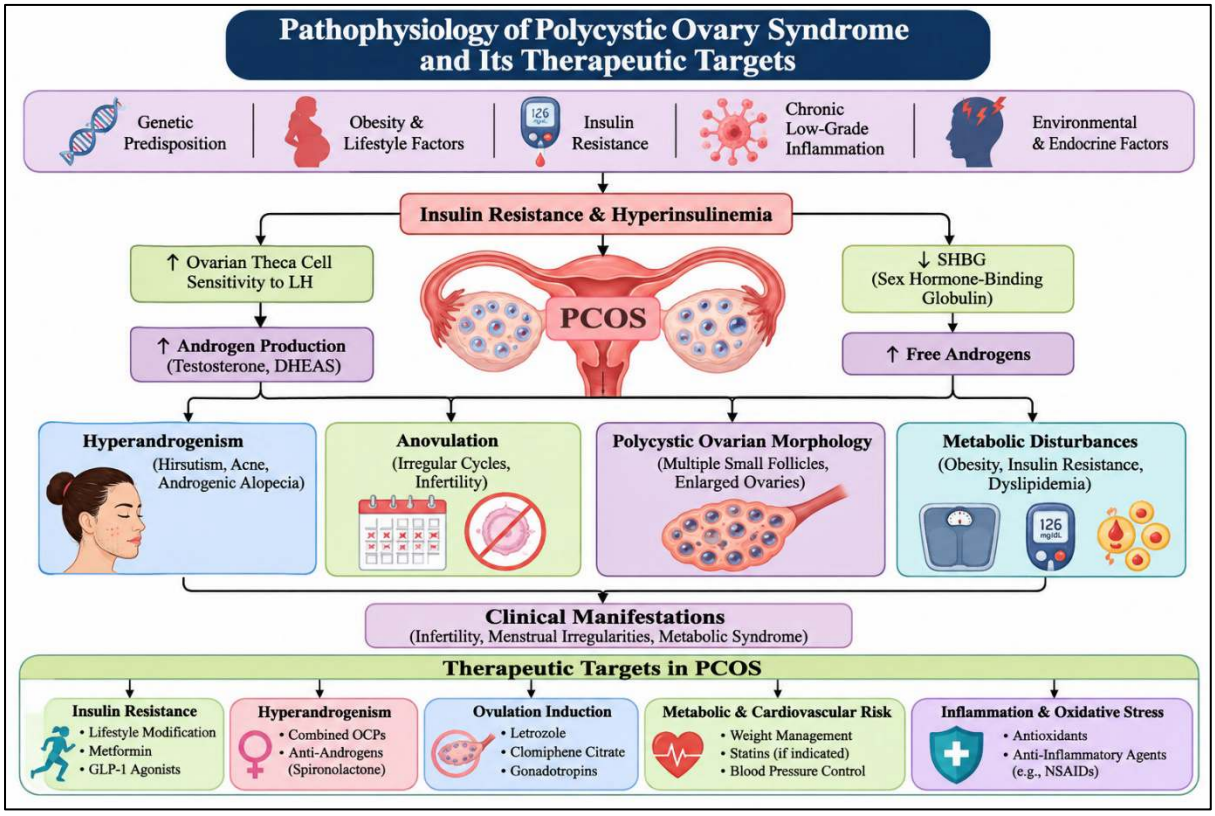

Figure 4. Pathophysiology of Polycystic Ovary Syndrome and Its Therapeutic Targets

9.2 Insulin Sensitizers and Metabolic Management

The management of metabolism is essential to the treatment of women diagnosed with PCOS. This is specifically true for those patients who are diagnosed with insulin resistance, impaired glucose tolerance or other metabolic conditions that could pose serious health risks. Metformin is one of the treatments that is known to be effective for improving the metabolic state in patients with PCOS, as well as for correcting menstrual irregularities. Metformin is known to reduce the production of glucose in the liver, thus improving the insulin sensitivity of the body. The efficiency of Metformin administration is directly dependent on the clinical case of the patient. In the initial phase of therapy, it is rather common to experience side effects. Thus, gradual increase of the dosage is recommended in order to ensure the proper level of tolerability of the treatment. Before prescribing Metformin to the patient, their renal efficiency should be checked, with vitamin B12 to be monitored in the course of treatment. Healthy lifestyle

practices, such as regular physical activity, proper nutrition and good sleep, are crucial for the improvement of metabolism [44].

