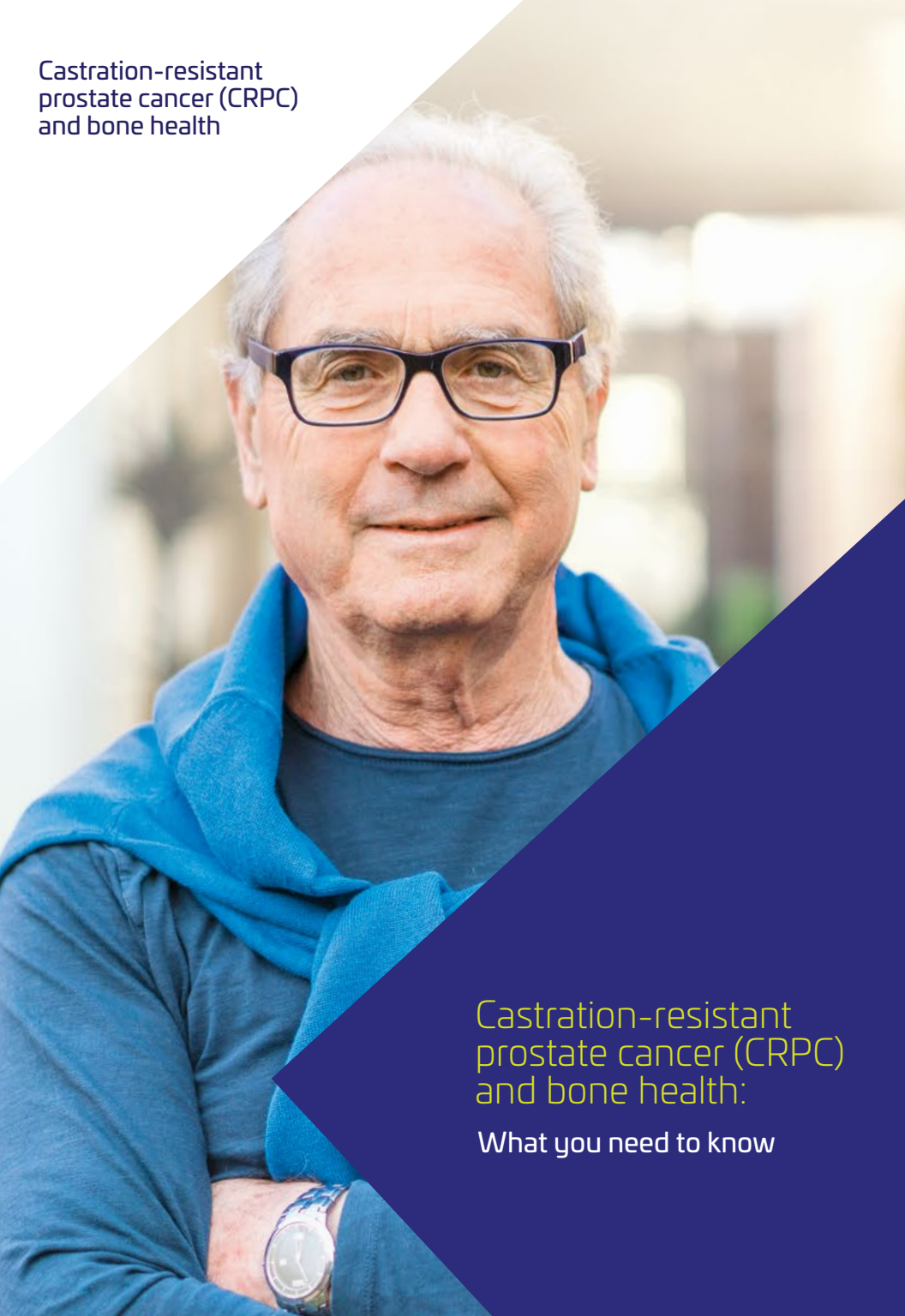

Castration-resistant prostate cancer (CRPC) and bone health:

What you need to know

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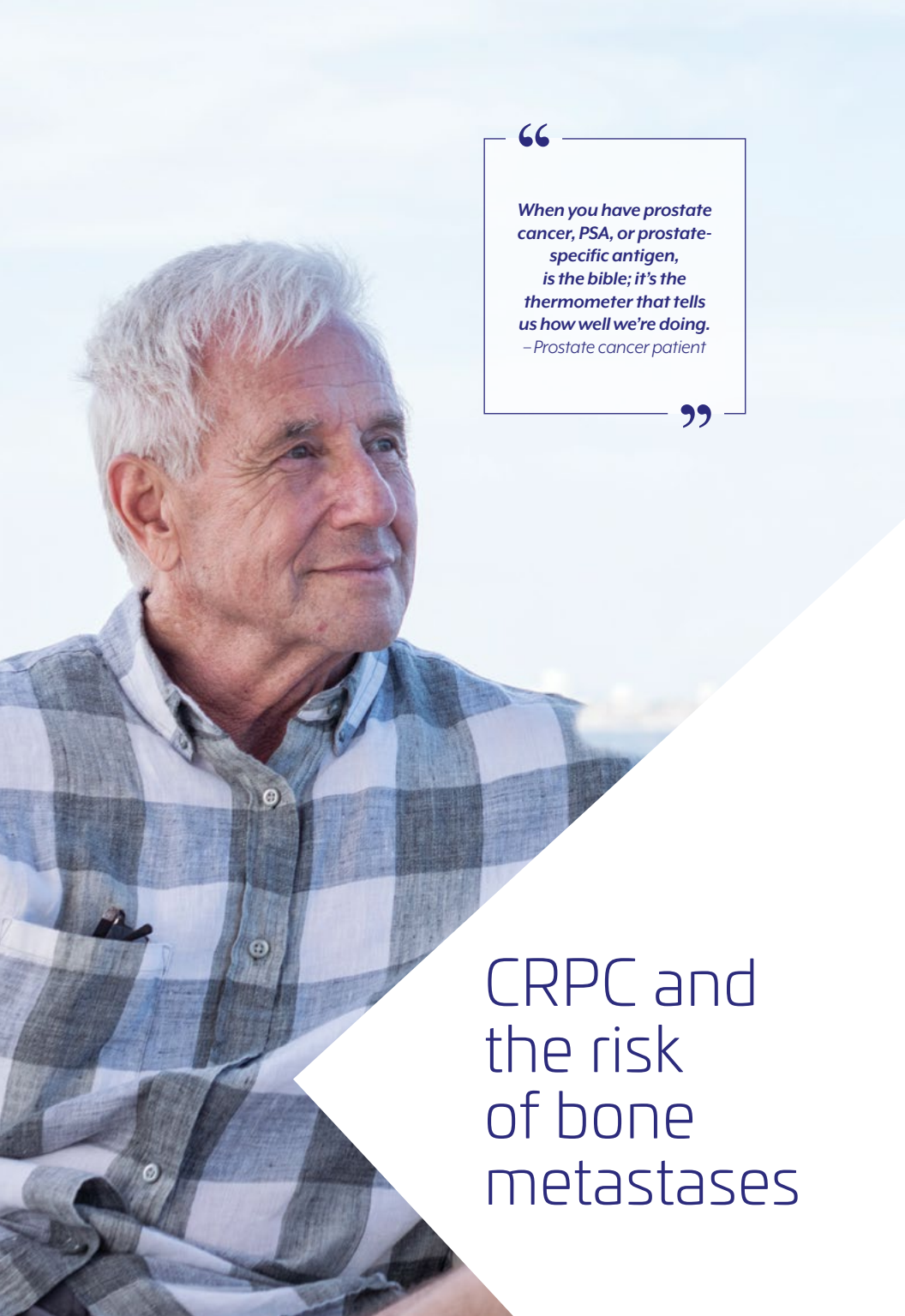
This brochure was developed in collaboration with medical oncologists, nurses, and prostate cancer patients.

