**Bone Pain Palliation Therapy**

**What is Bone Pain Palliation Therapy?**

A bone-seeking radioactive substance is injected intravenously and immediately starts targeting sites of increased bone turnover – areas where bone is resorbed and deposited as part of the normal response to various processes in the body. In some cancers that start in bones or spread to bones, the accompanying inflammation or penetration of the cancer itself to the adjoining bone sheaths (or periosteum), which has very high nerve supply, causes an immense amount of pain, which is often debilitating and requires high doses of pain killers that limit your functionality.

These bone seeking beta-emitter radioactive substances will attach to these areas of increased bone turnover i.e. at the cancer site and over a few millimetres only emit enough radiation to damage these nerve endings to permanently or temporarily relieve the pain associated with these bone cancers.

**It is known to be effective in:**

- Primary bone cancers i.e. cancers that start in the bones
- Metastatic bone cancer i.e. cancer that spread to bone from elsewhere

Any bone-seeking radioactive material that is not absorbed by bony turnover sites passes out of your body primarily in the urine, while the remainder decays over time in the body. The bone-seeking agent is effectively trapped in the site of increased bone turnover and primarily has its effect on the adjacent nerve endings of the periosteum. Some targeting of the tumour causing the increased bone turnover may also occur, although this is of secondary importance since these agents are not indicated for treating the tumours themselves i.e. the distance over which they act is too small to effectively kill the tumours.

**Investigations that will be needed for the treatment:**

You need a scan before the treatment known as bone scan to see whether these bone seeking agents will indeed accumulate at the sites of increased bone turnover. Some bone malignancies do not demonstrate increased accumulation at the cancer sites. In these cases, you will not benefit from bone pain palliation therapy.

You will need tests which your doctor will arrange for you, as follows:

- A diphosphonate scintigraphic bone scan
- Blood tests to assess bone marrow reserve

**Is there any preparation before the treatment?**

It may be necessary to stop any bisphosphonate therapy (also used to treat bone pain and osteoporosis) if the bone scan doesn’t demonstrate suitable uptake of the bisphosphonate agent. These drugs may interfere with uptake of the treating bone-seeking agent.

**How is bone-seeking treatment given?**

The radioactive beta-emitting bone-seeking agent is simply infused via intravenous catheter. The line is then flushed to prevent leakage of the material into the surrounding tissue and removed. A plaster or dressing is then applied.

**What happens after the procedure?**

This procedure can be performed as an outpatient.

Patients will be required to remain in the nuclear medicine department or treatment facility for 4-6 hours after administration of the agent.

The patient is required to drink plenty of fluids after the procedure to increase urinary excretion of any excess bone-seeking agent.

Depending on the agent used, you will be required to follow-up for blood tests to assess for bone marrow toxicity at 6-12 weeks after the procedure. Bone-seeking agents by virtue of the proximity to
the bone marrow can cause damage to the blood-forming cells in the bone marrow.

Some of these agents also emit what is known as a gamma-ray, which can be imaged. If this is the case, the nuclear physician may wish to perform a scan of the whole body to confirm that the bone-seeking agent has indeed been taken up by the sites of increased bone turnover.

Will there be any danger to my family or friends?

You will usually be discharged after 4-6 hours because this type of treatment delivers its radiation within your body and only very small amounts exits your body. As a precaution, during the treatment no visitors are allowed. Following discharge your family and friends are not at risk, but we recommend some sensible precautions:

- Wash your clothes separately from your family’s
- Use separate eating utensils, cutlery etc.
- Refrain from all contact with young children and pregnant women for 3 days
- Restrict close contact with other adults for 3 days (this includes hugging and kissing)
- Avoid sharing a bed with another person for 3 days (this includes sexual intercourse)
- Wash your hands with soap and plenty of water each time you use the toilet.
- You must have at least 1 shower a day.
- Rinse the shower out after using
- Keep the toilet and surrounding area very clean.
- Men should urinate sitting down to avoid splashing.
- Flush the toilet 3 times with the lid closed after each use.
- Rinse the bathroom sink and tub thoroughly after using.
- Use a separate toothbrush than your family
- After brushing your teeth, spit into the toilet then flush the toilet 2 times.
- Do not chew gum.

On the day of treatment you will be given specific advice according to your individual circumstances as the advice depends on the amount of treatment your doctor prescribes.

Can I have treatment if I am pregnant or breast-feeding?

No. Women who are pregnant or breast-feeding must not be given treatment. Bone palliation radiation therapy is radioactive and is not given if you are pregnant. If there are any concerns about pregnancy, a pregnancy test will be done. Reliable birth control should be used until treatment has finished and for at least 6 months afterward. Men are advised not to father a child for the same period. If you are breast-feeding, you should tell your doctor so you can discuss stopping this before you have therapy.

How many treatments will I need?

