Why can't I choose to undergo whole-body CT?

The question that often gets posed is if a person is willing to pay for the procedure, then why can't they have it? In other words, they accept that there is no evidence for population-based screening, but as an individual they want the procedure and further, they will pay for it.

Any decision where benefit is being balanced against harm must be made from a complete knowledge of the issues, not from just "one side of the story". And in addition, regulatory means are sometimes employed to ensure a "safety net" for members of society.

What does this all mean for NZ?

In New Zealand the regulatory control over the use of x-rays in medical diagnosis is via the *Radiation Protection Act, Radiation Protection Regulations* and the *Code of safe practice for the use of x-rays in medical diagnosis, NRL C5*. The *Code* has as one of its corner-stone radiation protection principles that all x-ray examinations must be justified – there must be a net benefit to exposed persons that outweighs the risk associated with the radiation dose received.

Meeting the justification principle is every radiologist licensee's responsibility and ensuring that patients have appropriate referrals from medical practitioners is part of that responsibility. Self-referral for a whole-body CT scan would seem not to satisfy these requirements.

The Radiation Protection Advisory Council have been advised of the overseas trend of promoting whole body CT and will be considering the issue, in the New Zealand context, at their next meeting in November this year.

For further information contact John Le Heron (John_Le_Heron@nrl.moh.govt.nz).

The NRL Waste Store – changes in policy and practice

NRL has accepted unwanted sealed radioactive material from owners for a long time. Currently, for a fee, NRL conditions the material and places it in a secure and monitored store.

The current mode of operation of this store is unsustainable in the medium term, for the following reasons:

- The space NRL can dedicate to this purpose is limited.
- There is doubt about whether NRL would be allowed to build a dedicated store elsewhere.
- There has been increasing use of radioactive material in industry (resulting in increased material to be disposed of).
- The financial constraints under which NRL operates are not consistent with the acceptance of a long-term cost against a one-off payment.

NRL is changing both policy and practice in respect to the operation of the store.

The changes in policy are:

- Effective now, NRL has changed its pricing structure so there will no longer be a financial incentive to send material to NRL rather than any other disposal route, such as export.
- In the near future regulatory practice will change so that purchasers of sealed radioactive material must demonstrate consideration of disposal prior to approval of the sale.
- In the long term, only material for which there is no other disposal route will be accepted.

The changes in practice relate to NRL's need to ensure that sources sent to NRL are suitable for long term storage, can easily be removed from their current housing, and are not leaking. To this end, NRL now requires the following:

- An application form must be completed prior to NRL making an offer to accept the source.
- NRL must be provided with the result of a recent source leakage test (such as a wipe test).
- An acceptance that the current owner will be liable for all costs associated with any cleanup activity undertaken here should any source be found to be leaking upon its arrival at NRL.

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NRL
National Radiation Laboratory

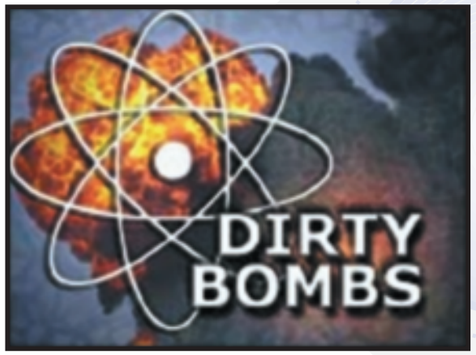
The Source

Issue 10
October 2002

Threat of nuclear terrorism underlines importance of security of radioactive sources

Fears that terrorists could steal a radioactive source, combine it with conventional explosives and detonate it in a crowded urban area have gained ground since the US government claimed to have foiled a so-called "dirty bomb plot" in June. The International Atomic Energy Agency (IAEA) has recently reported that there are 'millions' of radiation sources world-wide that terrorists could utilise to produce these dirty bombs.