9.3 Hormonal Therapy and Menstrual Regulation

Hormone treatments are often used for abnormal menstruation, symptoms of excess male hormones, and risk of cancer of the inner lining of the womb. Combined oral contraceptives are frequently the first choice among medications for patients who do not want to have children. These medicines suppress production of male hormones in the ovaries and boost levels of sex hormone-binding globulin which lowers levels of free male hormones. Apart from making periods regular, hormone treatments protect the lining of the womb from excessive exposure to estrogens. If combined hormone medications cannot be used, patients may try medications containing only progestins or cycles of progestogen therapy. The timing of treatments depends on the patient's menstrual cycle, contraindications, and personal wishes. In cases of hirsutism or other problems caused by the excess of male hormones patients may need to take antiandrogen medications such as spironolactone. Such medicines may need supervision and are not prescribed while the patient is pregnant because of the risk to the fetus. Doctors also need to take care of problems that come with the excess of male hormones such as acne treatment, psychological distress, and metabolic disorders [45].

9.4 Ovulation Induction and Fertility Management

Polycystic ovarian syndrome, PCOS, can render one unable to conceive (anovulatory infertility). For such patients the aim of treatment is to induce ovulation, and provide some benefits in terms of metabolic health and other fertility aspects. Due to PCOS-related anovulatory infertility, an aromatase inhibitor known as letrozole is the preferred choice of medication for initiating ovulation, assuming no other infertility factor is identified. Letrozole alters feedback in hypothalamus and pituitary gland by inhibiting estrogen production temporarily, thus stimulating follicular growth due to a boost in endogenous gonadotropins. Clomiphene citrate has similar properties and may be prescribed in cases when letrozole is not appropriate. Additionally, metformin may be used for selected patients with metabolic indications and it may work even though its success rate is lower than that of letrozole. Gonadotropins may be used if previously prescribed medications do not work for patients. Due

to the threat of causing multiple pregnancies, it is crucial to monitor patients during therapy. Assisted reproductive technologies may be used if patients do not benefit from treatments mentioned before, or if any other reason for infertility has been discovered at this stage [46].

9.5 Long-Term Risk Reduction

Management of PCOS takes the goal of minimizing the possibility of suffering from metabolic, reproductive, and psychological complications. Individuals suffering from PCOS tend to have a higher risk of having impaired glucose tolerance and being diagnosed with type 2 diabetes, especially in the presence of some additional risk factors. It is important to get evaluated for the glycemic status and blood pressure along with lipid profile and overall cardiovascular risk as a part of routine care. Intolerance of prolonged anovulation could lead to endometrial hyperplasia. Some can try cycle regulation or take progestogens to protect the endometrium. Cases when abnormal uterine bleeding occurs require separate consideration, rather than being attributed to PCOS. It is also critical to consider the psychological health aspect because PCOS may be aggravated by anxiety, depression, and the decreased quality of life. Periodic monitoring and lifestyle changes, appropriate pharmacotherapy, and some more factors should be taken into account while treating PCOS [47].

10. Endometriosis

Endometriosis is a long-term inflammatory disorder that is influenced by estrogen and which features the outgrowth of tissue similar to the endometrium outside of the uterus itself. The most frequently affected regions are pelvic peritoneum, ovaries, and other pelvic organs leading to dysmenorrhea, long-lasting pelvic pain, pain during intercourse, as well as infertility. Additionally, symptoms in patients can vary greatly among individuals, and their severity does not correlate with the size of the area affected by the disease. The treatment mostly focuses on providing the patient with pain relief, controlling hormone-sensitive lesions, and allowing for enhancing the quality of life of the patient as it is essential to take into account the need of the patient for fertility and tolerance of therapies [48].

10.1 Pathophysiology and Clinical Presentation

The workings of endometriosis is extremely complicated and involves many different factors such as hormonal changes, immune system modifications, changes in how the body handles

pain, blood vessel formation, and inflammation. Retrograde menstruation is just one way to explain endometriosis, and can only explain some of the cases; other influences, which may include genetic component, may also promote the disease occurrence. Endometriotic tissue reacts to estrogen and can release substances that increase inflammation, presence of adhesions, and tissue irritation. Changes in the peripheral pathways and also inflammation can lead to worse symptoms. The condition can cause severe menstrual pain, pelvic pain, pain during sexual intercourse, and pain during defecation and urination during menstruation. Some people can suffer from advanced forms of the disease but not experience any symptoms, while others can suffer from acute pain despite their tissue not being affected much. Diagnosis requires the use of transvaginal ultrasound or MRI scans and cannot always guarantee full detection. Treatment can be started based on clinical opinion without conducting all the tests and surgeries [49].

