Radioactive substances decontamination exercise

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In common with all hospitals prepared to accept casualties contaminated with radioactive substances, Aberdeen Royal Infirmary has a contingency plan for dealing with them. Such plans are prepared by each hospital after discussion between the hospital's radiation protection adviser and its accident and emergency staff. As in virtually all hospitals with such plans those in this hospital have never had to be used. As part of an ongoing evaluation of all contingency arrangements an exercise was held to see how well the arrangements for dealing with radioactive contamination worked in practice. We report the results of the exercise as the practical problems we experienced must be common to all similar plans and might be of use to other hospitals.

Scenario

As radioactive substances could not be used anthracene powder was used instead. This glows brightly when exposed to an ultraviolet light source such as a Wood's lamp, so much that even very small amounts are seen under ambient lighting conditions. The Wood's lamps were kindly loaned by our dermatology department. Anthracene powder had the real advantage that, like radioactive contamination, it could not be seen under normal lighting conditions. It could also be easily transferred from a "contaminated" area to a non-contaminated area.

The supposed accident was assumed to have occurred at a local oil service company where two operators had been working with equipment containing a radioactive source. (The oil industry uses many large radioactive sources in a wide variety of processes. As stated in the handbook *National Arrangements for Incidents Involving Radioactivity*, however, "Radioactive materials are used for a wide variety of purposes in industry, medicine, research and teaching, etc. They also arise from the nuclear power industry and there are many thousands of transport movements of radioactive materials associated with these activities during any year.") An explosion had occurred, blowing the men across the room in which they were working; both were assumed to have sustained local burns to their hands and faces. One man was assumed to have sustained a broken tibia and facial lacerations caused by flying debris, the other broken ribs and a pneumothorax. The casualties were made up realistically and parts of their bodies were "contaminated," together with some of the surrounding area. This contamination was deliberately not extensive but was localised to small areas. The ambulance service was keen to participate blind, and arrangements were made with the controlling officer.

Description of exercise

Although senior management staff in all areas were aware of the exercise (as much to stop events escalating

as to ensure that they did not come to a complete halt), most of the participants had either no knowledge or only a vague awareness of its existence. No special care was taken to ensure that staff were aware of our standing procedures beforehand. The incident was started at 1.30 pm. The internal calling of staff by the hospital switchboard (working blind) was successful, and all the requisite staff were in the accident and emergency department before the ambulance containing the casualties arrived. All the equipment to be used was ready. It was not possible to carry out our plan to cover the floor with impervious material so that subsequent decontamination would be easier. After starting to cover the floor it was evident that it would take several hours to do so in a way that would not be inconvenient or even dangerous.

Response of ambulance crew—The ambulance crew had been warned that the casualties were contaminated and that they were entering a radiation controlled area. They put on protective gloves (which subsequently split) but no other protective clothing. They were given no advice other than that available from a low grade laboratory worker but were given whatever they asked for by way of protective clothing. All that was requested were masks, which the crew found difficult to work in and subsequently removed. Before this exercise coverall suits were issued only on request at the ambulance depot but were not routinely carried in ambulances. As expected, the clothing of the ambulance men became generally contaminated, particularly where they had knelt on the floor. At the end of the exercise the skin on the hands and knees of the men was badly contaminated; parts of their faces and hair were also contaminated. This was primarily caused by the requirement that they wear their hats at all times. Each time they readjusted these with contaminated hands they also contaminated their faces. As they were contaminated, their ambulance was also widely contaminated. In the course of their work they also spread the contamination from the very local areas to a much wider area. (The area contaminated was also increased during the initial examination in the accident and emergency department.) To stop this spread occurring without the advice of someone operating a contamination monitor is almost impossible.

Response by accident and emergency staff—All staff had donned protective clothing by the time the ambulance containing the casualties arrived. Several types of clothing were used, ranging from a simple paper suit and mask to a "rubber" suit with a Martindale hood (figure). All staff wore normal disposable gloves. The first obvious problem arose because the ambulance men were allowed to follow their normal practice of bringing patients into the department. This was in fact contrary to our plan, but no one took steps to stop them. As their shoes were contaminated the entrance and the receiving area immediately became slightly contaminated. After the

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Protective clothing against radioactive contamination on trial. Left of picture: paper suit. Right: Martindale hood and "rubber" suit

ambulance men had been monitored they were asked to wait in their ambulance until they and the vehicle could be decontaminated.