Usually 1-2 treatments can be given, the frequency of which depends on the half-life of the bone-seeking agent administered, the life expectancy of the patient, the required onset of action and the bone marrow reserve. These will be discussed with you by your doctor as each patient’s case is unique and needs to be individualized. The subsequent treatments will depend upon the effect therapy had on your blood cells especially of the bone marrow.

Subsequent clinic assessment (including bloods and scan) are required 2 weeks prior to next treatment cycle.

Are there any side effects?

The most reported side effect is bone marrow suppression but even this side-effect is uncommon on not severe in most case.

Other reported side effects are:

- Temporary reduction in your blood count and white cells
- A transient increase in pain as the radiation itself cause increased inflammation prior to nerve ending destruction
- A flushing like sensation as a result of the release of high amounts of bony calcium
- Spinal cord compression with neurological fallout if spinal metastases or tumours are
What else is important?

The response to therapy may be delayed between 2-4 weeks. Additional pain medication may be prescribed during this period until the pain-relieving effects occur.

Depending on the bone-seeking agent used, the pain-relieving effects may last between 2-6 months. Therapy, however, can be repeated after 8 weeks depending on the aforementioned considerations.

Who is excluded from this therapy?

Absolute contraindications:

- Breast feeding
- Pregnancy

Relative contraindications*:

- Haemoglobin levels < 9 × 10⁹ g/l
- Platelets < 100 × 10⁹/l
- White cell count < 3.5 × 10⁹/l
- Super scan (widespread bony cancer spread on imaging) with abnormal blood work
- Poor renal function (which limits clearance of excess agent)
- Life expectancy < 4 weeks (for Sr-89, Sm-153 leidronam, Re-186etidronate)

* Lower levels can be considered at the discretion of the doctor providing certain criteria are met. These will be discussed with you by you Nuclear Physician.

What are the radiation risks involved?

Nuclear medicine procedures are very safe. Your doctor should have discussed the treatment you are having with you and will have considered the benefits of having or not having the therapy, before sending us your referral form. However, if you have any questions at all, please do not hesitate to ask us.

Every day we live with all types of risk; this could be from travelling by road, rail or air, smoking a cigarette or using an electrical appliance. There is even a risk from background radiation depending on where we live.

Risks from radiation

There is a 1 in 10,000 chance of dying from a road traffic accident and this is considered very rare. Exposure to any type of radiation increases the risk of getting cancer. This includes naturally occurring radiation. Radiation dose (an amount of radiation) is measured in ‘millisieverts’ (usually abbreviated to ‘mSv’) and we naturally receive between 1.5mSv and 7.5mSv from the sun and our surroundings, depending on where we live. This is known as the average level of annual background radiation.

Amount of radiation we can give in hospital tests is regulated by radiation protection authorities. We evaluate and test each radiation exposure and give the minimum amount to produce an effective test result. We give substantially less than our colleagues in the USA.

Your treatment

Nuclear medicine uses radioactivity to help diagnose and treat medical conditions. Risk for developing a cancer is relatively low, for example an average dose of 7.4 GBq (e.g. in treating thyroid cancer) has an approximate ‘effective dose’ of 20mSv which gives a predicted lifetime risk of developing a cancer by 1 in 1000. Now compare this to the lifetime risk for developing cancer on its own – 1 in 2.32. This would mean you have to do 430 odd treatments before you have the same random lifetime risk for developing a malignancy. The doses used in bone palliation treatment are lower than this. If you are concerned and/or your test is not identified, we will be happy to discuss this with you when you attend for your test and provide an exact value. Alternatively, see contact details on back page.

What damage can be expected if any?

As with all radiation, there is a theoretical risk of causing tissue damage. When this damage occurs in the DNA or chromosomes, the risk of a mutation in these regions is increased. Such mutations in a developing foetus can cause organ abnormalities or irreparable damage and if early enough with high enough radiation dose can even cause foetal death.

Similarly, DNA damage may also lead to mutations that can cause cells to divide unchallenged. This is how cancer develops. The risk again is minimal with
scans and only becomes a problem at increased activity associated with radiation treatment.

*For this reason, and for safety purposes, all female patient suspected of being pregnant or uncertain will be tested. For therapy patients, the benefit will be weighed against the risk and discussed with the patient.*

*Will I be a danger to my family?*

The activity involved in therapy is still reasonably low and simply by maintaining a distance of approximately one meter from your relative protects them. There is no need for specialized shielding. In fact, since Nuclear Medicine studies use high energy radiation, normally the radiation would simply pass straight through other parson without interacting with tissue. By wearing lead shields etc., you slow the beams down thus allowing it to deposit its energy into the body tissues which is not a desired effect. Finally, by limiting the time of exposure, your family members limit the likelihood that they will absorb any radiation. We recommend limiting time in close proximity to less than 2 minutes.

Even where a pregnant woman is exposed to gamma radiation, we have yet to see any effect to the foetus or the breast tissue. Theoretically it is possible. In practice it remains to be shown.