10.2 Hormonal Suppression Therapy

Hormonal suppression is one of the most popular pharmacological techniques utilized for the management of pain associated with endometriosis. The key aim of hormonal suppression is to inhibit the stimulation from ovarian hormones as well as the functioning of endometriosis tissue. Hormonal contraceptives can either be administered in a continuous or cyclic manner with the goal of curbing menstruation and associated discomforts. Continuous regimen may be particularly helpful in patients with severe menstruation. Progestogens like oral medications or levonorgestrel-releasing intrauterine systems are also widely prescribed for the purpose of suppression of endometrial actions in order to ease the pain. Adverse effects of treatments using progestins can vary depending on the prescribed medication including irregular bleeding, changes in mood, breast tenderness, or other. The use of combined hormonal contraceptives presumes the presence of contraindications related to estrogens and specifically thrombosis and cardiovascular problems. Hormonal suppression is effective in symptoms control, but it does not cure endometriosis. After completing the treatment, symptoms may reappear. These methods are usually not prescribed on a patient planning a pregnancy because hormonal suppression limits chances for making conception during the process [50].

10.3 Analgesics and Anti-Inflammatory Agents

Pain management is an especially vital aspect of the treatment of endometriosis. Pain-relief medications from the group of non-steroidal anti-inflammatory drugs (NSAIDs) like ibuprofen and naproxen are routinely applied for the treatment of dysmenorrhea and additional symptoms of inflammation. NSAIDs act by inhibiting cyclooxygenase enzymes and producing a decrease of prostaglandin levels which results in a relief of pain and inflammation. However, the usage of NSAIDs in endometriosis is not as well supported as in case of primary dysmenorrhea. NSAIDs can be used on their own for mild cases, or combined with hormones. Side effects include irritation of the digestive tract, ulcers, bleeding, and impairment of the kidneys. Pain management should take into account the patient's digestive tract condition, kidney damage, and other risk factors. Acetaminophen should be considered in selected cases when NSAIDs cannot be applied, even though the medication might not be as effective in cases of severe pain caused by endometriosis. If pain does not disappear despite the applied treatment, it is necessary to look for other reasons [51].

10.4 GnRH Agonists and Antagonists

Gonadotropin-releasing hormone (GnRH) agonists and antagonists can lessen the amount of estrogen that the ovaries produce and are addressed to specified patients with pain accompanying endometriosis, mostly when initial hormone treatment did not yield results or when hormone treatment cannot be applied.

GnRH agonists refer to medicines that boost the secretion of gonadotropins by stimulating the receptors initially. Continued use leads to the receptors being desensitized and stops the secretion of gonadotropins. The example of a GnRH agonist is leuprolide and goserelin.

GnRH antagonists are agents that block GnRH receptors directly and thus stop the secretion of LH and FSH immediately, without the hormone flare that occurs with the agonists' use. Some oral products may act together with hormone replacement therapy or be used separately depending on the medication.

Both methods may be efficient in terms of relieving the pain associated with endometriosis; however, the adverse effects caused by stopping the secretion of estrogens include hot flashes, dryness of the vagina, mood changes as well as loss of bone mass. The extent of these effects

will depend on the medication and duration of therapy being applied as well as the individual characteristics of the patient [52].

10.5 Emerging Pharmacological Approaches

Research on pharmacotherapy for endometriosis has evolved beyond orthodox hormonal suppression and pain relief strategies. The newer strategies aim to enhance the effectiveness of pain management, minimize the side effects, and target the physiological pathways associated with inflammation, lesion formation, and abnormal tissue signalling. The introduction of oral GnRH antagonists and their combinations with add-back therapy is a major breakthrough in pain treatment because they make it possible to suppress ovarian activity in an effective and flexible manner. Their application will depend on how effective the therapy is in a particular case as well as safety, approval by regulatory authorities, and unique individual features of the patient's undergoing treatment. Various alternative strategies have also been studied, including those targeting inflammatory substances, angiogenesis, immune pathways, and mechanisms involved in pain sensitization. However, with many of these approaches, the data available remains insufficient and, thus, they are characterized only by being investigated with their effectiveness, safety, and effects on fertility still to be proven [53].

11. Fertility-Related Pharmacotherapy

Fertility medication therapy employs drugs to enhance reproductive outcomes among those who are infertile as a result of ovulation disorders or other conditions affecting fertility. The choice of treatment is based on the specific cause of infertility, the age and ovarian function of the patient, and the presence of any other fertility issues. There are several types of medications used in fertility treatments from oral tablets to gonadotropins to drugs used in assisted reproductive technologies. Proper evaluation of patients' conditions is crucial for effective medication therapy [54].

