



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals

ISSN 2349-7203





Human Journals

Review Article

July 2023 Vol.:27, Issue:4

© All rights are reserved by H.V.Kambale et al.

A Review on Pregnancy Complications and Role of Lifestyle Modification in a Woman with Polycystic Ovary Syndrome

	IJPPR INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH An official Publication of Human Journals	
Kulal Priya Bhausahab, S.A.Waghmare, H.V.Kambale*		
<i>Department of Pharmaceutical Chemistry, Loknete Shri Dadapatil Pharate College of pharmacy, Mandavgan Pharata, Tal- Shirur, Dist- Pune, Maharashtra, India.</i>		
Submitted:	23 June 2023	
Accepted:	12 July 2023	
Published:	30 July 2023	



HUMAN JOURNALS

ijppr.humanjournals.com

Keywords: polycystic ovary syndrome, hyperandrogenism, insulin resistance, molecular mechanisms.

ABSTRACT

Polycystic ovary syndrome (PCOS) is an endocrine-gynecology disorder affecting many women of childbearing age. Although a part of the involved mechanism in PCOS occurrence is discovered, the exact etiology and pathophysiology are not comprehensively understood yet. Furthermore, the complete information on PCOS commonly prescribed and repurposed medications is summarized through tables. Epigenetics, environmental toxicants, stress, diet as external factors, insulin resistance, hyperandrogenism, inflammation, oxidative stress, and obesity as internal factors were investigated. Lifestyle modifications and complementary and alternative medicines are preferred first-line therapy in many cases. Medications, including 3-hydroxy-3-methyl-3-glutaryl-coenzyme. (HMG-CoA) reductase inhibitors, thiazolidinediones, sodium-glucose cotransporter-2 inhibitors, dipeptidyl peptidase-4 inhibitors, glucose-like peptide-1 receptor agonists, mucolytic agents, and some supplements have supporting data for being repurposed in PCOS. Since there are few completed clinical trials with a low population and mostly without results on PCOS repurposed medications, it would be helpful to do further research and run well-designed clinical trials on this subject. Moreover, understanding more about PCOS would be beneficial to find new medications implying the effect via the novel discovered routes. Although recent research indicates modest long-term lifestyle changes might reduce the extent of impaired glucose tolerance and delay the conversion to diabetes mellitus in the general population, this has not yet been examined in women with PCOS. Current conservative treatment should emphasize sustainable weight loss through dietary modification and exercise. Modifying additional lifestyle factors, including alcohol consumption, psychosocial stressors and smoking, are also crucial in the long-term treatment of PCOS.

INTRODUCTION

PCOS is one of the most common causes of female infertility. It can also increase your risk for other health conditions. Your healthcare provider can treat PCOS based on your symptoms and if you have plans for having children. New genetic research suggests men can develop characteristics of polycystic ovary syndrome (PCOS)—a common metabolic and reproductive disorder that affects women. The study was presented virtually at ENDO 2021, the Endocrine Society's annual meeting, 20-Mar-2021. Despite the high prevalence of PCOS, a strong rationale for lifestyle intervention and the fact that lifestyle intervention is recommended as first-line treatment in women with PCOS who are overweight, the literature in this area is limited and challenging to interpret.

Many women with PCOS also have insulin resistance, in which the body doesn't use the hormone insulin effectively. Polycystic ovary issue (PCOS) is the first regular endocrine ailment, affecting on woman's regenerative age 5.18% 12 Polycystic ovary issue described by hyperandrogenism and diligent anovulatory of unproductiveness woman. The women ovaries impact around 68% of around the globe lifted androgen levels, menstrual irregularities and little cysts. In 2003, an overall understanding assemble broke down by hyperandrogenic appearances fuse in skin break out, hirsutism, dyslipidemia, insult opposition, diabetes, rotundity, disease, desolateness and coronary heart contaminations. Polycystic ovary syndrome (PCOS) is a common endocrine condition with reproductive and metabolic consequences, including ovulation, infertility and an increased prevalence of 6diabetes mellitus.

