Hormone blood tests in the menopause transition

This WHC Fact Sheet will help to increase understanding of the hormones that are measured in hormone blood tests and explain why hormone blood tests are generally not helpful in diagnosing and managing the menopause.

Key points

- In those of average menopause age, it is seldom useful to monitor hormone blood levels in the menopause transition or in postmenopause.
- A woman's own hormones fluctuate erratically in the perimenopause and conventional licensed hormone replacement therapy (HRT) does not usually stop or prevent the hormone fluctuations.
- Follicle Stimulating Hormone (FSH) is persistently high and estradiol is persistently low in the post menopause.
- Estradiol levels fluctuate over a 24-hour period for women taking transdermal HRT containing estradiol.
- Estradiol levels do not indicate the available and active estrogens for women taking oral estrogens and do not reflect activity at the estrogen receptors.
- Neither estradiol nor FSH levels indicate how severe symptoms are, how long symptoms will last, whether or not treatment is needed nor, if HRT is taken, what dose of HRT is needed.
- If you are struggling with ongoing symptoms of the menopause transition, please speak to a healthcare professional to exclude other causes of your symptoms and work out of the optimal way for you to manage your symptoms.

Introduction

For women in the menopause transition at the average age range of 45 to 55 years and during postmenopause, blood tests to measure hormone levels are not usually needed to:

- diagnose the perimenopause or menopause
- monitor HRT or manage menopause symptoms
- manage the long-term health consequences of the menopause

To diagnose and manage the perimenopause and menopause, period pattern (if present) and symptoms experienced and their impact are the most important factors, alongside medical and family history. Talking to your healthcare professional and accessing trusted resources are the best ways to make informed decisions about effectively managing menopause symptoms and the long-term health consequences of the menopause.

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The blood tests usually offered in relation to the menopause transition are FSH and estradiol. Before going into detail about whether or not a hormone test is required, the following points should be noted:

1. For women going through the menopause transition in the average age range, blood tests are not usually helpful in working out if and where you are in the menopause transition, predicting how long symptoms will last, and they are not usually an accurate way of determining exactly how well you are absorbing HRT.

2. There is little connection between the level of estrogen on a single blood test and menopause symptoms, and there is no threshold level of estrogen that must be aimed for to successfully manage symptoms of the menopause. The same estrogen level can result in symptom control for one woman, but not for another.

3. There are many pitfalls to interpreting a single estrogen level or FSH level. Levels of both hormones can vary significantly from person to person and hour by hour before and during the perimenopause. For women taking HRT, estrogen levels can significantly vary with time – they do not remain constant over time. For the same dose of HRT, estrogen levels will vary between different women.

4. For women taking HRT in the perimenopause, there is no way of knowing how much estrogen in the blood result is from the HRT and how much is being made by the body.

5. Blood tests are not usually an accurate way of determining effectiveness of HRT.

6. Blood tests cannot be used to individualise hormone treatment or to work out what dose of HRT is required to manage symptoms.

7. There is no good quality data clinically validating hormone testing from urine or saliva tests offered by some private laboratories.

8. There is a link to estrogen levels and bone protection, but no exact threshold has been demonstrated that should be aimed for. Even low doses of estrogen can help maintain bone density.

What do hormone blood tests measure?

To understand blood test results and what they may or may not show, it is necessary to understand what hormones are, what is being measured and how they change in the menopause transition.

A hormone is a chemical messenger. FSH is a hormone made by the brain and this helps control the function of the ovaries. Estrogens are a group of hormones that are responsible for development and regulation of the female reproductive system and they have many other roles in the body, including helping maintain bone density.

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How much estrogen does my body produce?

Before the menopause transition, your ovaries make most of your estrogen. The blood level of estrogen increases and decreases during each monthly cycle. For most women not on hormone contraception, this cycle will lead to a monthly period. Levels are at their lowest during the first few days of your period and highest in the middle of your cycle at the time of ovulation. The level of estradiol varies between around 110-1285 pmol/L during a monthly cycle, but this range does vary hugely from individual to individual. A small amount of estrogen is also made in other sites in the body, including the liver, fat tissue, brain, womb lining (endometrium) and adrenal glands.

In the perimenopause, your estrogen levels can change more erratically when compared to the hormone changes of the menstrual cycle. Estrogen levels can swing from very high to very low. The level of estrogen can be lower than normal and higher than normal. When estrogen levels are lower you may have symptoms of estrogen deficiency, e.g. hot flushes or night sweats. There can also be symptoms when the estrogen level is higher than normal, e.g. breast tenderness or headaches. The hormone fluctuations are why symptoms can fluctuate so dramatically. The actual change of hormones can also trigger symptoms for some women such as low mood, anxiety and migraine.

After the menopause the ovaries make very little estrogen – it is not measurable by normal hospital laboratories – but a tiny amount of estrogen is made in other parts of the body. In the postmenopause, the body then generally adapts to this state of low estrogen and symptoms of the menopause usually start to settle after periods stop – though they can still go on for a varying, unpredictable number of years after.