Your diagnosis—CRPC

Castration-resistant prostate cancer (also known as “CRPC”) is when the level of your prostate-specific antigen (PSA) has increased or your cancer has shown other signs of progression while using hormone therapy (i.e., androgen deprivation therapy, or “ADT”). Under normal conditions, prostate cancer cells need the male hormone “testosterone” to grow and spread. ADT lowers testosterone to very low levels. However, with time, prostate cancer cells may outsmart this approach and begin to grow despite lowered testosterone. This results initially in increasing PSA levels and, ultimately, in the spread of the cancer to distant sites (“metastases”).



> ***When you have prostate cancer, PSA, or prostate-specific antigen, is the bible; it's the thermometer that tells us how well we're doing.***
> *– Prostate cancer patient*

CRPC and the risk of bone metastases

Having CRPC puts you at a much higher risk for bone metastases. In fact, **about 90% of men with CRPC will develop bone metastases**, which are associated with pain, fractures, anemia, weight loss, fatigue, and increased susceptibility to infection—all of which have a negative effect on your quality of life.

PSA levels can help you tell if your cancer is likely to be confined to the prostate gland. PSA is a protein made by prostate cells. Although PSA is mostly found in semen, PSA can also be found in the blood using a PSA test. If your PSA level is high, your cancer is more likely to have spread beyond the prostate. PSA levels can also be used to monitor your response to cancer therapy and to determine if the disease has recurred or progressed.

Importance of PSA doubling time

The **PSA doubling time**—the time it takes your PSA level to double its value—can be used to help determine if your prostate cancer is rapidly progressing and aggressive, and therefore more likely to spread. For some people, the PSA doubling time is long (meaning that the level rises slowly); for others, it's short (fast). For example, if your PSA doubling time is two years, this means your PSA level doubles about every two years. The shorter (or "faster") your PSA doubling time, the higher your risk of developing bone metastases. Depending on your PSA doubling time, your doctor will schedule appropriate scans and imaging to check for metastasis based on your risk.

Bone metastases

Because you have prostate cancer, you are at risk of bone metastases. As cancer cells divide, they can break away from the **primary tumour** and are carried to other parts of the body, such as the bones, where they form a new tumour. This new tumour is called a "metastasis" (or "metastases" when there is more than one new tumour).

> If you develop a bone metastasis, it does *not* mean you have two types of cancer. You still only have **one type of cancer**, but it has spread to a second location in your body.

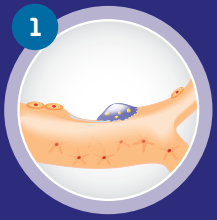
Bone metastases are different from bone cancer. With bone cancer, the cancer starts in the bones. With bone metastases, the cancer starts somewhere else and *spreads* to the bones. Bone metastases are much more common than primary bone cancers, especially in adults.

Roughly 90% of men with CRPC will develop metastasis to the bone. But there are medicines available to help manage the effects from bone metastases and steps you can take to help keep your bones as strong as possible.

Your bones are constantly being broken down and repaired (or "remodelled") to keep them strong. When cancer spreads (or "metastasizes") to the bones, the **normal balance of the bone remodeling process** (the breakdown of old bone and the laying down of new bone) is **affected** in two ways:

1. Some cancer cells produce substances that turn on the **osteoclasts**—the cells responsible for breaking down bone. When this happens, old bone is broken down but no new bone is formed to replace it. This leaves holes in the bone (called "osteolytic" or "lytic" lesions). These holes make the bone **weak**. As a result, bone with these holes tends to **break with little or no trauma**.

2. Some cancer cells release substances that **turn on the osteoblasts**—the cells responsible for laying down new bone. When this happens, **new bone is laid down over old bone that has not been broken down**. In areas where this happens, the remodelled bone becomes **harder than normal bone**. (This is called "**sclerosis**", and these areas are called "**osteoblastic**" or "**blastic**" lesions.) Even though these areas are harder than normal bone, they **break more easily because their structure is abnormal**.



"**Osteoclasts**" are cells that **break down old bone**.

"**Osteoblasts**" are cells that **lay down new bone**.

> ***Patients should ask what the consequences of having bone tumours are and what they can do to reduce the potential impact on their bones.***
> *– Uro-oncologist*

The risk of skeletal-related events

When bones are weakened, the risk of damage becomes greater, even with little trauma or stress. This can lead to problems with bone health, known as "skeletal-related events" or "SREs." SREs include radiation to the bone, fractures (breaks), the need for surgery, and spinal cord compression.

Radiation to the bone: Radiation therapy is used to treat bone pain and spinal cord compression. It can also help reduce the risk of fracture and control the growth of some tumours.

Pathological fracture: A tumour can cause bone to be destroyed to the point where it breaks relatively easily. In fact, if the bone is damaged enough, fractures can happen even while doing something as simple as getting out of a chair or rolling over in bed. These fractures (called "pathological fractures" because they result from a weakness in the bone caused by a disease) can lead to pain, loss of blood, and loss of mobility. Most often, they happen in the long bones of the arms and legs, and the bones of the spine.

> ***I try to watch myself with lifting. I try not to lift heavy things. But I still do my own housework.*** *– Prostate cancer patient*

Bone surgery: Surgery can be performed if a bone has been weakened by metastasis and is at risk of fracture, or to treat a fracture caused by a bone metastasis. It can often quickly control the pain and help restore a person's mobility. During surgery, thin metal rods, pins, screws, nails, plates, or other devices may be used to strengthen the bone. It can also help prevent or treat spinal cord compression.

Spinal cord compression: Cancer in the bones of the spine—the "vertebrae"—can lead to pressure on the spinal cord. When this happens, it is called "spinal cord compression" and it is very serious. Pressure on the spinal cord can damage nerves that are responsible for different movements of the limbs. Without treatment, spinal cord compression can lead to paralysis (a loss of the ability to move certain parts of the body). Although it usually affects the legs, a tumour pressing on the spinal cord in the neck can affect the arms. Spinal cord compression, although a rare event, is an emergency and must be treated immediately to prevent permanent damage.

Symptoms: Numbness, pain in the back or neck, and difficulty walking (unsteadiness) are a few common symptoms you may experience.

Reducing the risk of bone fractures

When you have bone metastases from prostate cancer, it's especially important to protect your bones and try to keep them strong to help avoid pathologic fractures.