A number of expert groups have pointed out that the intent of such terrorist action would be to create 'mass disruption rather than mass destruction'. There seems little doubt that such an attack would cause mass pandemonium, and even if actual health risks associated with dispersed radioactive materials might be slight, public concerns would be unlikely to recognise this as fact. Furthermore, any clean up of contaminated areas would be slow and difficult, especially as material could be dispersed over a large area.



The IAEA has reported that the numbers of sources lost in Eastern Europe since the break-up of the former Soviet Union is likely to be 'several thousand' while over 1,500 sources of all types have been lost by US companies since 1996. Of these, fewer than half have been recovered. The IAEA further reports that there have been over 260 detected attempts to smuggle radioactive sources across European borders since 1993.

As a result of these significant concerns, the IAEA has urged member states (which include New Zealand) to increase efforts to minimise risks associated with theft or loss of sources within their jurisdictions. In particular, the IAEA has identified that accountancy and control mechanisms, and physical security should be of primary concern.

Based upon our current records, the NRL has identified over 2,000 sealed sources presently in use or storage within New Zealand. While many of these are of low activity it is the view of the IAEA, and shared by the NRL, that almost any source exploded as part of a dirty bomb would cause public disruption. Owners of sources must recognise this situation and accept that they have special responsibilities regarding security, in addition to safe use.

Sources that may be taken into the community, especially within vehicles, pose a special risk. Theft of sources from vehicles has happened in New Zealand and owners of such sources are especially directed to minimise the likelihood of such occurrences through prudent security measures.

The NRL is presently redesigning registration forms so as to better identify and record individual sources and source housings. Licensees are urged to take the time to complete registration details in full so that both establishments and the NRL have full and accurate records of sources that presently exist.

For further information contact Jim Turnbull (Jim_Turnbull@nrl.moh.govt.nz).

Dental drill: collimation, collimation, collimation

When it comes to x-raying patients, the radiation protection equivalent of real estate's "location, location, location" is "collimation, collimation, collimation". So why is restricting the x-ray beam to just the region of interest so important?

First, the larger the volume of tissue irradiated the larger the effective dose to the patient. In particular, a larger than necessary beam may include particularly radiosensitive organs or tissues (such as the thyroid in the case of dental x-rays), whereas tight collimation would have excluded such organs.

Second, the larger the volume of tissue irradiated the more scatter that is produced. Some of this increased scatter will reach the film or image receptor, leading to decreased image contrast. Furthermore, the increased scatter means that occupational doses will also increase, all other factors being equal.

To put it into the positive, restricting the x-ray beam to just the region of the body that needs to be imaged results in better image quality, lower patient doses and lower occupational dose – ie, collimation is a winner in all cases!

Collimation in dental x-rays

With medical x-ray machines the size of the x-ray beam is varied to suit the task by means of an adjustable light beam diaphragm. However, with dental x-ray machines the beam size is generally fixed. For intra-oral dental machines the *Code of safe practice for the use of x-rays in dentistry, NRL C7*, requires that the x-ray beam at the tip of the positioning device has a diameter that does not exceed 60 mm.

The diagram illustrates relative x-ray beam areas for 3 situations: the positioning device is placed 20 mm from the patient's skin (red area and inwards); the positioning device is placed against the patient's skin (yellow area and inwards); and rectangular collimation is used (blue area and inwards). The relative patient effective doses would be approximately 120%, 100% and 50% respectively. Thus the dose saving with rectangular collimation is significant.

For intra-oral x-ray units, the circular collimation is achieved primarily by a lead washer located in the x-ray tube port, where the dimensions of the circular aperture in the washer are such that the beam does not exceed the 60 mm diameter at the end of the positioning device. If this washer is missing for some reason, clearly the x-ray beam will be larger – by how much will depend on the construction of the particular x-ray tube and housing. An example where this has occurred resulted in a beam area about 6 times greater than it should have been, and led to patient effective doses about 10 times larger than necessary.

To summarise, tight collimation results in lower patient doses, lower occupational doses and improved image quality compared with poor collimation. Dentists have to ensure their x-ray units meet the base mandatory requirements in the *Code* for collimation. They are also encouraged to use rectangular collimation for intra-oral radiography, to further limit the x-ray beam dimensions.