There are different types of estrogen that occur naturally.

1. **Estrone** (**E1**): this is a weak estrogen. It is found in the body before the menopause but is the most important estrogen in our body after the menopause. Estrone is made in the fatty tissue where it is converted from androgens (male hormones found in the female body). The androgens are made by the adrenal glands.

2. **Estradiol** (**E2**): this is the most potent estrogen produced mainly by your ovaries before the menopause.

3. **Estriol** (**E3**): this estrogen is produced by the placenta during pregnancy.

4. **Estretrol** (**E4**): this estrogen is only made by the liver of the fetus.

Estradiol is considered the most important naturally occurring estrogen. It is the most potent estrogen; it helps us to feel well and it helps to protect our heart and bones. This is the estrogen most found in HRT tablets, patches, gels, spray and some vaginal preparations. This is the estrogen measured in lab testing.

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The estrogen blood test measures estradiol. The result is the total estradiol level, including the free and active hormone plus the protein bound inactive or less active hormone. It is not possible to know how much of the estradiol is active and how much is inactive. Furthermore, estrogens need estrogen receptors to 'work' and the activity of estrogen receptors in cells is dependent on many other factors which are not usually measurable.

Because of variations in how the estradiol is measured, it is not possible to compare results from different labs.

Other types of estrogen found in HRT

The alternatives to estradiol used in HRT include conjugated equine estrogens and tibolone. Conjugated equine estrogens are found in some less commonly prescribed types of HRT and are a mix of estrogens derived from horse urine. Tibolone is a fully synthetic type of HRT containing molecules that act on estrogen receptors, though they are biochemically different from estrogen.

Estriol is found in some vaginal estrogen preparations used to treat vaginal and bladder symptoms of the menopause.

Hormone blood tests are not helpful at all for women taking tibolone or conjugated estrogens.

Other types of estrogen found in combined contraception

Combined contraception contains an estrogen and a progestogen. Most combined contraception pills, patches and rings contain a synthetic 'man-made' estrogen called ethinyl estradiol. Some contain estradiol. Estetrol is used in a newer combined oral contraceptive pill.

Combined hormone contraception is mentioned here because, for some women, it is helpful in managing symptoms of the perimenopause as well as providing contraception. Measuring hormone levels is unhelpful for women taking the combined pill which supresses the production of a woman's own estradiol and FSH.

Can a blood test diagnose the menopause?

FSH is the hormone measured to diagnose the menopause. Blood tests are not usually used to diagnose the menopause if you are going through the menopause transition at an average age of 45-55 years. Symptoms and bleeding patterns are the factors used to diagnose the menopause transition.

The FSH level increases in the postmenopause and stays persistently raised. The level fluctuates significantly in the perimenopause when it could be normal or raised. In the perimenopause, you could have many symptoms of the menopause but the FSH can be normal. The FSH level is not predictive of where you are in the menopause transition and does not indicate severity of symptoms experienced.

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The National Institute for Health and Care Excellence (NICE) does not recommend the routine use of blood tests to diagnose the menopause for women at the age of 45 years or over. It advises that blood tests for FSH should be considered in women aged 40-45 years with menopause symptoms including a change in the menstrual cycle, and blood tests are important in women under 40 years in whom the menopause is suspected to diagnose Premature Ovarian Insufficiency (POI).

FSH levels are not useful in monitoring the absorption of hormones from HRT.

After the menopause, swings in estradiol and FSH no longer occur but blood tests are usually still not very helpful. If you are not taking HRT, your estradiol level will be low regardless of whether you are experiencing symptoms or not.

Sometimes it can be difficult to know if you are peri- or postmenopausal if you are not bleeding because of progestogen only contraception (e.g. a mini pill, Depo Provera injection, Nexplanon implant or a 52mg levonorgestrel containing intrauterine device such as the MirenaTM), or if you have had a gynaecological procedure such as endometrial ablation or hysterectomy. Again, an estradiol or FSH level may not be useful as it can be so variable in the perimenopause. The symptoms, and their impact, are the most important factor in determining treatment.

How much estrogen is needed to manage menopause symptoms?

The amount of estrogen – or dose of HRT – needed to manage menopause symptoms varies from woman to woman. Some will have good symptom control with a low dose and others may need a higher dose.

HRT can never replicate the hormone ups and downs of a pre-menopause monthly cycle. The HRT just gives an estrogen dose that aims to give enough to manage symptoms and help protect the bones and heart. For younger women, you also need HRT to protect the brain also (see the section on POI).

There is no way of knowing what dose or HRT any individual woman will need to manage her symptoms and a blood test will not give us the answer to this.

Will a blood test tell me how well the HRT is being absorbed if there are ongoing menopause symptoms on HRT?

Sometimes an estrogen blood test is taken in the hope that this can indicate how well the estrogen is absorbed.