Obesity, central obesity and insulin resistance are strongly implicated in its etiology and reduction of these risk factors should be a central treatment focus. Short-term weight loss has been consistently successful in reducing insulin resistance and restoring ovulation and fertility. However, problems arise with maintaining weight loss and precisely quantifying the associated long-term benefits of risk factor change. Although recent research indicates modest long-term lifestyle changes might reduce the extent of impaired glucose tolerance and delay the conversion to diabetes mellitus in the general population, this has not yet been examined in women with PCOS. Current conservative treatment should emphasize sustainable weight loss through dietary modification and exercise. Modifying additional lifestyle factors, including alcohol consumption, psychosocial stressors and smoking, are also crucial in the long-term treatment of PCOS.

Pregnant women with PCOS experience a higher incidence of perinatal morbidity from gestational diabetes, pregnancy-induced hypertension, and preeclampsia.

Polycystic ovarian syndrome (PCOS) is a hormonal imbalance caused by the ovaries creating excess male hormones. If you have PCOS, your ovaries produce unusually high levels of hormones called androgens.

What is polycystic ovarian syndrome?

- Polycystic ovarian syndrome (PCOS) is a hormonal imbalance caused by the ovaries (the organ that produces and releases eggs) creating excess male hormones.
- PCOS is one of the most common causes of female infertility. It can also increase your risk for other health conditions.
- Treat PCOS based on your symptoms and if you have plans for having children.

PCOS is a problem with hormones that affects women during their childbearing years (ages 15 to 44).

- PCOS affects a woman's ovaries, the reproductive organs that produce estrogen and progesterone- hormones that regulate the menstrual cycle.
- The ovaries also produce a small amount of male hormones called androgens. The ovaries release eggs to be fertilized by a man's sperm.
- The release of an egg each month is called ovulation. Follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which are produced in the pituitary gland, control ovulation.
- FSH stimulates the ovary to produce a follicle a sac that contains an egg- and then LH triggers the ovary to release a mature egg.
- **PCOS is a "syndrome." or group of symptoms that affects the ovaries and ovulation.**
- Its three main features are: cysts in the ovaries high levels of male hormones irregular or skipped periods In PCOS, many small, fluid-filled sacs grow inside the ovaries.
- The word "polycystic" means "many cysts." These sacs are actually follicles, each one containing an immature egg.

- The eggs never mature enough to trigger ovulation. The lack of ovulation alters levels of estrogen, progesterone, FSH, and LH.
- Progesterone levels are lower than usual, while androgen levels are higher than usual.
- Extra male hormones disrupt the menstrual cycle, so women with PCOS get fewer periods than usual. PCOS isn't a new condition.
- Italian physician Antonio Vallisneri first described its symptoms in 1721.
- Researchers revealed that PCOS patients have lower levels of the hormone incretin in a recent study. As a result, targeting this system as a treatment for type 2 diabetes has become a feasible alternative, with improved glycemic control and weight loss in type 2 diabetes patients. The complicated name, Polycystic
- Ovarian Syndrome can be simplified as follows:
- Poly- means many.
- A cyst means a bubble-like thing in the body tissue.
- The ovary is the female organ that produces ova or eggs.
- Syndrome means a group of signs and symptoms complained by the patient.