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Whole-body CT screening

Readers may be aware that recently in the USA and in Australia there has been considerable promotion in some quarters for the use of whole-body CT examinations for screening asymptomatic self-referred persons. Is whole-body CT simply a means of extracting money from the "worried well", or does it have a place in the modern medical arsenal for preventive medicine? What are the pros and cons, and what are the regulatory controls, if any, applicable to such use in New Zealand?

What is whole-body CT?

What are meant by the various terms "whole-body CT", "whole body scanning", "total body scanning" or "full body scans"? Each refers to the CT scanning of most of the body (head to groin) of a self-referred patient in the absence of any symptoms. The procedure results in the patient being exposed to a significant amount of radiation – the actual effective dose will depend on the protocol and CT scanner used, but is likely to be in the range 1 to 20 mSv. On the imaging side, the procedure generates a very large amount of image data which may be viewed in cross section or in 3-dimensions.

What do proponents of the technique claim?

The positive claims for the technique are that a "clear" whole body scan gives the patient "peace of mind", and that if there are abnormalities detected then early detection means early intervention and improved outcome. But are these claims true?

The likelihood of a false negative outcome for whole-body screening (ie, missed disease) is arguably greater than for a referred CT scan, for two reasons. First the radiologist reading the screening images has no clinical guidance of what to look for in an apparently normal, healthy individual. And second, this is compounded by the need to search through a larger image data set than would be typical for a symptom-driven CT scan. Hence the peace of mind may not be as well founded as claimed.

The second positive claim is hotly debated in the medical literature. There is little argument about the capability of CT to provide early detection. But what is open to question is whether early detection does actually influence medical outcome. The proponents of whole-body screening tend to provide anecdote-based arguments – putting forward those cases where disease was found and the benefits to those individuals. This is countered by arguments based on looking at the screened population as a whole – where the claims are that there is no scientific evidence to date showing a net benefit for the screened population, where the prevalence of actual life-threatening disease is low.

What are the negative aspects of whole-body CT screening?

If the procedure results in suspicious findings then these will fall into 3 categories – real life-threatening disease, insignificant abnormalities, or false positives. Follow-up tests, which may range from simple non-invasive tests through to high-risk procedures, will be required to clarify the findings. Because the likelihood of false positives is higher for whole-body screening being performed on symptom-less patients and because the prevalence of benign abnormalities is not uncommon, a significant number of medical interventions (with their own attendant risks) will occur unnecessarily.

As mentioned above, the patient undergoing whole-body CT will receive a radiation dose that will increase that patient's risk of radiation-induced cancer by a small amount.

And on a more technical note, the factors and technique used to perform whole-body CT may not be the optimum for disease detection in the various parts of the body scanned – for example, contrast media are not used. This further increases the chances of the false negative findings discussed above.

Statements from professional bodies and other agencies

Given the above background information it is not surprising that relevant professional bodies have issued statements. The Royal Australian and New Zealand College of Radiologists issued a media release in June 2002 warning consumers about the widely advertised scans. Part of that release stated "The issue here is not the money. It's whether on balance you'll gain more benefit than harm. It will always be possible to trot out someone who has had a cancer found early and removed as a result of a whole body scan. That's wonderful for that individual but hides the statistics about people who may have had unnecessary tests and had complications or who have been mistakenly reassured."

The American College of Radiology has also issued a statement that it does not believe there is sufficient scientific evidence to justify recommending total body CT screening for patients with no symptoms or a family history suggesting disease.

The US Food and Drug Administration has posted considerable information on whole body scanning on its website (http://www.fda.gov/cdrh/ct/), but the essential message is that "at this time the FDA knows of no data demonstrating that whole-body CT screening is effective in detecting any particular disease early enough for the disease to be managed, treated, or cured and advantageously spare a person at least some of the detriment associated with a serious illness or premature death".