11.1 Assessment of Ovulatory Dysfunction

Ovulatory dysfunction represents a significant contributor to female infertility and may occur with conditions such as polycystic ovary syndrome (PCOS), hypothalamic dysfunction, hyperprolactinemia, and thyroid disorder. The correct underlying cause must be diagnosed before starting any treatment for infertility. Clinical assessment includes a review of menstrual

history, cycle regularity, history of pregnancies, medical history, and examination of symptoms associated with endocrine diseases. Irregularity of periods or absence of cycles may mean anovulation. Depending on the clinical case, the following investigations may be done: serum progesterone on the right day of the cycle, thyroid-stimulating hormone, prolactin, and other hormones. Pelvic ultrasound may be used for evaluating ovarian structure and reproductive system. The assessment has to be considering the reserve of the ovaries and assess other possible reasons for infertility like patency of the fallopian tubes or male infertility. It is important to have a complete assessment so the treatment starts timely and only helps patients who need it the most. Treatment has to depend on the reason for ovulatory dysfunction [55].

11.2 Ovulation Induction Agents

Treatment requires assessment of ovulatory response and consideration of risks such as multiple pregnancy, adverse effects, and treatment failure. Patients who do not respond to oral medications may require specialist evaluation for alternative approaches.

Ovulation induction is a process by which drugs are used to stimulate the development of follicles and to induce the process of maturation of oocytes in people who have problems with ovulation. The choice of the agent is based on the disease that causes the ovulation problem, previous response to treatment, and the need for monitoring.

Letrozole: Letrozole is classified as an aromatase inhibitor. Functioning this way, it temporarily decreases the production of estrogen. In this way, hypothalamic-pituitary feedback is altered, as well as the endogenous FSH secretion level increases. It is considered to be a first-choice drug for the therapy of anovulatory infertility caused by PCOS, assuming that there are no other infertility factors.

Clomiphene citrate: Clomiphene citrate functions as a selective estrogen receptor modulator and decreases the negative feedback of estrogen in the hypothalamus and the pituitary gland. As a result, the secretion of gonadotropins is increased, promoting follicular growth. It remains a second option for some patients, but letrozole is the treatment of choice when it comes to treatment of anovulatory infertility caused by PCOS.

Metformin: Metformin has been shown to enhance insulin sensitivity, and may also aid in restoring regular menstruation and ovulation in some patients with PCOS. Its use depends on

both metabolic and clinical considerations, although it is not as effective as the drug letrozole at inducing ovulation.

Patients will need to be monitored for their degree of response to treatment, and the various risks of treatment, including multiple births, side effects, and treatment failure taken into account [56].

11.3 Gonadotropins and Hormonal Support

Gonadotropins are medications that come in injection forms with FSH, human menopausal gonadotropin (hMG), or something similar to stimulate the development of ovarian follicles. If oral ovulation-inducing medication fails, injections may be used in order to stimulate the ovaries. While FSH is conducive in growing ovarian follicles, luteinizing hormone helps do this and smoothly works with steroids. Final maturation of oocytes happens with the help of hCG, after follicles are developed enough. Additionally, progesterone may be applied in order to support the luteal phase in some cases. Gonadotropins are used with caution and monitored through ultrasound and, at times, hormone tests. If too much stimulation is carried out, ovarian hyperstimulation syndrome (OHSS) might develop, which leads to abdominal pain, overgrown ovaries, accumulation of fluids, and sometimes thrombosis as an extreme case. Injections may lead to multiple pregnancies because a lot of follicles are developing [57].

11.4 Pharmacotherapy in Assisted Reproductive Technologies

The process of assisted reproductive techniques (ART), especially IVF, requires the use of various medications to perform different phases of the procedure from ovarian stimulation through egg retrieval to fertilization and embryo transfer. During ovarian stimulation phase, follicular development is stimulated by gonadotropins. To inhibit the early rise in LH concentrations and avoid premature ovulation, GnRH agonists or antagonists can be added to therapy protocol. Final immature oocyte maturation can be accomplished with appropriate medication: hCG or GnRH agonist. Furthermore, once egg retrieval and fertilization are completed, progesterone is usually administered during luteal phase. It must be noted that the choice of route, dosage and duration depends on the specific ART protocol and the health condition of the patient. In some cases, other medications may be used but routine use of unproven complementary approaches needs to be avoided. Use of medication in ART requires

collaborative work of all medical professionals involved in the treatment process including doctors, pharmacists, nurses and lab workers. Training of patients on how to inject the medicine, when to take it and how to store it is of particular importance because patient's adherence affects the outcome of therapy [58].

11.5 Safety, Monitoring, and Treatment Outcomes

Monitoring the safety of patients in any fertility pharmacotherapy is important. Clinicians should evaluate any relevant medical problems, previous medication use, objectives of treatment, and potential influence on result in successful treatment or complication prior to initiation of the therapy. Monitoring procedures may include transvaginal ultrasound, assessment of serum estradiol in necessary cases, and monitoring of follicular development. These data ensure correction of dosing regimen and detection of too strong reaction of ovaries to the treatment. Patients receiving gonadotropins should know about that possible symptoms of OHSS include growing abdominal distention, severe pain, vomiting, and problems with breathing, which require the assessment of the medical professionals immediately. Treatment outcomes can be determined using ovulation rates, clinical pregnancy rates, birth rates, negative effects of therapy, and the opinion of patients [59].