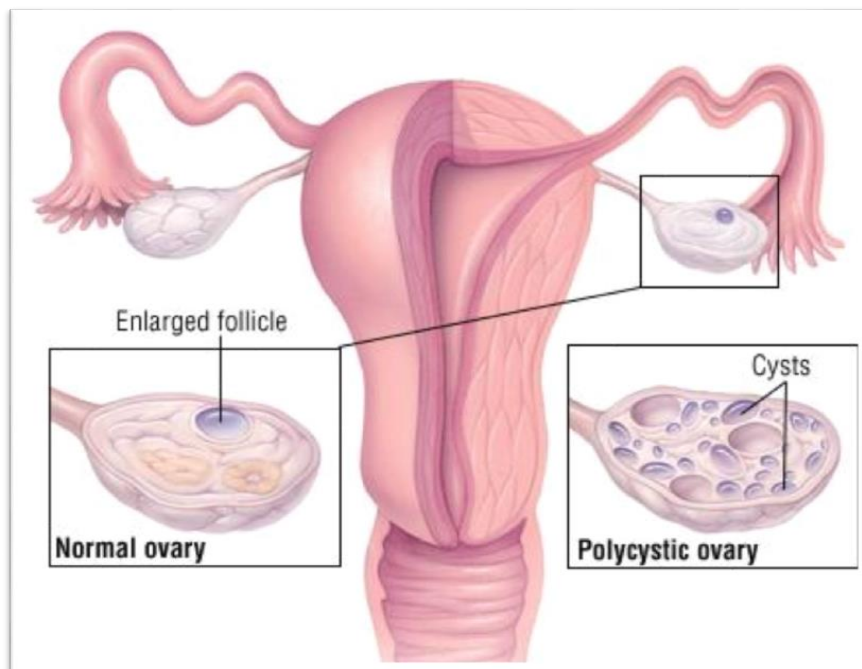


Figure 1- diagrammatic representation of normal ovary and polycystic ovary.

Who can get PCOS?

A woman can get PCOS at any time after puberty. Most people are diagnosed in their 20s or 30s when they are trying to get pregnant. You may have a higher chance of getting PCOS if you are overweight or have obesity, or if other people in your family have PCOS.

Signs and symptoms of PCOS

- **Infertility**
- **Acne**
- **Darkening of the skin**
- **Obesity**
- **Cysts in ovary**
- **Irregular periods**
- **excessive hair growth (hirsutism)**
- **Anxiety and Depression**

Infertility

PCOS is the most common cause of infertility in people with AFAB. Not ovulating regularly or frequently can result in not being able to conceive.

Acne

With PCOS, higher levels of androgens can enlarge oil-production glands on your skin, which can cause acne (pimples). Acne is common in teenage years, but young women with PCOS may continue to have severe acne. PCOS can cause skin tags, which are thick lumps of skin that can grow in your armpits, on your neck or along your bra line. You might also develop rough, dark, velvety patches of skin in your armpits or on your neck.

Darkening of the skin

You may get patches of dark skin, especially in the folds of your neck, armpits, groin (between the legs) and under your breasts. This is known as acanthosis nigricans.

Obesity

While half of women with PCOS experience weight gain or are obese, it can also affect women who are thin. Women with PCOS can gain weight and may be at increased risk of having an unhealthy weight. It can be hard to manage your weight when you have PCOS. Research suggests that hormones involved in controlling appetite and hunger aren't regulated properly in some women with PCOS.

Cysts in ovary

Many people with PCOS have ovaries that appear larger or with many follicles (egg sac cysts) on ultrasound.

Irregular periods

Abnormal menstruation involves missing periods or not having a period at all. It may also involve heavy bleeding during periods.

Excessive hair growth (hirsutism)

Women experience excess hair growth in unwanted places. With PCOS, women see this most often on their face, arms, back, chest, thumbs, toes, and abdomen.

Anxiety and depression

About one-quarter of women with PCOS have mood-related disorders, says Medling. These include anxiety, depression, poor body image, and even eating disorders. One 2016 meta-analysis on six studies that looked at women from four countries found that depression and anxiety were about three times more likely in those with PCOS compared to those without the condition. Stress is when you feel threatened or that you can't cope with a situation. A little stress can provide motivation to act, but too much stress can affect your health. Anxiety is an unpleasant feeling of nervousness, fear or worry that something bad is happening or is about to happen. For some people, these feelings can become constant and extreme. Ongoing

feelings of anxiety can interfere with daily life. Depression is a serious illness that negatively affects the way you think and how you feel and act. People with depression have constant and extreme negative feelings and thoughts. Depression can stop you from doing everyday activities such as sleeping and eating, and it can make it hard for you to function physically and emotionally.