Fractures can be a serious problem. They may cause:

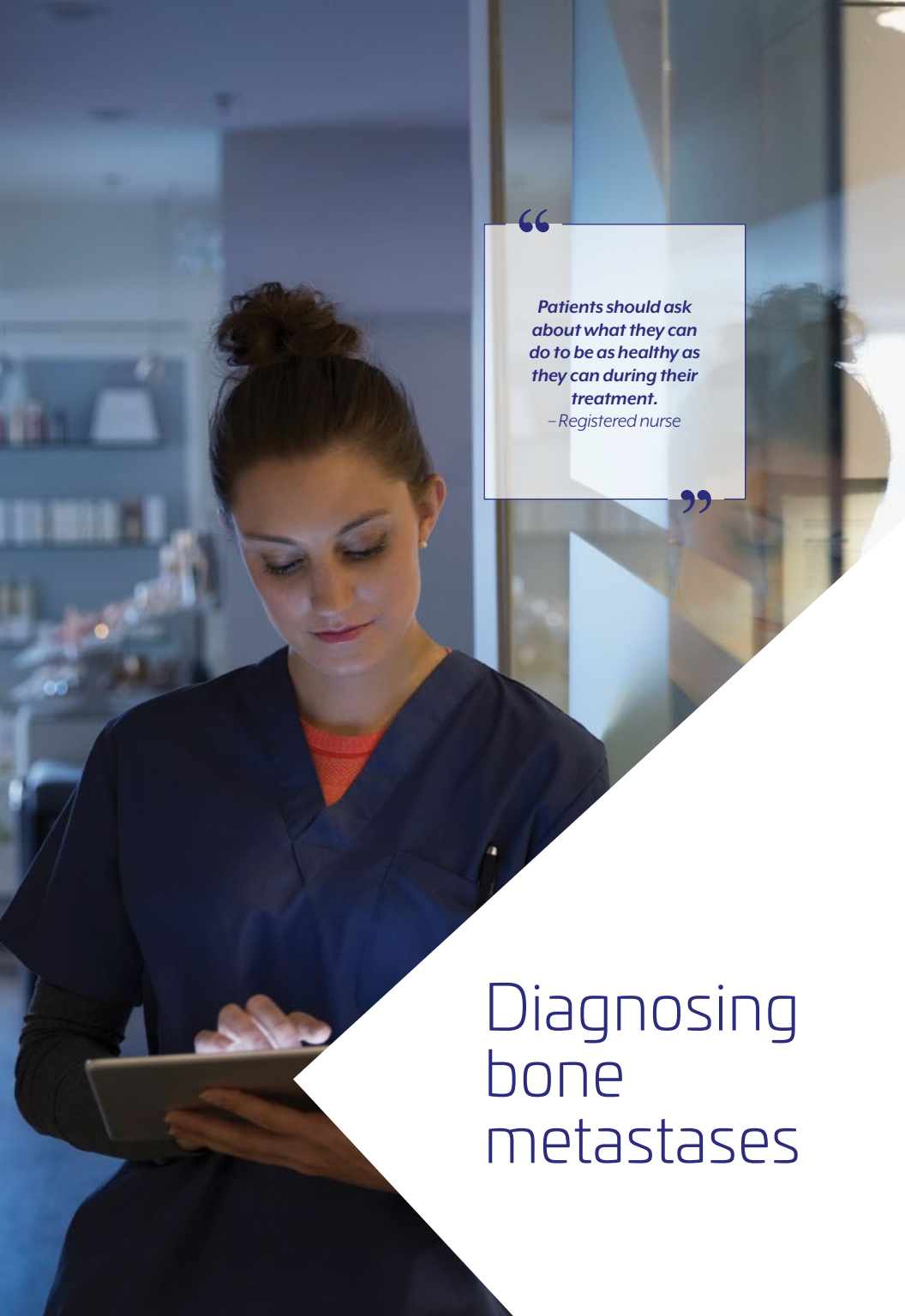
- Pain
- Loss of blood
- Loss of mobility

A fracture is one of the first signs of a bone metastasis. Therefore, it is important to take steps to keep your bones healthy. Be proactive.

> If you have prostate cancer, there is a risk that the cancer may spread to your bones. It's never too late to take steps to protect your bones.

This booklet is intended to offer you some tips and hopefully will encourage you to talk to your doctor or healthcare professional about how you can help protect your bones before, during, and after cancer treatment.

> *With metastatic disease, then there's risk of fractures — higher risk of fractures — so we need to tell patients to watch out for their activity, to stay healthy and active, but to avoid sports or avoid any activities where there's a risk of falling or hurting themselves; where there's risk of fracture.*
>
> *– Urologist*



> ***Patients should ask about what they can do to be as healthy as they can during their treatment.***
> *– Registered nurse*

Diagnosing bone metastases

If a **bone metastasis** is suspected, your healthcare team will conduct **tests to determine if it is present**. Tests (or "diagnostic tests") to check for bone metastases will usually be done if:

- You experience any symptoms of a bone metastasis;
- Your doctor suspects bone metastases (especially if your cancer is more likely to spread to the bones); or
- A routine test, such as an X-ray, suggests a problem with your bones.

These tests can be done before, during, and after cancer treatment.

Keep in mind that—because different tests give your doctor different information about your cancer and your bones—you may need to have **multiple tests**. This can help your doctor choose the best treatment plan for you. Some tests can also help determine **how your treatment is working**.

Your doctor may ask for different blood tests and imaging tests to diagnose and follow the bone disease. The most frequent radiological exams to determine the presence of a bone metastasis are X-rays, bone scans, and, sometimes, CT scans, PET scans, and MRIs. Sometimes a biopsy is done if the primary cancer, or where the cancer started, is not known. The following table gives you an overview of the various tests; each test is described in detail later on in this brochure.

Diagnostic tests—an overview

Test name	About the test
Blood chemistry tests (blood tests)	Blood tests measure the amount of chemical substances in your blood.
Blood test for calcium	This test measures the amount of calcium in your blood. High calcium levels can be a sign of bone metastases.
Blood test for alkaline phosphatase	This test measures the amount of the enzyme alkaline phosphatase in your blood. Levels of this enzyme may increase with bone metastases.
Blood test for tumour markers	Tests for tumour markers check the levels of certain markers in your blood that may be increased if cancer is present.
Urine test (N-telopeptide)	Increased N-telopeptide (NTX) levels in your urine may indicate the breakdown of bone.
Imaging tests	Imaging tests use different methods—such as X-rays, magnetic fields, or radioactive compounds—to establish a picture of the inside of your body.
X-ray	This imaging test uses a small amount of radiation to obtain pictures of your internal organs and structures. X-rays may show if cancer has spread to your bones and may also show bone fractures.
Bone density (DXA) scan	This imaging test measures your bone density using X-rays and computer technology. It can assess your risk of bone fractures.
Bone scan (skeletal scintigraphy)	This test uses nuclear radioactive materials to create an image of your skeleton, showing abnormal areas. It can help your doctor see if your cancer has spread to your bones, and can also be used to determine if your cancer treatment is working.

Test name	About the test
Positron-emission tomography (PET) scan	A PET scan uses a radioactive substance to create 3D colour images to see how your body's cells are working. It can be used to see how far the cancer has spread and find out if the cancer treatment is working.
Computed tomography (CT) scan	In a CT scan, a computer collects a series of X-ray images to create a detailed image of the organs, tissues, bones, and blood vessels in your body. CT scans can be used to diagnose cancer, find and measure tumours, or determine if your cancer treatment is working.
Magnetic resonance imaging (MRI)	An MRI scan uses powerful magnetic forces and radiofrequency waves to create a detailed picture of the organs, bones, and tissue inside your body. An MRI scan can be used to diagnose cancer and find tumours, and the results can be used to help plan cancer treatment.
Bone biopsy	For a bone biopsy, a small piece of tissue is taken from your bones and is examined under a microscope to look for cancer cells. A bone biopsy is sometimes done with a needle, but other times a doctor may need to surgically remove a small part of the tumour.

Blood chemistry tests

Blood chemistry tests measure the **levels of chemical substances** (such as sugars, fats, and other compounds) **in your blood**. Most of the time, the amounts of substances stay at normal levels in healthy people. However, changes in the "normal" levels of some substances in the blood can suggest disease. (For example, a high level of sugar in the blood could mean someone has diabetes.) In a similar way, some blood tests can help your doctor look for **bone metastases**.

There are many different types of blood chemistry tests. The main ones used to look for bone metastases measure:

- Calcium;
- Alkaline phosphatase; and
- Tumour markers.