12. Drug–Contraceptive Interactions

Interactions between drugs and contraceptives are significant from a clinical point of view as some medicines reduce contraceptive efficiency or affect the efficacy and safety of other medicines. Among the mechanisms of interaction are changes in the activity of enzymes in the liver, changes in absorption, and changes in the metabolism of hormones. Knowing the interaction profile of a contraceptive formulation is important for medical practitioners to choose the right approaches, avoid undesired pregnancy, and provide correct drug counseling advice [60].

12.1 Enzyme-Inducing Drugs and Contraceptive Effectiveness

There are medications that can induce liver enzymes which metabolize drugs, such as cytochrome P450, resulting thus in faster breakdown of the hormone contraceptives and decreased levels of those hormones in the bloodstream. This can result in diminishing efficiency of certain types of contraceptives. Drugs that induce liver enzymes in a serious way

include rifampicin, rifabutine, carbamazepine, phenytoin, phenobarbital, primidone, some medications for treatment of HIV, and several others (**Table 4)**. The effect that the drugs induce depends on the particular drug that is used as well as on the dosage and amount of medication that is used. Hormonal formulations such as implants and some other hormonal preparations may see their effect diminished. Copper IUD and other hormonal mechanisms of contraception are not affected by hepatic induction like systemic hormonal contraceptives. Women who need medication that interacts with their contraceptives should consult their healthcare providers and choose some other reliable method of contraception [61].

Table 4. Clinically Significant Drug–Contraceptive Interactions

Drug category	Examples	Interaction mechanism	Clinical significance
Antiepileptics	Carbamazepine, phenytoin, phenobarbital	Induction of hepatic drug-metabolizing enzymes.	May reduce the effectiveness of hormonal contraceptives.
Antitubercular drugs	Rifampicin, rifabutin	Induction of CYP enzymes and drug transport pathways.	May significantly reduce hormonal contraceptive concentrations.
Antiretroviral agents	Efavirenz, nevirapine	Enzyme induction and altered hormonal drug metabolism.	May decrease contraceptive hormone exposure.
Antifungal agents	Ketoconazole, itraconazole	Inhibition of selected CYP enzymes.	May increase concentrations of certain contraceptive hormones.
Antibiotics	Rifampicin and rifabutin	Enzyme induction.	Can reduce contraceptive effectiveness; most other

			broad-spectrum antibiotics do not have this established effect.
St. John's wort	Hypericum perforatum	Induces CYP3A4 and drug transporters.	May reduce hormonal contraceptive effectiveness and increase breakthrough bleeding.

12.2 Antibiotics, Antiepileptics, and Antiretroviral Agents

The impact of different medications on contraceptive efficiency differs with the kind of drug that is used.

Antibiotics: Most antibiotics have very mild effects on hormonal contraceptives. However, rifampicin and rifabutin stand out in this regard for they can induce metabolic enzymes and lower the concentration of hormones. At the same time, vomiting or severe diarrhea caused by antibiotics taken may disrupt the process of gaining enough medicine via the mouth.

Antiepileptics: Antiepileptic medicines which induce the metabolism of drugs, like carbamazepine, phenytoin, and phenobarbital are able to lower the effectiveness of different hormonal contraceptives. Different antiepileptic medicines also have different interaction mechanisms. Drugs which contain estrogen are able to lower the concentration of lamotrigine thus making the seizure control more difficult.

Antiretroviral agents: Interactions between contraceptive devices and drugs can depend on the particular medication taken. Certain medicines may interfere with hormones, while others will not create serious problems [62].

12.3 Contraceptive Effects on Other Medications

Hormonal contraception influences medication therapy as well as pharmacology. For instance, estrogen-containing contraceptives raise the metabolism of lamotrigine making lamotrigine levels lower in the blood thus making it difficult to prevent seizures. In contrast, stopping estrogen-containing contraceptive medication leads to higher lamotrigine levels and greater possibility that patients experience adverse reactions because there will have been no re-

evaluation of dosages. Contraceptives using combined hormonal contents can impact drug metabolism through induction and inhibition of enzymes but this impact differs according to which drug or formulation is used. Some drugs necessitate clinical monitoring or adjusting the dose once hormonal contraception is started or stopped. Besides possible effects of hormonal contraception on drug therapy, laboratory examinations may be influenced too. Therefore, healthcare providers must be aware of this when interpreting the results of their findings. A thorough medication review process must be performed in specific groups of patients, for example, in patients suffering from epilepsy, HIV, TB, or chronic diseases. Moreover, working together is important for all pharmacy professionals involved [63].

