Safe handling of radio-isotopes

H. E. A. FARRAN

Northwick Park Hospital, Harrow

In order to administer radioactive isotopes to humans it is necessary to acquire two pieces of paper. The first, which is essential, is a licence to store and dispose of radio-isotopes which is issued by the Department of the Environment. The second, which is advisable, is the authority of the M.R.C. Advisory Panel on the Use of Radioactive Isotopes in Humans.

The M.R.C. authorization is issued by a panel who will have consulted with experts in the particular field under consideration. They are primarily concerned with the possibility of risk to the patient, but they will also consider the possible consequences to other patients and to staff. Our authorization for putting ^{90}Y into knees confines us to non-pregnant subjects over 45 years of age. The ultimate hazards of radiation are still not completely clear, but there is a certain amount of evidence that the risk of inducing malignancy, including leukaemia, by radiation seems to be greater in the young—also of course they have a longer expectation of life in which to develop late effects. The possibility of somatic damage during pregnancy is equally one which should be avoided.

The insertion of a β -emitting isotope in the form of a colloid into a joint should not constitute a hazard for other patients, or apart from the actual injection, for staff. The main risk with β -emission is that of getting it on the skin with consequent radiation to the skin and the possibility of ingestion either orally or by way of cuts or scratches. To obviate this risk all manipulations are routinely carried out wearing surgical gloves and nothing is touched with the bare hands.

The Department of the Environment is primarily concerned with pollution, and radioactive pollution is one of the most insidious forms there is, since it can build up to appreciable levels without being noticed. At Northwick Park Hospital we are allowed to put a total of 150 mCi. down the drains in the course of a month. As the hospital uses about 200,000 gallons of water a month, even this amount is pretty well diluted before it reaches the main sewer. In smaller institutions the total allowed is often of the order of 10 mCi. However, we are only allowed to dispose of 2 μCi . of any isotope per cubic foot of solid waste and not more than 1 μCi . per object. If, as we do, you are injecting 5 mCi. in 5 ml. each time, then just one drop of your solution will contain about

$0.02 \times 1,000 \mu\text{Ci}$. which is 20 μCi . or ten times our allowed amount. Also you are doing very well if you leave only 1 per cent. of the dose in the syringe, which is 50 μCi . Hence a certain routine must be developed so that anything which may become contaminated during the injection can be collected for monitoring, and possible rinsing, and then storage till the natural decay of the isotope enables it to be disposed of.

There are certain basic rules for the safe handling of isotopes which apply under all circumstances. All solutions, whether for injection or for use as standards or for technical reasons for setting counters, etc., must be labelled with the isotope and the amount of activity and the date to which this applies. Solutions must never be pipetted by mouth; either syringes or remote control pipette fillers must be used. The containers must be stoppered and must never be carried in the fingers or the pocket, and this is particularly important when we are considering the mCi. amounts used for treatment. All glassware used must be rinsed and segregated before being sent for washing—the present-day use of disposables means that, while they must still be rinsed, complete cleaning is no longer essential.

The most effective form of protection is adequate training and radioactive isotopes should only be dispensed and injected by trained personnel or under their supervision till an adequate level of expertise is achieved; even then accidents can happen and in any department using radioactivity there must be a radiation safety officer whose responsibility it is to see that such precautions as are necessary are taken and who can be called on in case of emergency. There is a Code of Practice covering the use of radioactivity in hospitals, and it is the responsibility of all persons using radioactive isotopes to make sure that they have read the relevant sections.

Our routine of injection is for the yttrium to be diluted, when necessary, in the laboratory so that only the solution has to be withdrawn from the dose vial in the treatment room. This is done on a special trolley which is covered with 'Benchkote', a type of blotting paper with an impervious backing. There are various techniques for the actual filling of the syringe, to avoid variations in pressure so that there is no risk of finishing with a negative pressure, so that when the syringe and needle are withdrawn the needle

stays behind, or with a positive pressure which runs the risk of blowing the top off an improperly sealed dose bottle. A small bleed needle inserted before the operation is one way of dealing with this problem. I prefer to take up more than the intended volume of air into the syringe and then to exchange it for the solution in a series of about 1 ml. fillings, while I hold the lead pot in which the bottle is kept. When the syringe contains the required volume of the solution to be injected, the plunger is pulled well back to leave an airspace between the fluid and the needle which is then removed and the syringe does not leak when being attached to the needle which is already *in situ* in the patient's knee. At the end of the procedure, all swabs used after the radioactivity has been injected, together with the disposable plastic 'waterproof' which is under the patient's knees, and the operator's gloves, are collected and monitored and sent for disposal together with the syringes and needles used. All this material is handled when wearing gloves.

All this sounds and is very obvious, but it is surprising how many people, who are not used to

dealing with radioactivity, will fill a syringe and then just empty out the excess, more or less over a swab, without realizing the consequences. Apart from the fact that it is illegal, this is antisocial. In an institution such as this, where a large number of experiments are going on involving the use of minimal amounts of radioactivity, contamination carried on either the feet or the hands into a counting room can well wreck other people's carefully designed experiments. From the patient's viewpoint a single large localized dose of radiation in the right place may well be of benefit, but from the staff's viewpoint continual small doses of radiation may well be harmful. The use of ^{90}Y which is a pure β -emitter reduces the radiation received by nursing staff and other patients to a reasonably low level so that the chief hazard is that of contamination from the actual administration of the radioactivity. All this is covered by one sentence in a standard reference book on the subject, which states that 'for protection from ionizing radiation one ounce of commonsense is better than a pound of lead'.