Blood test for calcium

When cancer cells spread to your bones, the bone tissue is broken down and calcium from your bones is released into the bloodstream. This causes the **level of calcium** in your blood to **increase** (this is called "**hypercalcemia**"). When the level of calcium in the blood is higher than what's considered normal, this may mean changes to your bones (possibly bone metastases) have occurred.

Did you know...?

The normal blood calcium level for adults is **8.5–10.3 mg/dL**.

Blood test for alkaline phosphatase

Alkaline phosphatase (or "ALP") is an enzyme—a type of protein—found in all body tissues, but mostly in bones and in the liver. When bones are broken down due to metastasis, your **levels of alkaline phosphatase** may **increase**.

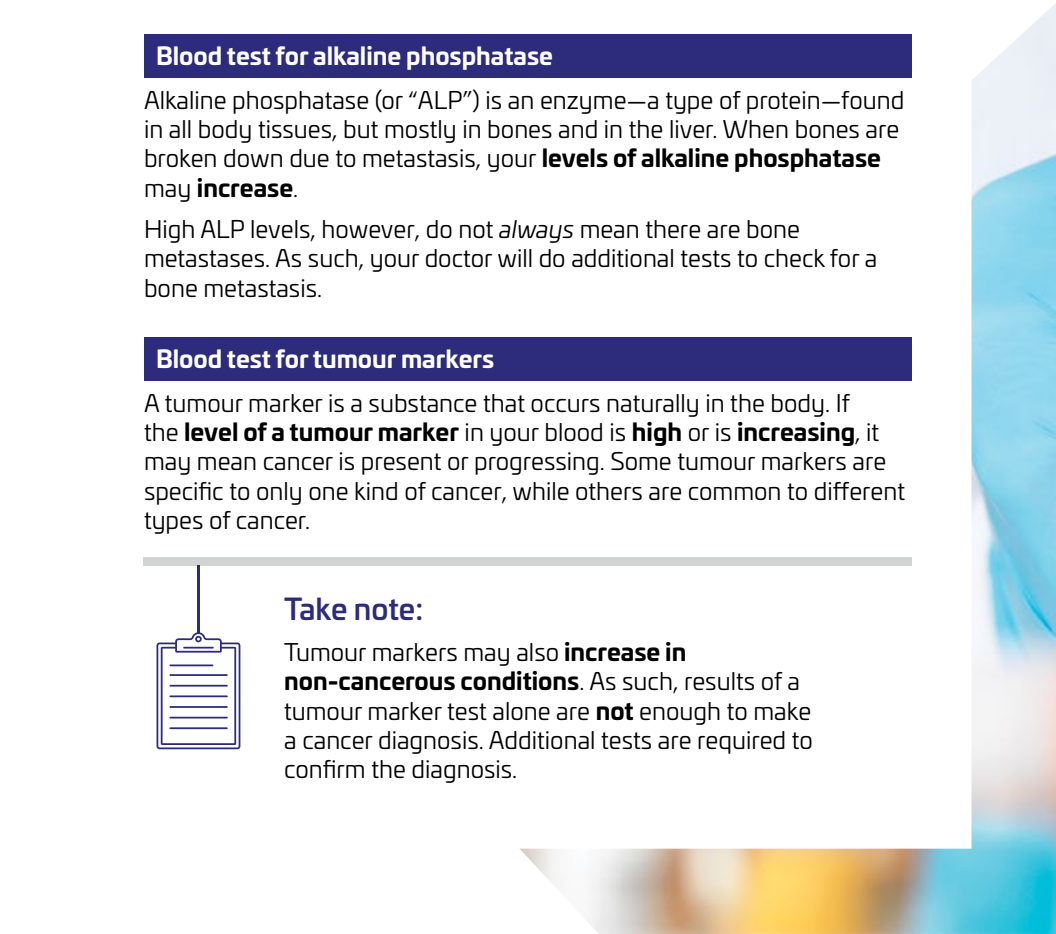
High ALP levels, however, do not *always* mean there are bone metastases. As such, your doctor will do additional tests to check for a bone metastasis.

Blood test for tumour markers

A tumour marker is a substance that occurs naturally in the body. If the **level of a tumour marker** in your blood is **high** or is **increasing**, it may mean cancer is present or progressing. Some tumour markers are specific to only one kind of cancer, while others are common to different types of cancer.

Take note:

Tumour markers may also **increase in non-cancerous conditions**. As such, results of a tumour marker test alone are **not** enough to make a cancer diagnosis. Additional tests are required to confirm the diagnosis.



Depending on the type of cancer you have, **you may have regular blood tests** to measure the level of tumour marker(s) in your blood.

An increase in the level of a tumour marker **may** mean the cancer is progressing or has spread; however, it does not necessarily mean the cancer has spread *to the bones*. Other tests would be needed to diagnose a bone metastasis.

Your levels of tumour markers can also **help your doctors guide your therapy**. For example, if the level of a tumour marker decreases or returns to normal, it may mean your cancer is responding to treatment. On the other hand, if there is no change or the level of a tumour marker increases, it may mean your cancer is not responding. For this reason, **your levels of tumour markers may be monitored periodically** during your therapy.

Urine tests

Some substances can be released into your urine when bone is damaged. One of these is a peptide—a small protein—called "**N-telopeptide**," usually shortened to "NTX." NTX is a product that is formed when a certain type of collagen is broken down. NTX may be used as a marker to detect the breakdown of bone. Higher levels of NTX indicate a higher amount of bone resorption.

This test is not routinely done, but it is worth knowing how it works in case your doctor decides to proceed with it.

In order for the NTX urine test to be performed, you may be asked to collect your urine over 24 hours. This is because the amount of NTX in urine differs over the course of a full day. Alternatively, you may be asked to collect a sample of urine from your second urination of the morning. Only a very small amount of urine—about 2 mL—is needed for the test.

Imaging tests

Different imaging tests will give your doctor different **information about your cancer and the health of your bones**. The results of different tests can also show **how your treatment is working**.

Imaging tests use different methods—such as X-rays, magnetic fields, or nuclear radioactive compounds—to establish a **picture of the inside of your body**. These tests can be helpful to see if cancer has spread to your bones, and/or if your cancer treatment is working. The results can help guide your doctor's recommendations when it comes to changes to your treatment.

X-ray

An X-ray is an imaging test that uses **small doses of radiation** to take **pictures of your internal organs and structures**. X-rays are often one of the first tests ordered if your doctor suspects cancer in your bones, or if you are having bone pain or other symptoms that may mean the cancer has spread to your bones. X-rays can **also show fractures**.

X-rays are usually done at a **clinic** or in the **hospital**. The test is relatively quick. It generally takes **10 to 15 minutes** and you don't usually need any special preparation.

So what can you expect when you go for an X-ray?

- First, you'll need to **remove any clothing, jewelry, or other objects** in the area of your body where the X-rays will be taken, as these items could interfere with the images.
- Depending on the area being studied, you may be asked to **lie on an X-ray table, or sit or stand in front of an X-ray machine**. The X-ray machine, which is like a big camera, is positioned over the area of your body to be imaged.
- While the images are being taken, the X-ray technician will ask you to **remain very still**, or perhaps hold your breath. He or she will take the images while standing behind a shield.
- You'll know the X-ray has been taken when you **hear a small beep or buzz**.
- You may be asked to **change positions** so X-rays can be taken from different angles.
- Finally, you will be able to leave once the technician has checked that the X-ray images are clear enough to be evaluated.

Did you know...?

An X-ray image is also sometimes called a "**radiograph**" or a "**radiogram**."

Bone density (DXA) scan

A bone density scan is an imaging test that **measures bone density using X-rays and computer technology**. This type of scan can be used to assess your risk of bone fractures.