Causes of PCOS

The name 'polycystic ovary syndrome' suggests the problem is mainly with the ovaries, and that you might have multiple cysts on your ovaries. But the cause of PCOS is hormonal.

In some women diagnosed with PCOS, an ultrasound image of the ovaries shows multiple follicles in the ovaries. These are not cysts. They are eggs that haven't developed properly.

Genetics and family history

No single gene has been found to cause PCOS, so the link is likely to involve multiple genes.

It's estimated that up to a third of women with PCOS have a relative who has PCOS (e.g. mother, aunt, sister or daughter). This may be higher in some ethnic groups.

Hormones

Hormones are chemicals made in your body that carry messages through your bloodstream. They help control many functions in your body, such as growth, energy, sexual function, reproduction, digestion and temperature. With PCOS, it's thought that increased levels of insulin in the body cause the ovaries to work differently, which produces high levels of androgens (male-type hormones). These hormones cause various symptoms, such as irregular periods and hair and skin conditions. If the hormone levels are controlled, the ovaries often function normally and symptoms may improve.

Insulin

About 85% of women with PCOS have insulin resistance. If you are insulin resistant, your body blocks glucose from going into your cells. This causes your body to produce more insulin. Higher levels of insulin increase the production of androgens (male-type hormones) in your ovaries. Insulin resistance may be caused by lifestyle factors (e.g. being overweight) or genetic factors.

Androgens

Androgens are normally present in men and women, but at much lower levels in women. Many women with PCOS have increased levels of androgens. This can cause symptoms such as excessive body hair growth, scalp hair loss, acne and irregular periods.

Increased levels of androgens in women may also lead to eggs being underdeveloped. This can make it hard to get pregnant.

Weight

PCOS can affect women of all weight ranges. But a heavier weight can increase the hormones responsible for PCOS symptoms. Weight loss can normalize hormone production and lead to improvements in PCOS symptoms.

Pathophysiology of PCOS

PCOS is a hyperandrogenic state with oligo-anovulation that cannot be explained by any other disorder. It is a diagnosis of exclusion. Nevertheless, it accounts for the majority of hyperandrogenic presentations.

Nearly all causes of PCOS are due to functional ovarian hyperandrogenism (FOH). Two-thirds of PCOS presentations have typical functional ovarian hyperandrogenism, characterized by dysregulation of androgen secretion with an over-response of 17-hydroxyprogesterone (17-OHP) to gonadotropin stimulation. The remaining PCOS with atypical FOH lack of overresponse of 17-OHP, but testosterone elevation can detect it after suppressing adrenal androgen production. About 3% of PCOS patients have a related isolated functional adrenal hyperandrogenism. The remainder of PCOS cases is mild. These lack evidence of steroid secretory abnormalities; most of these patients are obese, which practitioners postulate accounts for their atypical PCOS. Specific testing for the FOH subpopulation has low clinical utility in the present day.

Functional ovarian hyperandrogenism PCOS presents with the primary features: hyperandrogenism, oligo anovulation, and polycystic ovaries morphology. Functional ovarian hyperandrogenism is multifactorial, with a combination of heritable and environmental factors. Causes for this dysregulation include insulin excess, which is known to sensitize the ovary to luteinizing hormone (LH) by interfering with the process of homologous desensitization to LH in the normal ovulation cycle as well as an intrinsic imbalance among

intraovarian regulatory systems. Theca cells in PCOS have overexpression of most steroidogenic enzymes and proteins involved in androgen synthesis, which suggested a prominent abnormality at the level and activity of steroidogenic enzymes, including P450c17, which has been highly identified. Granulosa cells prematurely luteinize primarily as a result of androgen and insulin excess.