Decontamination procedures—Our procedures as laid down at the time of the exercise had a minimum number of physicists, doctors, and nurses in the controlled area to carry out the decontamination, who were serviced by other staff who did not proceed beyond the barriers. Although some local decontamination was carried out as recommended, in practice, the shower was regarded as the prime means of decontamination. Both the casualties were extensively monitored for signs of contamination when they first entered the controlled area. Monitoring after this tended to be restricted to regions of the body identified as being contaminated or to those parts immediately accessible to the person with the monitor. After the exercise it was found that the moving and handling of the casualties by the nursing and medical staff had contaminated areas previously found to be clean. The working procedures that had to be adopted also meant that each of the staff in the area had to move from patient to patient as required. At the end of the exercise contamination by anthracene powder was found on the wrists of everyone concerned and on the faces of everyone except the person wearing the Martindale hood.

Discussion

The conclusions drawn from the exercise are summarised in a list of suggested changes to our current procedures and equipment.

Procedures—Firstly, attention must be paid to not contaminating the patient further. Covering the patient's hands would be useful. The movement of staff between patients may have added to the recontamination problem, and to minimise this a team of staff is required for each patient despite this requiring more people within the controlled area. Alternatively, limiting the number of patients in the area to one at a time may also solve the problem, although this may not always be possible. More localised decontamination by wiping and rubbing of "hot" regions should be carried out before showering the patient. This ought to limit the spread of contamination on the patient and decrease the likelihood of staff becoming contaminated during showering. Monitoring of the patient should be repeated at timed

intervals to ensure that recontamination of clean areas is not occurring. Secondly, a much better system of control of waste is required. Even with two patients large volumes of waste were produced, which was all regarded as being contaminated, and several disposal points are necessary; any liquid waste produced can go straight into the normal drainage system. Compared with the liquid waste put into the drainage system from routine diagnostic and therapeutic uses of radionuclides the waste arising from virtually all likely incidents is trivial.

Clothing—Firstly, the Martindale hood prevented facial contamination, but made communication very difficult. Problems were also encountered with failure of the batteries powering the ventilation system despite their being regularly checked and charged. Staff with beards would need to wear a hood or to shave. Wearing masks and goggles did not prevent facial contamination but in a real incident would ensure that no contaminated particles were inhaled. Secondly, the paper suits proved to be efficient but were of limited use in the shower. The "rubber" suit was found to be suitable for prolonged exposure to water but was uncomfortable to wear for a long period. (Both types ensured that only localised decontamination of the staff taking part in the exercise would have been required.) Thirdly, longer gloves are required to prevent wrist contamination, and, fourthly, Wellington boots in sizes suitable for nurses are necessary—most of ours proved to be too big.

Equipment and materials—Firstly, a large clock with a sweep second hand, hung where it can be seen by all staff, is required; secondly, large gauze swabs should replace disposable wipes for local decontamination as they proved more effective; and, thirdly, more polythene bags with ties and adhesive tape for sealing are required. The volume of waste produced rapidly exhausted the supplies we had placed in the controlled area.

For very little effort it was possible to test our emergency procedures realistically. The exercise highlighted several problems in what had seemed to be reasonable procedures. This has allowed us to modify our plans so that should a casualty contaminated by radiation ever be admitted, contamination of the accident and emergency department with loss of its facilities for a period of time ought to be avoided. We have in fact identified an alternative area at the external end of a little used secondary service corridor near to the accident and emergency department where, after minor structural alterations, decontamination will be able to be carried out. Access to vehicles is possible, and if necessary the corridor can be sealed, isolating it from the rest of the hospital. A small covered loading bay is to be converted into a decontamination room by erecting one wall and installing a shower head, sinks, and drainage. Access to the service corridor will be unaffected by this work. Equipment will have to be moved into the area when an incident occurs, but this is considered to be a minor inconvenience compared with the problems that would be caused if the accident and emergency department were to be contaminated and remain so for a prolonged period.

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ANY QUESTIONS

What is the cause of drowsiness and tiredness in some people while taking antibiotics such as penicillin V and simple analgesics such as paracetamol?

I do not know of any pharmacological explanation for this observation. I suspect that the reason for the association may be different in different

patients. Drowsiness and tiredness are common non-specific side effects occurring in some patients with a wide variety of drugs. I am not aware of any controlled trials showing that drowsiness is more common with either of these drugs than it is with placebo.—LINDA BEELEY, consultant clinical pharmacologist, Birmingham