In men with prostate cancer, a bone density scan may be recommended to check bone health before and after starting certain treatments.

Your **bone density test results** are reported using a measurement called a "T-score". Your T-score indicates how much higher or lower your bone density is compared to the bone density of a healthy 30-year-old person. The **lower your T-score (bone density)**, the **higher your risk of breaking a bone**:

> If your T-score is -1.0 or higher (for example, -0.7), your bone density is normal.

> If your T-score is lower than -1.0 (for example, -1.7), your bone density is low.

A DXA scan is usually done as an outpatient procedure (not requiring an overnight stay) in the X-ray (or "radiology") department of a **clinic** or **hospital**. The test takes **5 to 20 minutes**, depending on the number of body areas being scanned.

Although you can eat normally before the test, you should not take calcium supplements for 24 hours before the scan. You may be asked to wear clothing that has **no metal zippers, belts, or buttons**, or you may be asked to **change into a hospital gown** and remove anything that may interfere with the test, such as eye glasses or jewelry.

While the scan is being performed, you must **lie still on the table**. During the test, the **DXA scanner moves over the area of your body to be scanned** and uses low doses of X-rays to generate pictures on a computer screen. Scans are taken of the hip bones and lower spine and sometimes of the forearms. In some cases, the whole body is scanned by the DXA machine.

Take note:

Although the DXA scan uses X-rays, the amount of radiation you are exposed to during a DXA scan is very low (less than one-tenth the amount of radiation used in a chest X-ray) and poses no danger. Remember that your doctor expects the benefits of the DXA scan to outweigh any possible risks.

Nuclear bone scan (skeletal scintigraphy)

A bone scan using radioactive materials can help **show whether or not cancer has spread to your bones**. In this type of bone scan, a **small amount of low-level radioactive material is injected into a vein**.

The test uses a computer to generate an image of all the bones in your body (your skeleton) and looks to see if there are any abnormalities, such as metastasis or inflammation. This type of scan can sometimes **show bone metastases** that have not yet caused any symptoms. It can also be used to determine **whether or not your cancer treatment is working**.

Did you know...?

This type of bone scan is also called "skeletal (or bone) scintigraphy."

In a bone scintigraphy, the **radioactive material** (e.g., technetium 99m) **settles into areas of damaged bone** throughout your entire skeleton. These areas appear as "hot spots" on the images because they attract the radioactive material. Although hot spots may suggest the presence of cancer, they could be caused by other bone diseases. For this reason, other tests (such as regular X-rays, an MRI scan, or a bone biopsy) may be needed.

A bone scan is usually done as an outpatient procedure (not requiring an overnight stay) in the nuclear medicine department of a hospital. Usually, no special preparation for the test is needed. You may be asked to wear clothing that has **no metal zippers, belts, or buttons**, or you may be asked to **change into a hospital gown** and remove anything that may interfere with the test, such as eye glasses or jewelry.

A bone scan is completed in two stages:

1. You start by getting an **injection of the radioactive material** into a vein in your arm or hand. This usually takes about **15 minutes**.
   - You will be asked to return later (usually 2 to 4 hours after the injection) for the actual bone scan. This gives your bones time to absorb the radioactive material.
   - You may also be asked to drink at least two glasses of fluid after the injection (but before the scan), and to urinate as often as you need to, including just before the test is performed.
2. During the test itself, you must **lie very still on a table** while the scanner and camera move back and forth over your body. The scan takes about **30 to 60 minutes** to complete.
   - After the scan, the injected radioactive material quickly loses its radioactivity and passes out of your body in your urine or feces. (Drinking fluids after the test can help flush the radioactive material from your body.) This process may take a few hours or days, depending on the type of radioactive material used. For this reason, you may be given special precautions to follow after your scan regarding using the washroom, such as flushing the toilet twice and washing your hands thoroughly.

In general, the dose of radioactive material given for a bone scan is small and the **levels of radiation you are exposed to are low**. The potential benefits of the test outweigh the risks, and there are **no known long-term side effects** from exposure to such a low dose of radioactive material. However, some potential side effects that you may experience include bleeding, soreness, or swelling at the injection site. Although allergic reactions to the radioactive material sometimes occur, they are extremely rare.

Sometimes on bone scans, there is an increase in radioactivity at a metastatic lesion, which may look like a new or progressing metastasis. This is known as the "flare phenomenon." It happens soon after starting **systemic** hormonal therapy or chemotherapy. This increased radioactivity is due to "normal" bone activity at the metastatic location. It usually peaks by 3 months of therapy and subsides after 6 months.

Positron-emission tomography (PET) scan

A positron-emission tomography—or "PET"—scan is a **nuclear imaging test that uses a radioactive tracer to create images of your body**.

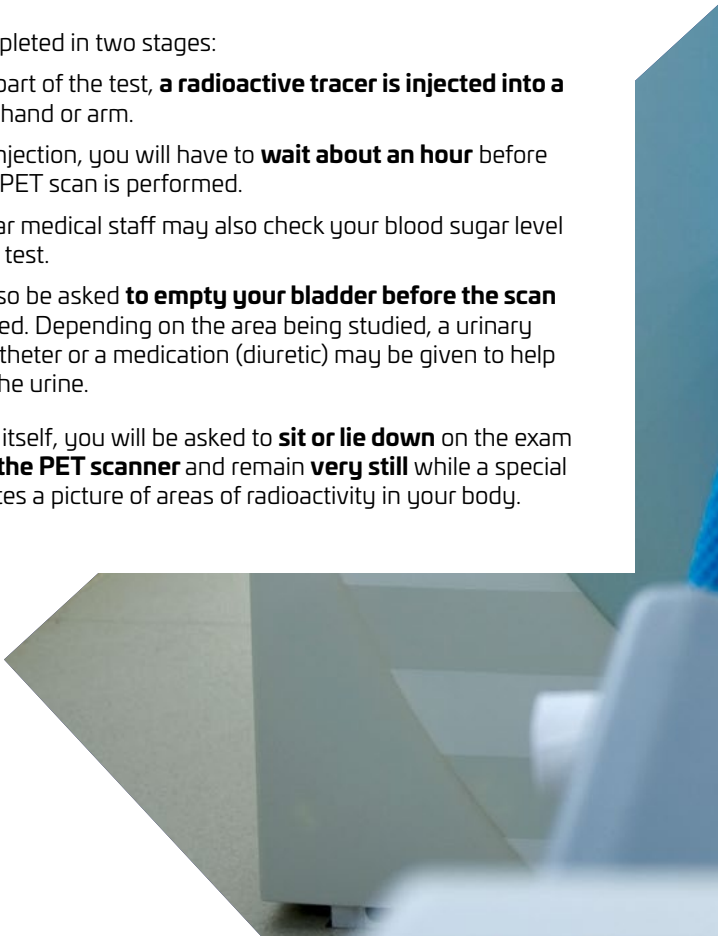
A PET scan is usually done as an outpatient procedure in the nuclear department of a hospital or specialized PET scan centre. The test takes **45 minutes to two hours** to complete, depending on whether a single organ or your whole body is scanned.

