Nuclear medicine

Nuclear medicine is an important tool used today in diagnosing and curing disease.
Does this mean that we need more nuclear reactors and nuclear waste dumps?

What is nuclear medicine?

Nuclear medicine uses radioactive substances in both diagnosing and treating disease. Radioactive substances give off ionising radiation as they decay.

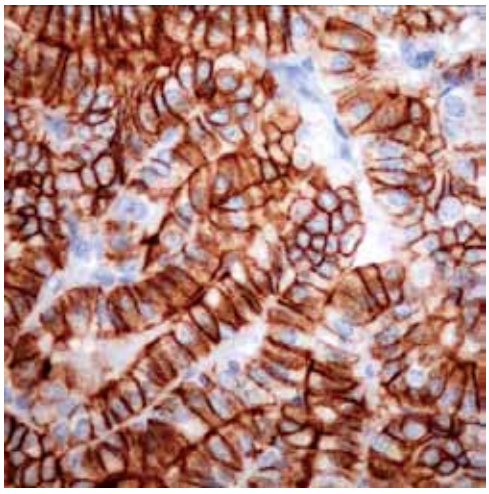
Looking for disease: nuclear scans

A radioactive substance is injected, swallowed or breathed in. It gives off radiation ("gamma rays") as it passes through or lodges in the body. These invisible rays can be tracked and used to produce images. Health workers then check these pictures to see whether the body is functioning normally, and to find lumps and tumours, including cancers. Scans are the main use of nuclear medicine.

Treating disease: radiotherapy

Radioactive substances can also be used to treat disease by producing radiation which stops cancers growing, and destroys cancer cells. It can be used to cure cancers or to ease a patient's suffering.

For example, thyroid cancers are treated by swallowing radioactive iodine.



Thyroid cancer cells

Another common therapy involves placing small pellets of a radioactive substance in the body, which gives off radiation that destroys cells, in particular cancer cells. For example pellets of cesium are used to treat prostate cancer.

Radiation risks

Ionising radiation can cause serious damage to our health by causing changes in our molecules – the small particles that humans, along with other living and non-living things, are made from. Ionising radiation can damage our own health, our children's health, and the health of future generations.

Very high doses of ionising radiation can result in death, organ failure, and make people infertile: for example, after nuclear bomb explosions and nuclear industry accidents.

Radiation can alter and damage the DNA – the instructions for building and mending our bodies. This damage can harm our health, and can be passed on to our children.

Cancer is the major hazard from smaller doses of ionising radiation, although it may not develop for many years. The risk is higher for children and young adults, and for women.

There is no "safe level" of radiation without a risk of cancer. Changes to our DNA can happen at any dose, although the risk is greater if the dose of radiation is higher.

Why use nuclear medicine?

Doctors perform tests - for diagnosis - using nuclear medicine assuming that the risk of disease is more serious than the possible harm to the patient.

Doctors also administer treatments using nuclear medicine because radiation damages cancer cells more than it harms normal cells.

The future of nuclear medicine

Scientists are seeking new methods of finding disease without using radioactive substances or nuclear reactors. Nuclear medicine materials do not have to be produced by reactors. Cyclotrons and linear accelerators are two alternative technologies. The Canadian government recently decided to move to these non-reactor methods. *See: www.triumf.ca/sites/default/files/isotopes-gc-re-eng.pdf*

Nuclear medicine

Radioactive medical waste

We do not need a national radioactive waste dump for medical waste. Radioactive waste is securely stored in hospitals.

Most states and territories each only have a few cubic metres of radioactive medical waste or less. Most is classified as low level waste.

Radioactive material from nuclear scans

These scans produce the vast bulk of medical nuclear waste. This is short-lived (it does not stay radioactive for long) and decays on the medical facilities' premises until has almost stopped giving off radiation. It then is safely disposed of, following set standards (for example through sewers, incineration or landfill).

Radioactive material from cancer therapy

Most radiotherapy nowdays uses X-rays or other electromagnetic radiation which do not produce any waste at all (see below). A very small proportion of cancer treatment uses radioactive materials. These end up as intermediate level waste but these treatments are being slowly phased out.

Does Australia need a nuclear reactor for medicine?

Australia has an OPAL type nuclear reactor at Lucas Heights in outer Sydney. Our previous nuclear reactor was built for nuclear research, and only later produced radioisotopes (the radioactive substances used in nuclear medicine). Governments have misleadingly promoted it as essential for modern medicine.

We do not need to produce radioisotopes in Australia. We imported all the radioactive materials needed for nuclear medicine after the old reactor was closed, while the OPAL reactor was still being built. The OPAL reactor was closed soon after it opened, to deal with technical faults. Once again between 2007 and 2010 we imported all our needs from South Africa and elsewhere.

We successfuly import all the machinery for modern imaging technology (nuclear medicine, CT and MRI scanners). Many nuclear medicine materials continue to be imported. So it is misleading to insist that we need to produce radioisotopes in Australia for fear of supply failures.

The Medical Association for Prevention of War believes that the world's nuclear medicine needs can and should be produced from a small number of tightly controlled reactors; and that safer alternatives should be a research priority.

X-RAYS and CT scans are NOT nuclear medicine

The first X-Ray:
William Roentgen made this image of his wife's hand and rings in 1896

X-rays are not classified as nuclear medicine because they are not produced from radioactive substances.

X-ray images, used to diagnose disease, are similar to photographs. A normal camera records light bouncing off the surface of objects into the camera. Because X-rays penetrate into softer objects (like bodies, or luggage), we can use them with a special camera to make pictures of the harder objects inside our bodies or our backpacks: lumps, bones, metal.

X-rays are also used in curing cancers, by focusing concentrated X-Rays on the cancer site.

X-rays are a type of ionising radiation. They can cause cancer although the risk from a single X-Ray involves is low. They are short-lived, and do not produce radioactive waste.

X-rays are produced using electricity. Fast-moving electrons are slowed down and hit a metal target, and X-Rays are produced. No radioactive waste is left.

CT scans, like X-Rays, are not classified as nuclear medicine.

CT scans use many X-Rays to create a 3-dimensional picture. They are a greater concern as the risk of cancer for the patient is greater for CT scans than for X-Rays. However they do not produce radioactive waste.

written by Nancy Atkin, with Dr Peter Karamoskos and Dr Bill Williams I July 2010 I

Medical Association for Prevention of War (Australia)
www.mapw.org.au