12.4 Clinical Management and Risk Reduction

Successful drug-contraceptive interactions management begins with the careful gathering of all the patient's medication history, which consists of all the medications taken such as prescription medications, non-prescription medications, herbs, etc. Once the relevant drugs for the specific drug interactions are identified, health care specialists must find out the drugs that would affect the effectiveness of birth control drugs and whether the occurrence of such an interaction is critical from a clinical point of view. In case of need, the selected birth control method must be modified in order to avoid the negative approach of the interaction. The patients must know they can seek medical help in case of the intention to start/stop the interactions. In the case of failures in terms of taking contraceptives, it is necessary to discuss emergency contraception and make the right choice of the method, taking into account potential interactions that can have an impact on the choice of method to use [64].

13. Personalized Treatment Approaches

The concept of personalized treatment means using pharmacological therapy in an optimal way defined by every individual's specific clinical feature, reproductive aspirations, hormonal profile, metabolic health, genetic data, and individual preferences regarding treatment. Two women with reproductive disorders receive different responses to the same medication due to different mechanisms of the disease, comorbid conditions, effects of metabolism on medications taken, and variations in reactions to side effects. Therefore, individualized

pharmacotherapy allows patients to benefit from an increased safety of the selected treatment, improved compliance, and effective outcomes [65].

13.1 Patient-Centered Pharmacotherapy

Pharmacotherapy based on patient-centric approach requires choosing medication in accordance with the patient's signs, diagnosis, medical history, willingness to have children, and preferences. For instance, a patient who suffers from dysmenorrhea and who wants to use contraception could take advantage of hormones-based contraception, while another patient opts for non-hormonal pain treatment. In treating patients with PCOS, the nature of the treatment depends on the problem being treated, whether it is menstrual irregularity, hyperandrogenism, metabolic disease, or infertility. Similarly, when treating endometriosis, one should pay attention to the severity of pain, previous therapies applied and their effectiveness, side effects of treatment, and the potential of the patient to get pregnant. Patient-centered approach also looks into the cost of treatment, availability of medications on the market, ease of administration of the medications, and the possibility of following the treatment. Moreover, it is important to communicate the possible outcomes of treatment clearly as well as its effectiveness and unwanted effects. Overall, this common approach makes it possible to guarantee good outcomes of treatment [66].

13.2 Influence of Hormonal Status and Individual Risk Factors

The hormonal condition is able to play a role in the choice of medicine and its safety in use. For instance, hormonal contraceptives can be good for some patients and not so good for others considering the side effects such as thromboembolic issues or other conditions like some cardiovascular diseases. The age of a person, his or her smoking habits, weight, risk factors of hypertension, liver and kidney functioning, and other diseases influence the suitability of the treatment. Another important factor is pregnancy and breastfeeding, since while during these periods the medicinal safety and eligibility for contraception can be varied. The role of hormone status is especially significant in the treatment modality of PCOS, endometriosis, and bleeding disorders, still the hormones must be looked at in the context, rather than being treated as a factor that should influence the decision-making [67].

13.3 Genetic and Metabolic Considerations

Differences in genetics and metabolism can lead to variation in the response to drugs, efficiency of treatment, and likelihood of suffering from side effects. Pharmacogenomics studies how genetic differences can affect the way medications are metabolized, transported, and interact with the body. Although pharmacogenomic tests are not performed for most menstrual or contraceptive medicines, there are cases when it can be of benefit. An example of that would be an influence of gene variations (in enzymes metabolizing drugs) on the absorption of certain medications or genetic predisposition to certain types of adverse reactions. It should be noted here that the usefulness of genetic tests depends very much on the drug in question and there is an absence of evidence for the application of pharmacogenomics for every medicine used in reproductive medicine. Metabolic properties are also significant factors. Insulin resistance is particularly relevant as it applies to PCOS, and lifestyle changes along with metformin can be prescribed as treatment options [68].

13.4 Shared Decision-Making and Treatment Adherence

Shared decision-making is a process in which healthcare providers and patients communicate about choices regarding treatment, and any potential complications or benefits arising therefrom. This is critical in the area of reproductive health, since the decisions can have an impact on menstruation, ability to conceive, sex life, or health in the long-term perspective. In this respect, adherence can be influenced by a number of factors, such as side effects, frequency of taking medications, price, misunderstanding, culture, etc. By addressing these issues through effective information campaign compliance could be increased. In this context, pharmacists can provide proper medication use instructions, identify drug interactions, provide recommendations as regards missed doses, and explain what patients should expect from the entire course of treatment. Written notes and some post-treatment consultations would also help, when the course of the treatment is complex, for example in case of artificial insemination. In addition, it is important that the patients make their decisions with respect to the treatment, concerning individual and family issues [69].

