Commentary (I)

Review of a Thallium-201 Contamination Incident

Cardiac imaging using thallium-201 is becoming a routine nuclear imaging study in many institutions. Frequently, because of the involvement of cardiologists in this nuclear cardiology procedure, as well as the physical location of excercise equipment, it is common to inject the patient with Tl-201 at some location other than the nuclear medicine department. It is recognized that there may be some loss of control from the aspect of radiation safety but this is outweighed by the technical requirements of the study and the value of the clinical information to be gained.

For these and other reasons at our institution, thallium cardiac stress studies are often performed in the cardiopulmonary department, which conducts the stress portion of the exam that uses a treadmill. On one such occasion recently, during a mid-morning patient study, 2 mCi of thallium-201 in 2 ml of thallous chloride was injected via an IV heparin lok; the needle and syringe (even though this was a Luer Lok syringe) disengaged after only approximately half of the dose was injected and the remainder of the material was released at a rapid rate resulting in a radioactive spill.

The chief nuclear medicine technologist was immediately notified; he instructed all personnel in the cardiopulmonary department to remain precisely where they were. An attempt was made to notify the radiation safety officer (RSO), but he was out of town. The designated radiologist then was given the responsibilities of the RSO; this physician had been the RSO for the previous year and he assumed the responsibilities and supervised the procedure.

The chief technologist arrived at the cardiopulmonary department approximately 2 min after the spill occurred and immediately began surveying using a Victoreen thin end window G-M survey meter to determine the extent of the contamination and whether or not the spill was major or minor in scope. A major spill is defined as greater than 10 mr/hr at 10 cm above the spill; a minor spill is defined as less than 10 mr/hr at 10 cm above the spill. It was determined that this was a minor spill. It was necessary to determine the precise nature and extent of the contaminated area. We employ a risk manager and he was notified of the contamination and it was written up as an incident. A staff nuclear medicine technologist accompanied the chief technologist to take notes during the procedure, to help control the cardiopulmonary staff, and to assure that radiation safety and decontamination procedures, including the prevention of spread of the contamination, were followed.

Additional surveying indicated that the spill had been limited to the patient's forearm and hand, certain limited areas of the administering technologist, and an area of approximately 3 ft square on the cardiopulmonary floor at the site of administration.

The administering technologist was thoroughly surveyed and it was determined that contamination was limited to his wrist (gloves prevented contamination to the hand), the upper portion of his lab coat, and center of his necktie. The affected clothing was carefully removed by the chief technologist using rubber gloves in a manner that would prevent the spread of contamination. The affected clothing was placed in a plastic bag, which was then transported to the radioactive waste storage area for decay. This contaminated bag was labeled as to its contents and approximate disposal date for twelve half-lives of Tl-201. The administering technologist was then escorted to the sink in the cardiopulmonary department and decontamination procedures as specified in the nuclear medicine policy manual were begun. Decontamination was performed using cold water and Isoclean. The primary goal was thorough removal of radioactive contamination, while maintaining skin continuity and thereby decreasing the probability of absorption of the radioactive contamination. The contaminated technologist was assisted in handling the sink controls and administering cleaning agents by the assisting nuclear medicine technologist to assure that there would be no transfer of contamination. After repeated cleaning by the administering technologist and resurveying by the chief technologist, the administering technologist was able to decontaminate the affected areas of his skin such that no radiation above background could be detected on his person.

All other personnel in the cardiopulmonary department at the time of this incident were thoroughly monitored, including the bottom of their shoes. No contamination was found on any personnel. Those not part of the decontamination team were released through a door away from the contamination site.

The patient decontaminated himself. The patient's physician, who was present, observed and assisted the patient in assuring that decontamination was performed properly.

The supervisor of nursing chose to observe this procedure for her own information and for future in-service education to staff. She arrived at the scene of the incident approximately 15 min after the chief technologist. She remained well out of the area of the contamination and provided additional background information and comment when the incident was reviewed.

In order to determine the final status of the room all door knobs, surfaces that may have been contaminated (especially the floor), equipment, etc. were surveyed by the chief technologist to determine whether or not any contamination was present. There was no significant contamination present in the laboratory except for the floor at the site of the incident. The area background reading was 0.1 mr/hr, and the reading on the floor was approximately 5 mr/hr at 6 cm above the floor. Decontamination procedures were performed by the chief technologist in accordance with standard hospital decontamination policies—this included using no more water than was necessary to perform the clean-up (to generate as little waste as possible). When the decontamination of the floor resulted in a radiation level 6 cm above the floor of not more than 0.5 mr/hr, decontamination was terminated. The RSO determined that the remaining contamination was between the cracks of the 1 ft square tiles of the floor. The floor area was then covered with plastic-backed absorbent paper over an area approximately 4 × 5 ft (an area larger than the contamination itself to give an area of safety). The area was then

labeled with "Caution, Radioactive Materials" signs, which included the exposure rate, date, time, and technologist's initials. Personnel within the department were instructed not to walk over the covering. The door into the hallway was locked to prevent traffic through this contaminated area.

Four days after the contamination incident, the area of the cardiopulmonary department floor, which had been covered, was re-surveyed with the same instrument and the radiation level did not exceed 0.1 mr/hr (background). All signs, labels, paper, and indications of an exclusion area were removed. The final survey indicated that no radioactive contamination was present and the cardiopulmonary department was released from radiation safety control by the RSO.

After review of the nature of this contamination incident and our response, it is felt that we were both prompt and thorough. The primary goal of any decontamination effort is to reduce or eliminate unnecessary radiation exposure to personnel as well as to prevent damage to hospital equipment. As a follow-up, our hospital will increase the scope of in-service radiation safety educational sessions, which already include nursing and housekeeping staff, to assure heightened awareness in areas of the hospital that now have a higher probability of radiation incidents, such as the cardiopulmonary department.

The radiation safety committee and the hospital safety committee are further reviewing this situation to assure that the incident was handled in the manner that best serves this institution. The potential cause of this incident is also being further evaluated to determine whether or not alternative administration devices are indicated to insure radiation safety. The various committees will also be evaluating the possibility that some disposable syringes may be defective.

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