Androgen excess enhances the initial recruitment of primordial follicles into the growth pool. Simultaneously, it initiates premature luteinization, which impairs the selection of the dominant follicle. This results in classical PCOS histopathologic and gross anatomic changes that constitute PCOM. PCOS is perpetuated by increased LH, but it is not caused by it. LH excess is common and is necessary for the expression of gonadal steroidogenic enzymes and sex hormone secretion but is less likely to be the primary cause of ovarian androgen excess because of LH-induced desensitization of theca cells.

About one-half of patients with functional ovarian hyperandrogenism have an abnormal degree of insulin-resistant hyperinsulinism, which acts on theca cell, increasing steroidogenesis and prematurely luteinizes granulosa cells, and stimulates fat accumulation. Hyperandrogenemia provokes LH excess, which then acts on both theca and luteinized granulosa sustaining cycle.

Ovarian hormonal dysregulation alters the pulsatile gonadotropin-releasing hormone (GnRH) release, potentially leading to a relative increase in LH versus follicle-stimulating hormone (FSH) biosynthesis and secretion. LH stimulates ovarian androgen production, while the relative decrease of FSH prevents adequate stimulation of aromatase activity within the granulosa cells, decreasing androgen conversion to the potent estrogen estradiol. This becomes a self-perpetuating noncyclic hormonal pattern.

Elevated serum androgens are converted in the periphery to estrogens, mostly estrone. As conversion occurs primarily in the stromal cells of adipose tissue, estrogen production will be augmented in obese PCOS patients. This conversion results in chronic feedback at the hypothalamus and pituitary gland, in contrast to the normal fluctuations in feedback observed in the presence of a growing follicle and rapidly changing estradiol levels. Unopposed estrogen stimulation of the endometrium may lead to endometrial hyperplasia.