13.5 Emerging Approaches in Precision Women's Medicine

Precision medicine for women's health seeks to provide customized healthcare according to the biological characteristics of the patients, along with their medical history, lifestyle, and

individual response to treatment. The recent progress in genomics, metabolomics, digital health, and artificial intelligence will make it possible to assess reproductive diseases more accurately and understand the efficacy of medication used for treatment. Both digital tools for tracking periods can be used to define the symptoms' structure, help to keep track and record symptoms of PMS or PMDD, and help during doctors' appointments. Nevertheless, these tools cannot lead to an independent diagnosis, and their efficiency depends on the quality of information, as well as its interpretation (**Figure 5)**. Artificial intelligence can also help in detecting patterns in medical histories, foreseeing treatment response, and making decisions. However, these applications have to pass strict testing and protect sensitive reproductive information. In the future, precision medicine will combine genetic, metabolic, hormonal, and medical information in order to find out which patients may benefit from special treatments. However, all of the innovations are still in development and must be studied before becoming effective in practice [70].

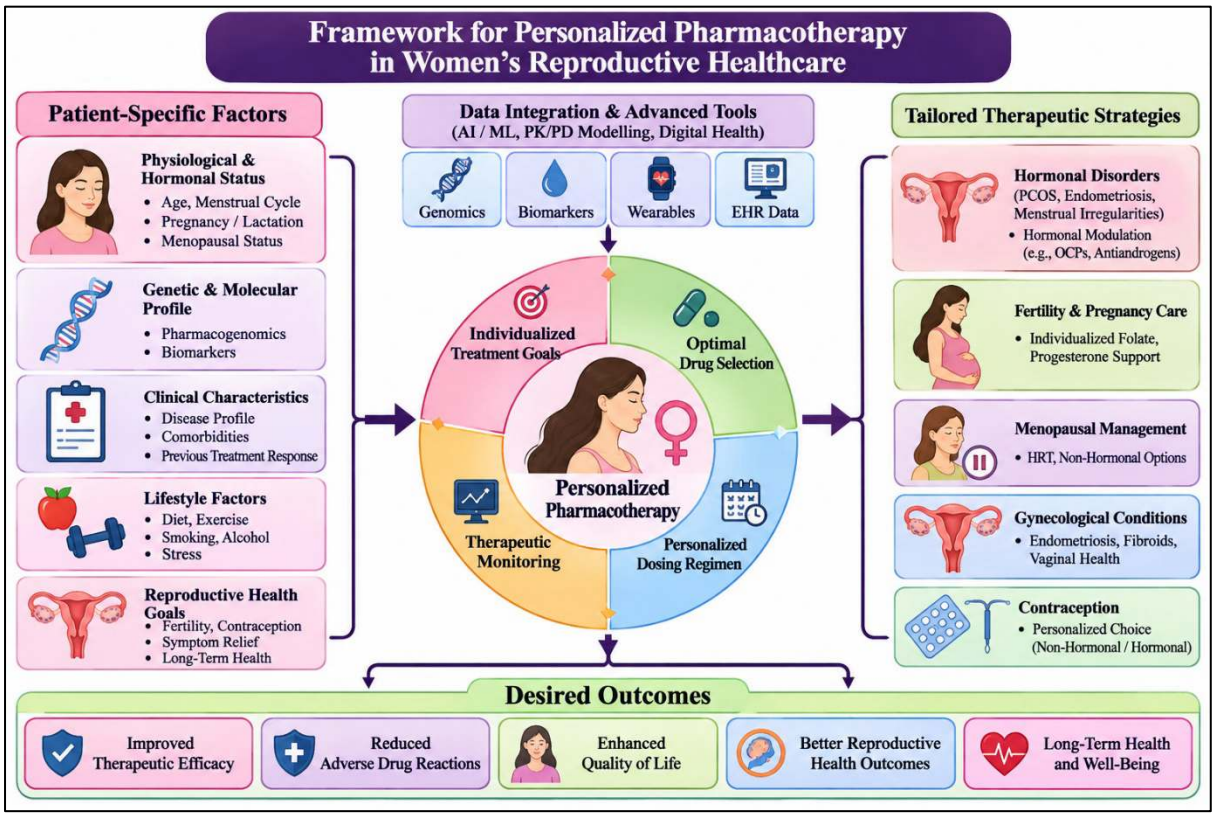

Figure 5. Framework for Personalized Pharmacotherapy in Women's Reproductive Healthcare

14. Current Challenges and Future Perspectives

Although reproductive pharmacology has advanced remarkably, there are significant challenges that still remain in the area of sex differences in pharmacological response, development of clinical evidence for women's health treatment options, and equitable access to health care services. Menstrual and reproductive health issues can affect both physical health and mental well-being, fertility, and quality of life. Further advancements in the field require better clinical studies, more personalized therapies, and improved implementation of medication and other support services [71].