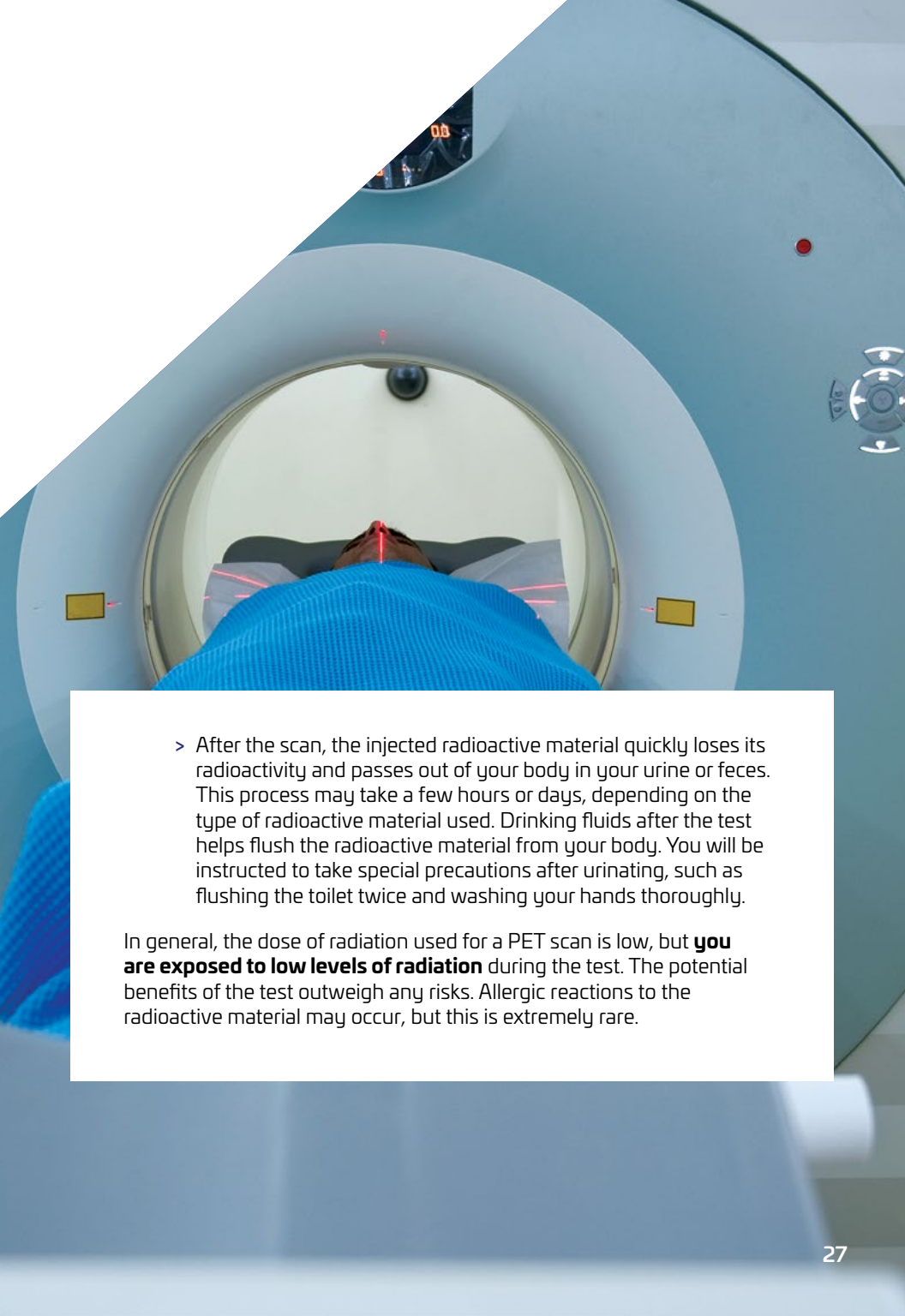
Be sure to dress in comfortable clothing with **no metal zippers, belts, or buttons**. You may have to **wear a hospital gown**, and remove anything that might interfere with the test, such as eye glasses or jewelry.

You may also be asked to avoid certain medications—your doctor will tell you which ones—as well as caffeine, tobacco, and alcohol before the test because these substances can affect the results.

A PET scan is completed in two stages:

1. For the first part of the test, **a radioactive tracer is injected into a vein** in your hand or arm.
   - > After the injection, you will have to **wait about an hour** before the actual PET scan is performed.
   - > The nuclear medical staff may also check your blood sugar level before the test.
   - > You will also be asked **to empty your bladder before the scan** is performed. Depending on the area being studied, a urinary bladder catheter or a medication (diuretic) may be given to help get rid of the urine.
2. For the scan itself, you will be asked to **sit or lie down** on the exam table **inside the PET scanner** and remain **very still** while a special camera creates a picture of areas of radioactivity in your body.





- After the scan, the injected radioactive material quickly loses its radioactivity and passes out of your body in your urine or feces. This process may take a few hours or days, depending on the type of radioactive material used. Drinking fluids after the test helps flush the radioactive material from your body. You will be instructed to take special precautions after urinating, such as flushing the toilet twice and washing your hands thoroughly.

In general, the dose of radiation used for a PET scan is low, but **you are exposed to low levels of radiation** during the test. The potential benefits of the test outweigh any risks. Allergic reactions to the radioactive material may occur, but this is extremely rare.

Computed tomography (CT) scan

A computed tomography (CT) scan is an **imaging test that uses a computer to collect a series of X-rays to create a detailed image** of organs, tissues, bones, and blood vessels in your body. Instead of taking one picture, as in a regular X-ray, the CT scanner rotates within the scanner and takes many pictures. It can be done on any part of the body.

A CT scan can be used to **diagnose cancer**, determine the **size and location of tumours**, determine the **stage** of cancer, or **guide doctors when they use needles** during certain procedures called "aspirations" or "biopsies." The results can also be used to **determine if the cancer treatment is working** or if the cancer has spread or returned following treatment.

CT scans are usually done as outpatient procedures (not requiring an overnight stay) in the radiology department of a **hospital** or in a **specialized CT centre**. These tests usually take **10 to 30 minutes**, but they may take longer depending on the size of the area being scanned.

Your healthcare professional will tell you whether any **special preparations** are needed before your scan. Preparation may include not eating or drinking anything for a certain number of hours before the test, taking a laxative, or having an **enema** (an injection of liquid into the anus, usually done to clean out the intestines). Some CT scans use a **contrast medium** to improve the clarity of organs and abnormalities, which may be given orally (by mouth), intravenously (injected into a vein), or by enema, depending on the part of the body being scanned.

Did you know...?

Before a CT scan, you will be asked to **remove all metal objects** (including eye glasses, braces, or jewelry).

So what can you expect when you go for a CT scan?

- During the scan, you must **lie down on a narrow table**. Straps and pillows may be used to help you stay in the correct position and remain still during the scan.
- The table you are lying on **glides into the CT scanner**, which looks like a large rectangular unit with a hole in its centre (like a doughnut). Some people feel a bit confined when they are in the scanner.
- While you are in the scanner, the **camera moves around inside the scanner** and takes many cross-sectional pictures, also called "image slices." You may hear clicking or whirring noises as the scanner takes images.
- A **computer will assemble the image slices together to generate a 3D picture** of your body.

CT scans use low levels of ionizing radiation. Ionizing radiation is strong enough to damage cells in our bodies and increase the chance of developing cancer. But the risk associated with any one scan is small. CT scans and other X-rays are strictly monitored and controlled to make sure they use the least possible amount of radiation. The benefits of having a CT scan outweigh the risk of exposure to the small amount of radiation received during the scan. On rare occasions, the contrast medium may cause an allergic reaction.

Magnetic resonance imaging (MRI) scan

A magnetic resonance imaging (MRI) scan is an **imaging test that uses powerful magnetic forces and radiofrequency (RF) waves to build detailed images** of organs, tissues, and bones inside your body. An MRI can help **find tumours** in various parts of the body, including the bones. It can also be used to help **plan cancer treatment**.