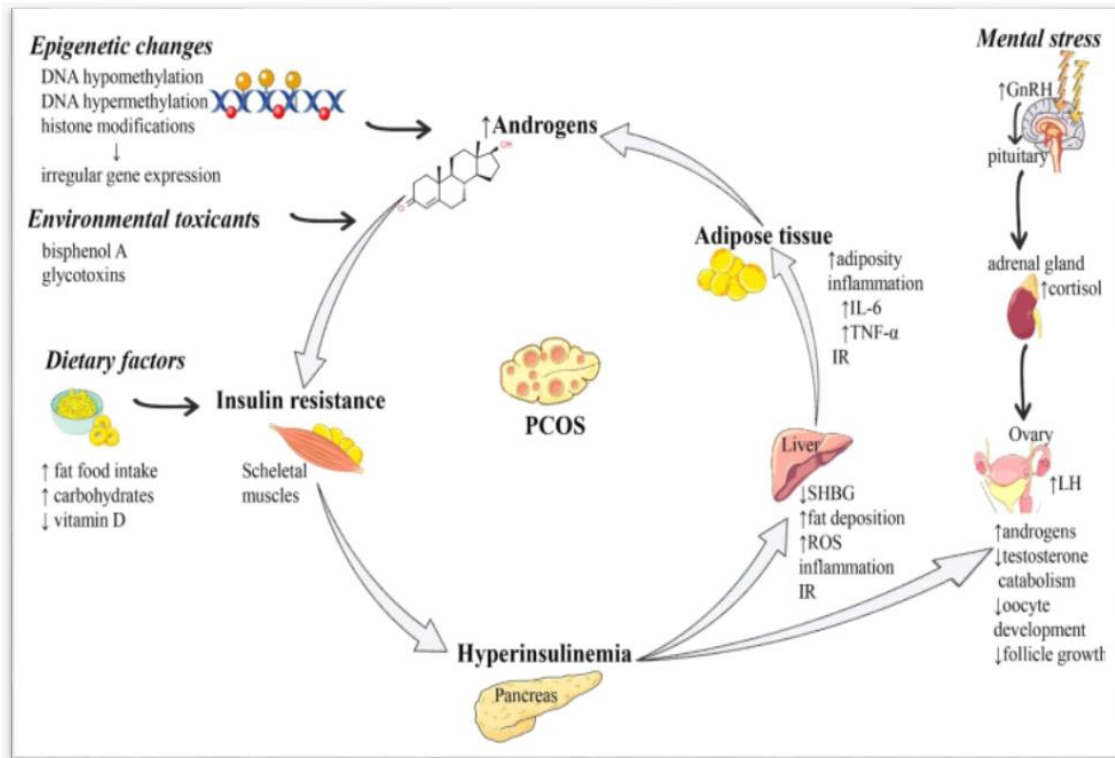


Figure 2- pathophysiology of PCOS

Lifestyle Changes for PCOS

There's no cure for PCOS, but your symptoms can be managed by making some lifestyle changes.

Exercise and PCOS

Exercise has a positive effect on polycystic ovary syndrome. It not only helps with weight loss but also may reduce the testosterone concentration in your blood.

About 50% of people with PCOS are overweight or obese. Short-term weight loss can help restore your fertility and ovulation, as well as improve your insulin resistance.

Mind-body exercises

Exercise can also improve your mental health. Polycystic ovary syndrome has been linked with an increased risk for mental health disorders. Exercises that engage your mind and body can help. These include yoga, tai chi, qi gong, and pilates.

Dietary fiber.

Increasing the amount of fiber in your diet will help you combat insulin resistance.

Women should eat about 21 grams to 25 grams of fiber a day. Foods that are high in fiber include.

- Beans
- Lentils
- Berries
- Broccoli
- Green peas
- Chia seeds
- Nuts like almonds and pistachios.

Do yoga or any other form of exercise-

It is a no-brainer that regular exercise can improve one's physical and mental well-being. Apart from healthy bones, heart, joints and muscles, daily workout or practicing yoga can relieve symptoms of PCOS like menstrual irregularity, obesity, hypertension, and glucose intolerance. Yoga is good for one's mind and body. Yoga and exercising help PCOS patients to battle the bulge and slash down the risk of heart issues.

Diagnosis and treatment

If you have PCOS symptoms, see your doctor. Your doctor will review your medical history and assess your physical symptoms, weight and BMI (body mass index). They may also recommend certain tests to rule out other conditions.

PCOS may be diagnosed if you have two or more of the following symptoms:

- Irregular or no periods.
- Features of 'clinical androgen excess' (e.g. pimples and excess hair growth) or higher than normal androgen levels (shown in your blood test).
- Polycystic ovaries visible on an ultrasound (i.e. more than 20 partly-developed eggs are visible on your ovaries or your ovaries are enlarged).

You don't need to have an ultrasound to confirm PCOS if you have irregular or no periods and high androgen levels.

Ultrasounds are not recommended for women under 20 years of age.

Tests

Your doctor may ask you to do different tests before they confirm a PCOS diagnosis. The tests will depend on your individual symptoms.

Blood tests

Blood tests for testosterone and free androgen index (FAI) can identify high androgen levels.

You may also have blood tests to check the levels of other reproductive hormones that affect your periods. For example, oestrogen (the female sex hormone) or the follicle-stimulating hormone (FSH).

Your doctor may also recommend blood tests to exclude conditions with similar symptoms to PCOS.

If you are taking the contraceptive pill, you will need to stop for three months before you do blood tests to check your hormone levels.

Ultrasound

Your doctor or specialist may perform an abdominal ultrasound to check for signs of PCOS (e.g. partly-developed eggs on your ovaries, enlarged ovaries or a thickened uterus lining).

A transvaginal ultrasound may be used on women who are sexually active. This is a procedure where a probe is inserted into your vagina, giving a much clearer picture of your ovaries than an abdominal ultrasound.