14.1 Challenges in Sex-Specific Drug Research

Throughout history, women have been underrepresented in some fields of clinical research and sex-specific assessments have not always been properly carried out. Consequently, the information about sex, hormonal status, pregnancy, and the reproductive aging effect on drug performance is insufficient for some medications. The monthly cycle causes physiological changes which may contribute to the difficulty of interpreting some pharmacological trials, but this variation has to be studied properly instead of excluding people to take part in the research. The study needs to differentiate between biological differences based on sex and age and ethnicity. Another problem is that there are no numerous large studies that include outcomes in the treatment of less studied disorders. The absence of consistency in outcomes measuring and short follow-ups slow down comparison of different treatments. More efficient recruiting, proper representativity during the phases of reproduction process, and premeditation of sex-oriented research are the steps which can provide better quality of evidence concerning this issue [72].

14.2 Limitations in Reproductive Pharmacotherapy

Reproductive pharmacotherapy has several limitations such as variations in treatment effectiveness, side effects, contraindications, and lack of long-term evidence for certain treatments. Treatments targeting one aspect of reproductive health may fail to address other issues affecting the patient. For example, hormonal medications can help with relieving pain

caused by endometriosis but do not seem appropriate for people trying to conceive. Side effects of medications influence patient compliance and quality of life. Such side effects, like irregular periods, emotional changes, gastrointestinal problems, and other treatment-related issues, may cause the patient to stop treatment without consulting a physician. Availability of specialists, diagnostic services, fertility services, and new drugs are different depending on the medical institution. Also, there may be a delay in finding a diagnosis and applying treatment due to financial problems and insufficient education in reproductive health. Another shortcoming is the absence of reliable biomarkers allowing predicting outcomes of treatment of certain reproductive disorders. Therefore, doctors rely on assessment of the symptoms, medical history, and trial and error approach [73].

14.3 Advances in Personalized and Precision Medicine

Scientific development in pharmacogenomics, biomarker studies, digital health, and computational modeling creates new paths to improvement of reproductive pharmacotherapy. The application of these methods can contribute to exploration of disease mechanisms, prediction of side effects, and choice of the treatment that is likely to be effective for a certain patient. Artificial intelligence and machine learning techniques allow for an analysis of complicated clinical data in order to investigate the relationship between patients and the outcome of treatment. If verified correctly, these methods may also facilitate clinical decisions related to PCOS, endometriosis, and menstruation disorders. Digital health provides the opportunities for symptom revelation, drug adherence, and follow-up. Nevertheless, digital health should be applied in a proper way in order to avoid erroneous predictions, needless interventions, and dependence on suggestions provided by machines [74].

14.4 Future Directions in Women's Reproductive Healthcare

Future advancements in reproductive pharmacology are expected to focus on personalized treatment, utilization of safer drugs, and better understanding of medicine according to each sex. The research should focus on underrepresented ethnicities and study the effects of treatment on different genders and ages. Creation of non-hormonal medicine for specific health problems like endometriosis or severe pain during menstruation opens chances to those who cannot use hormonal medicine or wish to be reproductive. New methods of medicine usage

provided new opportunities but benefits should be studied through trials. More studies should be done to find effective biomarkers to identify PCOS, endometriosis, and find out whether they can forecast the treatment outcomes and how effective medications are. Digital monitoring and artificial intelligence may play a role in the early recognition of symptoms with clinical observation. Clinical pharmacologists may contribute to the management of drug substitutions, contraceptive counseling, drug interactions, monitoring of the adverse effects, and educating clients [75].

15. Conclusion

Pharmacology has a major impact through the various stages of one's menstrual life in treating many problems and issues including ones related to menstruation, birth control, reproductive health, and infertility. A number of pharmacological methods have been used to treat many disorders, such as NSAIDS, hormonal contraceptives, SSRIs, insulin-sensitizing agents, and drugs inducing ovulation, which proved to be effective in treating such conditions as dysmenorrhea, PMDD, abnormal uterine bleeding, PCOS, and endometriosis. The right selection of the medicines is dependent on such factors as the patient's health state, aims of treatment, possible side effects, and potential interactions of the drug with others.

The invention and enhancement of precision medicine, pharmacogenomics, and digital health not only opened perspectives for further development of individually made reproductive medicine, but also initiated serious problems, such as lack of research in the field of sex-related medicine and unequal access to healthcare services. Correct prescribing based on evidence, education of patients, and making a decision together with physicians in order to enhance the safety and efficacy of treatment are all essential for improving the process of treatment. Ultimately, personalized pharmacological approach will allow maintaining the reproductive health of an individual.

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