Take note:

If you have a metal device inside your body—like an implant such as a cochlear (ear) implant, clips used for brain aneurysms, coils placed in blood vessels, or nearly any type of heart defibrillator or pacemaker—you cannot have an MRI because the magnet is strong enough to damage or dislodge these devices. In most cases, though, an MRI scan is safe for people who have had joint replacements, artificial heart valves, implanted ports for drugs, implanted nerve stimulators, or metal pins, screws, plates, stents, or staples. Tooth fillings and braces are not often affected by the magnetic field, but they may distort images of the face or brain. Be sure to speak to the radiation technologist if you have any concerns about undergoing an MRI.

Results of an MRI scan can show a change in the shape, size, or structure of tissues or organs. These scans can show when there's a mass (or "lesion"), although an MRI cannot always tell the difference between a cancerous and non-cancerous tumour. When there's a tumour, the MRI can tell its approximate shape, size, and location. An MRI scan can also detect **metastasis** and a tumour's **response to treatment**—for example, if the tumour has gotten smaller, stayed the same, or grown after treatment.

An MRI is usually done as an outpatient procedure (not requiring an overnight stay) at a **hospital** or at a **specialized MRI centre**. The test takes **up to 2 hours**, depending on the area of your body being scanned.

Be sure to dress in comfortable clothing with **no metal snaps or zippers**, and remove anything that may interfere with the test, such as metal jewelry and objects with a magnetic strip, like credit cards. You may have to **wear a hospital gown**, depending on which part of your body will be scanned by the MRI.

Some MRI scans need to use a **contrast medium**, a substance introduced into your body to produce clearer images of your body's internal structures. If a contrast medium is used, it is usually **injected into a vein in your hand or arm**.

Did you know...?

An MRI scan is an expensive test that is in very high demand, so be sure not to miss your appointment!

So, what can you expect when you go for an MRI?

- During the MRI, you must **lie on a movable exam table**. Straps and pillows may be used to help you remain in the correct position and hold still during the scan. For an MRI of the head, a device is positioned around the head to hold it in place. Devices that contain coils may be placed around or near the area to be scanned to help improve the quality of the images.
- The **table slides into a narrow cylinder** that contains the MRI scanning magnet. The inside of the scanner is well lit and has a fan that gently blows fresh air. The part of your body to be scanned will be positioned in the centre of the cylinder. The surface of the cylinder may be just a few inches from your face.
- You must **remain very still** during the scan and may be asked to hold your breath at times. The MRI team may offer ear plugs or ear phones so you can listen to music during the scan.

An MRI does not use any ionizing radiation and has **no known harmful effects**. Some people may have a mild reaction to the contrast medium. They may experience nausea, pain at the injection site, taste of metal, or a headache. There are also risks associated with sedation or general anesthetic. Your doctor will discuss these with you if you require either of these procedures for your MRI.

^{18}F-NaF PET/CT

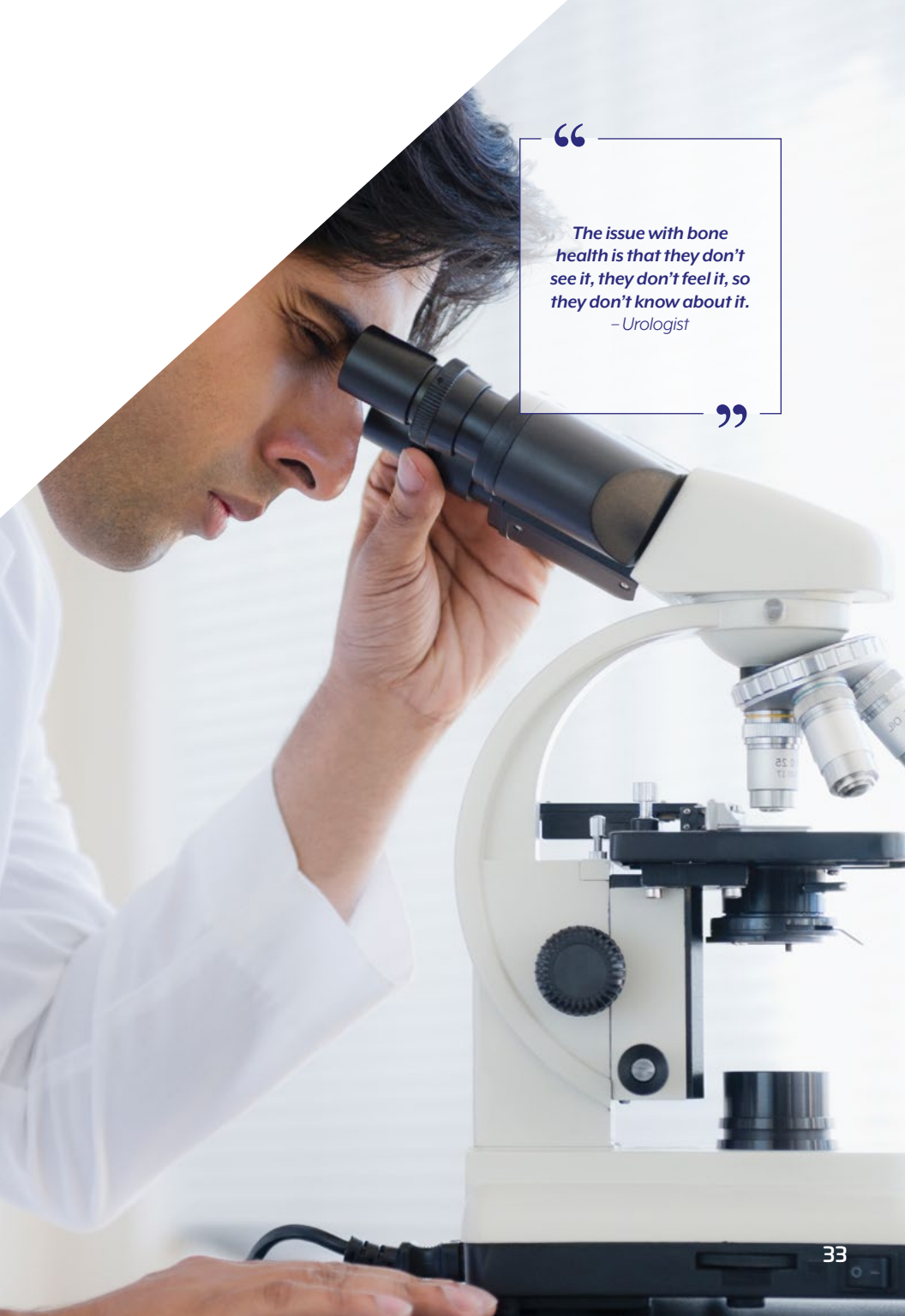
A test called "^{18}F-NaF PET/CT" is a technique for evaluating metastatic bone cancer. ^{18}F sodium fluoride is a **radioactive agent with superior sensitivity**, when compared to technetium 99m used for bone scintigraphy. It gives very clear images to help detect bone metastases, especially when other imaging tests are not conclusive.

Prostate-specific membrane antigen PET

This technique is a **special type of PET scan** that uses radioactive agents, usually either "gallium 68" (or "^{68}Ga") or "fluoride" (or "^{18}F-NaF), coupled with a protein that can target prostate cancer cells called prostate-specific membrane antigen (or "PSMA"). PSMA is found on the surface of prostate cancer cells at all tumour stages. This means the scan can reveal small and distant metastases, even at early stages.

Bone biopsy

In most cases, cancer is diagnosed **by removing a piece of tissue from the body and examining it under a microscope**. This is called a biopsy. When you have prostate cancer, your doctor may be able to tell if you have a bone metastasis by looking at the results of any imaging tests you have had. Furthermore, your doctor might want to confirm that the abnormal bone area is cancer by ordering a biopsy.



