

Bone markers (blood and urine tests) and osteoporosis

What is osteoporosis?

Osteoporosis occurs when the struts which make up the mesh-like structure within bones become thin causing them to become fragile and break easily, often following a minor bump or fall. These broken bones are often referred to as 'fragility fractures'. The terms 'fracture' and 'broken bone' mean the same thing. Although fractures can occur in different parts of the body, the wrists, hips and spine are most commonly affected. It is these broken bones or fractures which can lead to the pain associated with osteoporosis. Spinal fractures can also cause loss of height and curvature of the spine.

Throughout life, your skeleton is continually renewing itself. Cells called osteoclasts break down old bone (bone resorption) and cells called osteoblasts lay down new bone (bone formation). This process of renewal is often described as bone turnover and it enables bones to repair microscopic damage and maintain their strength. As we become older, the rate of bone turnover increases. As a consequence of this increase, the amount of bone that is removed often exceeds the amount that is formed. This imbalance leads to bone loss as part of the normal aging process, and may lead to osteoporosis making an individual more at risk of fracture.

What are bone markers?

During the bone remodelling process, chemicals are produced which can be detected in the blood and urine. These products are known as 'biochemical markers of bone turnover' or bone markers. An assessment of levels of these markers can be used to measure the rate of bone turnover, thus providing useful information about factors that might affect bone strength. Bone markers are classified as markers of either bone resorption or bone formation. These processes are closely linked together so either type of marker will reflect the rate of bone turnover.

Where can I get this test?

The test is only currently available in specialist centres when it is felt that the additional information provided could affect the type of drug treatment offered - your GP will be able to advise whether a consultant referral is required. Bone markers are also used in research to assess effects of treatments in drug trials or as part of an assessment of fracture risk. Bone marker tests are not generally requested by GPs. There are many factors, such as time of the day and other medical conditions you might have, that can affect the interpretation of bone marker testing and most GPs won't have the experience or the equipment to use these tests effectively. It is not advisable to buy a self-testing kit over the counter or on the internet because the accuracy or usefulness of these kits is unproven.

How are bone turnover markers measured?

Bone resorption markers can be measured in blood or urine. **Bone formation** markers are measured in blood. The two markers generally used are called PINP and CTX and these are the ones recommended in international expert guidance. These are both blood tests.

Some hospitals still use NTX which is a urine marker. Bone alkaline phosphatase (a blood test) is the other marker that is also sometimes used to help understand whether you are affected by other bone conditions but not to check if a drug is working.

Bone markers are summarised in the table below:

Bone markers of formation	Bone markers of resorption
<i>Blood tests</i>	<i>Blood and urine tests</i>
Bone alkaline phosphatase	(CTX) cross-linking telopeptide of type I collagen (blood test)
Procollagen type I N propeptide (PINP)	(NTX) cross linking telopeptide of type I collagen (urine test)

A blood or urine sample is taken to assess bone marker levels and sent to the laboratory for testing. Because bone turnover is highest in the morning and decreases significantly by lunchtime, blood samples for some markers such as CTX need to be taken early in the morning after fasting with follow up samples, at a later date, taken at the same time of the day. PINP, however can be measured at any time of day. If you are having a urine test, you will be asked to provide a sample as the second specimen of the morning (you pass urine once and then collect a specimen the second time) and as early as possible.

How are bone marker tests used?

These tests may be used for one of three reasons:

- a) To measure bone turnover as part of an assessment of bone strength and fracture risk. There haven't been many research trials to prove how effective this is so currently other methods are generally used to assess bone strength including measurement of bone density (using a bone density scan) and combining the results with all your other risk factors.
- b) To monitor the effectiveness of osteoporosis drug treatments. Most treatments work by decreasing the rate of bone resorption. The rate of bone formation also decreases but the overall effect is that the two processes come back into balance and this leads to an improvement in bone strength. The effect of a drug treatment on bone turnover can be assessed using bone markers within six months of commencing treatment.
- c) In research trials, to assess osteoporosis drugs in development.

Although there is evidence to suggest the value of bone marker tests as outlined above, expert opinion is divided on how useful or necessary they are and further research is required to establish how they should be best used in the management of osteoporosis. A UK independent review in 2014 looking at whether bone markers should be used, to see if a drug treatment is working, concluded there was insufficient evidence available to make recommendations. International expert guidance however has concluded that although more research is needed, bone markers can be useful in some situations.

How do I know my osteoporosis drug treatment is working if I'm not offered a bone marker test?

You can be confident that all of the licensed drug treatments for osteoporosis have been clinically tested and research has proven they reduce the risk of breaking bones. Having a bone-density scan provides some information and may be useful although it doesn't tell you everything about your bone strength or show conclusively whether a drug is working or not.

If you have a fracture while on treatment it does not necessarily mean that the drug is not working – no drug is 100% effective. However, if you continue to break bones, talk to your doctor; depending on your circumstances, a different drug may be suggested or you may be referred to a specialist for further advice and care.

This information reflects current evidence and best practice but is not intended to replace the medical advice provided by your own doctor or other healthcare professional.

This is one of many information resources available about osteoporosis and bone health. View the range at theros.org.uk and order more by calling us on 01761 471 771 or emailing info@theros.org.uk

For osteoporosis information and support contact our free specialist nurse Helpline:

 nurses@theros.org.uk

 0808 800 0035

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