Other tests

Your doctor may want to do some tests to assess your risk of developing heart (cardiovascular) disease and type 2 diabetes.

For example:

- a cholesterol blood test
- a blood pressure test
- a glucose tolerance blood test.

If you have PCOS, you will need a cholesterol and diabetes test every few years, and a blood pressure check every year. If you have risk factors, such as a family history of diabetes or previous abnormal cholesterol tests – or if you are planning to get pregnant – you will need to do these tests more often.

Treatment of PCOS

The main treatment options are discussed in more detail below.

Lifestyle changes

- In overweight women, the symptoms and overall risk of developing long-term health problems from PCOS can be greatly improved by losing excess weight.

Weight loss of just 5% can lead to a significant improvement in PCOS.

- You can find out whether you're a healthy weight by calculating your body mass index (BMI), which is a measurement of your weight in relation to your height.
- A normal BMI is between 18.5 and 24.9. Use the BMI healthy weight calculator to work out whether your BMI is in the healthy range.
- You can lose weight by exercising regularly and eating a healthy, balanced diet.
- Your diet should include plenty of fruit and vegetables, (at least 5 portions a day), whole foods (such as wholemeal bread, wholegrain cereals and brown rice), lean meats, fish and chicken.

Medicines

A number of medicines are available to treat different symptoms associated with PCOS.

Irregular or absent periods

The contraceptive pill may be recommended to induce regular periods, or periods may be induced using an intermittent course of progestogen tablets (which are usually given every 3 to 4 months, but can be given monthly).

This will also reduce the long-term risk of developing cancer of the womb lining (endometrial cancer) associated with not having regular periods.

Other hormonal methods of contraception, such as an intrauterine system (IUS), will also reduce this risk by keeping the womb lining thin, but they may not cause periods.

Fertility problems

A medicine called clomifene may be the first treatment recommended for women with PCOS who are trying to get pregnant.

Clomifene encourages the monthly release of an egg from the ovaries (ovulation).

If clomifene is unsuccessful in encouraging ovulation, another medicine called metformin may be recommended.

Metformin is often used to treat type 2 diabetes, but it can also lower insulin and blood sugar levels in women with PCOS.

As well as stimulating ovulation, encouraging regular monthly periods and lowering the risk of miscarriage, metformin can also have other long-term health benefits, such as lowering high cholesterol levels and reducing the risk of heart disease.

Metformin is not licensed for treating PCOS in the UK, but because many women with PCOS have insulin resistance, it can be used "off-label" in certain circumstances to encourage fertility and control the symptoms of PCOS.

Possible side effects of metformin include nausea, vomiting, stomach pain, diarrhoea and loss of appetite.

As metformin can stimulate fertility, if you're considering using it for PCOS and not trying to get pregnant, make sure you use suitable contraception if you're sexually active.

You can read a summary of the possible benefits and harms of metformin for PCOS from the National Institute of Health Care Excellence.

Letrozole is sometimes used to stimulate ovulation instead of clomifene. This medicine can also be used for treating breast cancer.

Use of letrozole for fertility treatment is "off-label". This means that the medicine's manufacturer has not applied for a licence for it to be used to treat PCOS.

In other words, although letrozole is licensed for treating breast cancer, it does not have a license for treating PCOS.

Doctors sometimes use an unlicensed medicine if they think it's likely to be effective and the benefits of treatment outweigh any associated risks.

If you're unable to get pregnant despite taking oral medicines, a different type of medicine called gonadotrophins may be recommended.

These are given by injection. There's a higher risk that they may overstimulate your ovaries and lead to multiple pregnancies.

Unwanted hair growth and hair loss

The combined oral contraceptive pill is usually used to treat excessive hair growth (hirsutism) and hair loss (alopecia).

A cream called eflornithine can also be used to slow down the growth of unwanted facial hair.

This cream does not remove hair or cure unwanted facial hair, so you may wish to use it alongside a hair removal product.