> ***The issue with bone health is that they don't see it, they don't feel it, so they don't know about it.***
> *– Urologist*

Maintaining bone strength

> ***We're on a team, and I'm the guy that's carrying the ball, unfortunately—but I'm not alone in it.***
> *– Prostate cancer patient*

> ***Prostate cancer weakens the bones, so it is really important that patients work hard at keeping them healthy.***
> *– Registered nurse*

In this section, you will learn how you can take action to keep your bones as healthy and strong as possible and get information on the treatment options.

Stay active

Weight-bearing activities, such as yoga or walking, are not only low-impact exercise, but they also contribute to balance and coordination, which helps prevent falls.

Ask your healthcare professional which activities are appropriate for you in order to keep active and keep your bones strong.

Therapeutic options

In addition to the cancer treatment, a bone medication may sometimes be given to patients with bone metastases. These drugs (such as denosumab or zoledronic acid) may be prescribed as soon as bone metastases are confirmed, whether pain or other symptoms are present or not.

Frequently asked questions

What treatment options do I have for relieving bone pain or other symptoms?

There are many ways to treat pain caused by cancer that has spread to the bones. Pain medicines are often very helpful. Treating the cancer with chemotherapy or hormone therapy, can also be helpful. If only one or a few areas are causing you pain, a local treatment, such as radiation therapy or ablation therapy, may provide relief. If the pain is caused by a fracture, treating the broken bone with surgery can help.

What kind of exercise is best for my bones?

Being physically active maintains optimal bone health and decreases the risk of a bone fracture by improving bone mass and increasing muscular strength, coordination, and balance, and thereby reducing falls. Physical activity that is weight bearing is best; examples include walking, dancing, stair climbing, aerobics, skating, and weight lifting. **If your doctor has told you your risk for fracture is high, you must talk to him/her before doing activities that involve running, skipping, or jumping, or before doing any other high-impact exercises.**

I understand that high calcium levels (hypercalcemia) can be a sign of bone metastases. What are the symptoms of hypercalcemia?

Early symptoms of hypercalcemia—having too much calcium in the blood—include constipation, urinating very frequently, feeling sluggish or sleepy, feeling thirsty all the time, and drinking large amounts of fluids. Later signs and symptoms can include muscle weakness, muscle and joint aches, confusion, coma, and kidney failure.

I understand that spinal cord compression can be very serious. What symptoms should I be aware of?

Spinal cord compression occurs when cancer grows large enough to press against the spinal cord, causing the spinal cord to be squeezed (compressed). Symptoms can include back pain (with pain that may go down one or both legs), numbness of the legs or belly, leg weakness or trouble moving the legs, and incontinence (loss of control of your urine or stool) or problems urinating. **If you notice symptoms like these, call your doctor right away or go to the emergency department at your hospital.** If spinal cord compression is not treated right away, it can lead to lifelong paralysis (inability to walk or even move).

I have been diagnosed with bone metastases. How will my doctor decide what treatment is best for me and the health of my bones?

The treatment your doctor selects will depend on where the cancer first started (primary cancer), how many bones the cancer has spread to, your symptoms, any previous treatment, and your personal preferences.

Which bones can be affected by bone metastases?

Metastases can occur in any bone in the body. However, metastases occur most frequently in the bones near the centre of the body. The spine is the most common site of bone metastases. Other common sites are the hip bone (pelvis), upper leg bone (femur), upper arm bone (humerus), ribs, and skull.

What are the cancer-related risk factors for bone metastases?

A risk factor is anything that increases the probability of developing a disease. Simply having cancer is a risk factor for bone metastases. However, not all people with cancer will develop bone metastases. Although doctors cannot predict who will and who won't develop bone metastases, they know that certain kinds of cancer (including prostate cancer) are more likely to spread to the bones than others.

What are the signs and symptoms of bone metastases?

It is important to know that sometimes bone metastases cause no signs and symptoms. However, when they do, the main symptoms of bone metastases are pain, fractures, spinal cord compression, and high blood calcium levels. Although some of these symptoms can be caused by something other than the spread of cancer to the bones, it is very important for you to tell your doctor if you develop any of these symptoms. Finding and treating bone metastases early can help prevent problems later.

Bone pain is often the first symptom of bone metastases. At first, the pain may come and go. It also tends to be worse at night, and may be relieved by movement. Later, the pain can become constant and may be worse during activity.

Bone fractures are another symptom of bone metastases because bones weakened by cancer may break during everyday activities. These types of fractures cause sudden, severe pain and are often the first sign of bone metastases.

Spinal cord compression—when cancer growth in the bones of the spine puts pressure on the spinal cord—is a serious sign of bone metastases. One of the earliest symptoms of spinal cord compression is pain in the back or neck. Other symptoms include numbness and weakness in the area of the body below the tumour. **Spinal cord compression is an emergency that must be treated right away to prevent permanent damage to the spinal cord, which can lead to paralysis.**

High blood calcium levels are another sign of bone metastases. This is called "**hypercalcemia**" and it is caused by calcium being released from the bones into the bloodstream because of the cancer in the bones. Symptoms of hypercalcemia include constipation, nausea, loss of appetite, excess urination, extreme thirst, tiredness, and possibly confusion. If not treated, hypercalcemia can cause someone to go into a coma.

Additional resources

While this booklet has provided you with a lot of information about bone health and bone metastases, you may still have questions. Medical organizations regularly publish guidelines for people who are dealing with prostate cancer and metastases. The websites listed below can provide you with more information. If you can't find the answers you are looking for, be sure to ask your doctor.

- The **National Comprehensive Cancer Network (NCCN)** has published a number of guides for people with prostate cancer. You can access the information at www.nccn.org/patients/guidelines/cancers.aspx#prostate.
- The **European Society for Medical Oncology (ESMO)** has also published a guide for men with prostate cancer. It is available at www.esmo.org/Patients/Patient-Guides/Prostate-Cancer.
- If you are looking for more information on bone health, you might want to visit the website of **Osteoporosis Canada** at www.osteoporosis.ca or the **National Osteoporosis Foundation** at nof.org.

Other websites that can offer helpful information on bone health and prostate cancer include:

- **Canadian Cancer Society:** www.cancer.ca
- **American Cancer Society:** www.cancer.org
- **Urology Care Foundation:** www.urologyhealth.org
- **Prostate Cancer Canada:** www.prostatecancer.ca

Glossary

- **Blastic lesion** – another name for an **osteoblastic lesion** (see below)
- **Enema** – the injection of liquid into the intestine by way of the anus, usually to clean out the intestines or for examination
- **Hypercalcemia** – high blood calcium levels
- **Lytic lesion** – another name for an **osteolytic lesion** (see below)
- **N-telopeptide** – a peptide (small protein) that is released into the urine when there is increased bone breakdown (resorption)
- **Osteoblast** – a type of bone-forming cell
- **Osteoblastic lesion** – a hardened area of bone that develops when new bone is laid down without old bone being broken down
- **Osteoclast** – a type of bone cell responsible for bone breakdown (resorption)
- **Osteolytic lesion** – a hole that develops in bones when parts of the bone are dissolved
- **Primary tumour** – the site where the cancer started
- **PSA doubling time** – the time it takes the PSA (prostate-specific antigen) to double
- **Radiogram** – another word for an X-ray
- **Radiograph** – another word for an X-ray
- **Sclerosis** – a condition of hardened bone that develops when new bone is laid down without the old bone being broken down first
- **Systemic** – pertaining to the whole body; it usually refers to treatments that affect the whole body instead of just a local site

Notes

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