Women may still experience symptoms of the menopause while taking HRT. HRT may not help all symptoms listed that are attributed to the menopause. The hormone swings may be responsible for symptoms – and they cannot be captured through a blood test. HRT itself does not stop the hormone swings of the perimenopause. In the perimenopause, when a blood test for estradiol is taken, there is no way of knowing how much of that measured is from the HRT and how much is the bodies' own estradiol.

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A small percentage of women do not absorb estrogen well through the skin because of many factors including site of application, skin irritation, skin type, ethnicity, age and level of hydration.

It is better to try a different type of HRT and to talk through your symptoms with a healthcare professional than to check an estrogen blood level.

Estradiol blood tests and different routes of delivery of HRT

Oral HRT

When the estradiol is swallowed in tablet form, it is absorbed into the blood stream and quickly travels to the liver where a lot of it is converted to estrone. Estrone is a weaker estrogen and is not usually measured in UK labs. So tablets can be effective in managing symptoms of the menopause, but the blood level of estradiol quickly rises and falls as most is converted to estrone. A blood test for estradiol is therefore not helpful.

Transdermal HRT

If estrogen is absorbed through the skin in a patch, gel or spray, it travels round the body in the blood stream as estradiol before arriving at the liver. At the liver the estradiol is converted to estrone or broken down to other chemical products. There is therefore more estradiol in the blood stream for longer compared with oral tablets.

There are still fluctuations of estradiol in the blood stream though, and many factors affect this.

When gel is applied to the skin, there is a significant rise and fall of estradiol as it is absorbed and then taken up by the receptors around the body. If a blood test is taken, the amount of estradiol will vary with time after application.

When a patch adheres to the skin, initially more estradiol is absorbed, but the blood level of estrogen still varies over time in an unpredictable pattern.

Estradiol spray currently available contains a chemical which aims to allow a 'smooth' transport of estradiol into the blood stream, but the blood level still varies over a 24 hour period.

It is not possible to predict what an estrogen blood level is for any given dose of any given type of HRT. Studies show a wide variation from individual to individual.

Estradiol implants

When an implant is fitted under the skin there is a slow release of estradiol. Estradiol blood tests are useful for monitoring when an implant has been inserted, to help ensure that the blood level is not significantly raised.

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Can blood tests be used to monitor HRT treatment?

The most effective way of monitoring HRT treatment is by having a regular review of symptoms. There is very little correlation between estradiol levels and symptoms. Some women feel better at lower estrogen doses and some need higher doses.

When the dose of HRT is increased, some women have side effects and some feel worse rather than better. If too much estrogen is given for an individual, the HRT can become less rather than more effective. This is a condition called tachyphylaxis and the dose of estrogen should be slowly decreased if this happens.

There is lack of evidence for safety of high doses of estrogen – beyond standard doses. There is no data to inform us what a safe upper limit of normal estradiol is.

Is there an estrogen level to aim for if HRT is being taken to treat or prevent osteoporosis?

HRT is sometimes used to prevent or treat osteoporosis in women. In these situations, it can be helpful to know that the estrogen is being absorbed.

Unfortunately, the same limitations apply when interpreting levels of estradiol. It will vary with transdermal HRT and blood levels should not be taken for women taking oral HRT. Bone protection can occur even at low doses of estrogen.

Should blood tests be used to monitor HRT in POI?

When women have a premature menopause under the age of 40 years, it is important that HRT is taken (unless there are contraindications to taking HRT) to help prevent osteoporosis, heart disease and dementia.

HRT cannot reproduce the ups and downs of estrogen during a premenopausal menstrual cycle. Estradiol levels are sometimes monitored for women taking HRT, accepting the limitations of measuring estradiol. The level aimed for is that which is around an average level of estrogen found in women who are having periods. However, the estradiol blood level is still not helpful for women swallowing oral estradiol or the combined oral contraceptive pill.

It is also important to monitor bone density and risk factors for heart disease and dementia.

Summary

In those of average menopause age, it is seldom useful to monitor hormone blood levels in the menopause transition or in postmenopause. Neither estradiol nor FSH levels indicate how severe symptoms are, how long symptoms will last, whether or not treatment is needed nor, if HRT is taken, what dose of HRT is needed.

If you are struggling with ongoing symptoms of the menopause transition, please speak to a GP or healthcare professional to exclude other causes of your symptoms and work out of the most optimal way for you to manage your symptoms.

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Further reading

NICE guidelines (NG23). Menopause: identification and management, updated November 2024.
https://www.nice.org.uk/guidance/ng23/informationforpublic

Guidelines of the European Society of Human Reproduction and Embryology (ESHRE). Management of women with premature ovarian insufficiency, December 2024.
https://www.eshre.eu/Guidelines-and-Legal/Guidelines/Premature-ovarian-insufficiency

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This Women's Health Concern fact sheet provides information and guidance, to be used in consultation with your own healthcare professional. It will be updated when guidance changes and/or new data becomes available.

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