Improvement may be seen 4 to 8 weeks after treatment with this medicine.

Eflornithine cream is not always available on the NHS because some local NHS authorities have decided it's not effective enough to justify NHS prescription.

If you have unwanted hair growth, you may also want to remove the excess hair by using methods such as plucking, shaving, threading, creams or laser removal.

Laser removal of facial hair may be available on the NHS in some parts of the UK.

Sometimes medicines called anti-androgens may also be offered for excessive hair growth, which may include

- cyproterone acetate
- spironolactone
- flutamide
- finasteride

These medicines are not suitable if you are pregnant or trying to get pregnant.

For hair loss from the head, a minoxidil cream may be recommended for use on the scalp. Minoxidil is not suitable if you are pregnant or trying to get pregnant.

Other symptoms

Medicines can also be used to treat some of the other problems associated with PCOS, including:

- weight-loss medicine, such as orlistat, if you're overweight.
- cholesterol-lowering medicine (statins) if you have high levels of cholesterol in your blood.
- acne treatments

IVF treatment

If you have PCOS and medicines do not help you to get pregnant, you may be offered in vitro fertilisation (IVF) treatment.

This involves eggs being collected from the ovaries and fertilised outside the womb. The fertilised egg or eggs are then placed back into the womb.

IVF treatment increased the chance of having twins or triplets if you have PCOS.

Surgery

A minor surgical procedure called laparoscopic ovarian drilling (LOD) may be a treatment option for fertility problems associated with PCOS that do not respond to medicine.

Under general anaesthetic, your doctor will make a small cut in your lower tummy and pass a long, thin microscope called a laparoscope through into your abdomen.

The ovaries will then be surgically treated using heat or a laser to destroy the tissue that's producing androgens (male hormones).

LOD has been found to lower levels of testosterone and luteinising hormone (LH), and raise levels of follicle-stimulating hormone (FSH).

This corrects your hormone imbalance and can restore the normal function of your ovaries.

CONCLUSION

Polycystic ovarian syndrome is one of the most important endocrine disorder that affects females in reproductive age and may lead to serious complications.

Further studies are needed to determine the exact aetiology of PCOS, method of prevention and proper management.

REFERENCES

1. Lin LH, Baracat MC, Gustavo AR, et al. Androgen receptor gene polymorphism and polycystic ovary syndrome. *Int J Gynaecol Obstet.* 2013;120:115–118.
2. Aubuchon M, Legro RS. Polycystic ovary syndrome: Current infertility management. *Clin Obstet Gynecol.* 2011;54(4):675–684.
3. American Congress of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 108: Polycystic Ovary Syndrome. *Obstet Gynecol.* 2009;114(4):936–949.
4. National Institutes of Health Department of Health and Human Services. *Beyond Infertility: Polycystic Ovary Syndrome (PCOS)* NIH Pub. No. 08-5863, April 2008.
5. McFarland C. Treating polycystic ovary syndrome and infertility. *MCN Am J Matern Child Nurs.* 2012;37(2):116–121.
6. Xita N, Georgiou I, Tsatsoulis A. The genetic basis of polycystic ovary syndrome. *Eur J Endocrinol.* 2002;147:717–725.
7. Diamanti-Kandarakis E, Kandarakis H, Legro RS. The role of genes and environment in the etiology of PCOS. *Endocrine.* 2006;30:19–26.
8. Shannon M, Wang Y. Polycystic ovary syndrome: A common but often unrecognized condition. *J Midwifery Womens Health.* 2012;57:221–230.
9. Urbanek M. The genetics of polycystic ovary syndrome. *Natl Clin Pract Endocrinol Metab.* 2007;3:103–111.
10. Marx TL, Mehta AE. Polycystic ovary syndrome: Pathogenesis and treatment over the short and long term. *Cleve Clin J Med.* 2003;70(1):31–33. 36–41, 45.