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June 5, 2012

U.S. Nuclear Regulatory Commission, Region III
Division of Nuclear Materials Safety
Materials Inspection Branch
2443 Warrenville Road, Suite 210
Lisle, IL 60532- 4352

RE: **Possible Medical Event - University of Michigan Hospitals and Health Centers (May 17, 2012) - Materials License No. 21-00215-04**

Materials Inspection Branch:

The University of Michigan is submitting the attached written report regarding a possible medical event that occurred at the University of Michigan Hospitals and Health Centers on May 17, 2012. The medical event was reported to the NRC Operations Center on May 22, 2012 (Event Report No. 47946).

This report is submitted in accordance with the provisions of 10 CFR 35.3045(d). It describes the event, the determined causes, the corrective actions that have been implemented, and other requirements specified in 10 CFR 35.3045(d)(1).

Please do not hesitate to contact me at Radiation Safety Service / OSEH [(734) 647-2251 or 764-6200] should you have additional questions or comments regarding this event.

Sincerely,

Mark L. Driscoll
Director / Radiation Safety Officer
Radiation Safety Officer / OSEH

cc: K. Frey
R. Ackermann
D. Raffel
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Files

Enclosure

University of Michigan
OSEH -- Radiation Safety Service
1239 Kipke Dr., Ann Arbor, MI 48109-1010

June 5, 2012

Report of a Possible Medical Event (May 17, 2012)

In accordance with the notification provisions of Title 10 Code of Federal Regulations Part 35.3045(d), the University of Michigan is submitting a written report describing a possible medical event occurring on May 17, 2012 at the University of Michigan Hospitals and Health Centers and reported to the NRC Operations Center on May 22, 2012 by Mark Driscoll, Radiation Safety Officer and Director, University of Michigan OSEH-Radiation Safety Service. This report summarizes the events prompting notification, assessed causes, and proposed remedial actions.

Licensee: The Board of Regents of the University of Michigan
License Number: 21-00215-04
NRC Operations Center Event Report No.: 47946

Prescribing Physician: Dr. Brett Mollard, Radiology House Officer
Referring Physician: Dr. Michael Sabel, Assoc. Prof. of Surgery

Summary of the Event

Isotope: Tc-99m
Form: Medronate (Drax-Image MDP-25)

A skin cancer patient at the University of Michigan Hospital was prescribed an intradermal injection of 3 mCi of Tc-99m as sulfur colloid for lymphoscintigraphy. Instead, the patient inadvertently received 25 mCi of Tc-99m Medronate ("MDP-25" from DRAX-Image), divided equally among 3 intradermal injections (approximately 8.33 mCi at each site).

For skin cancers, lymphoscintigraphy involves injecting Tc-99m sulfur colloid intradermally at sites where cancerous lesions were surgically removed. Some of the colloid enters the lymphatic system draining from the immediate intradermal area at the cancer site to lymph nodes most likely to hold metastatic melanoma. This allows a surgeon to identify sentinel lymph nodes using a scintillation detector and to remove them surgically as a follow-up staging and treatment procedure. Tc-99m (Medronate) is typically administered intravenously for diagnostic imaging of skeletal lesions, and distributes quickly into the body to permit timely and effective imaging of bone for osteogenic abnormalities. The normal dosage for MDP is about 25 mCi delivered IV.

Description of the Event

Background

Sometime before the lymphoscintigraphy procedure, the patient underwent a procedure to surgically remove a skin melanoma. The melanoma was located on the posterior of the upper right arm, overlying the region of the triceps muscle. The surgeon, in collaboration with the U-M Nuclear Medicine Division, then scheduled the patient for a lymphoscintigraphy surgical procedure on May 17, 2012.

Lymphoscintigraphy uses Tc-99m sulfur colloid acquired from a commercial radiopharmaceutical vendor (Pharmalucence) to identify and remove lymph nodes identified as sentinel nodes draining the original neoplasm. During the surgery, the skin from the site where the sulfur colloid injections are made near the location of the original melanoma is also completely excised surgically to ensure removal of all remaining cancer cells from the site of the original cancerous lesion.

Possible Medical Event

On May 17, 2012, a patient was prescribed intradermal injections that contained a total of 3 mCi of Tc-99m (sulfur colloid) for the lymphscintigraphy. The 3 mCi of Tc-99m sulfur colloid was to be injected in three separate areas in equal amounts of 1 mCi per injection site. The injection sites are separated by more than two centimeters and mark the vertices of a triangular pattern immediately surrounding the site where the lesion was removed. There are two injections laterally (left and right) and another superior to the lesion, proximal to the body. This pattern ensures the colloid will enter all the intradermal lymph vessels draining from the site of the original lesion.

However, instead of receiving the correct intradermal injection that contained 3 mCi of Tc-99m (sulfur colloid), the Nuclear Medicine Technologist (NMT) assigned to deliver the dosage inadvertently obtained the wrong syringe from the Nuclear Medicine Pharmacy passbox. This syringe contained approximately 25 mCi of Tc-99m (Medronate) intended for another patient. All syringes were properly labeled.

The NMT injected equal amounts of the Medronate (about 8.33 mCi of Tc-99m) into each of three intradermal injection sites surrounding the lesion in the manner intended for sulfur colloid. The mistake was discovered within 20 minutes by another technologist when she realized that dosage intended for her patient for bone imaging was absent from the passbox but the dosage for the skin cancer patient was there.

It is routine to take images of the areas of concern every 5 minutes after injection to ensure adequate lymph nodal uptake for the lymphoscintigraphy surgery. These images confirmed that the incorrect pharmaceutical was delivered to the patient and that it was the Medronate intended for another patient. Ordinarily, 80-100% of Tc-99m (sulfur colloid) remains at the injection sites. The injection sites are normally covered with lead during imaging because the concentration of colloid at the site would interfere with nodal imaging. Sulfur colloid is similar in behavior to microspheres, remaining largely near the injection site except as it is transported through the lymph system. As such, it has an effective half-life equal to the physical half-life of Tc-99m (about 6 hrs). Very little colloid locates elsewhere in the body except in sentinel lymph nodes draining the injection site(s).

In contrast, the images for this patient showed the activity had traveled well into the lymphatic and systemic circulatory systems and distributed into bone within 20 minutes after administration. Initially, the rapid movement was thought to be from an inadvertent intravenous injection at one of the sites. However, additional imaging left no doubt that Tc-99m (Medronate) was most likely injected because the bones of patient were absorbing the radiopharmaceutical.

This rapid distribution is consistent with Medronate which has a much shorter effective half-life than sulfur colloid and distributes more widely throughout the body in a short period of time. Sulfur colloid remains static and concentrates at the site of intradermal injection.

Notification of Patient & Hospital Personnel

The following personnel were notified immediately upon discovery of the error on May 17, 2012: the patient, the referring physician (employee of the Licensee), the Supervisor of the Nuclear Medicine Technologists, the Nuclear Pharmacist, Nuclear Medicine Clinical Physicist, the on-site Nuclear Medicine Physician and the Division Chief of Nuclear Medicine. The Radiation Safety Officer was notified on May 21, 2012. After investigating the incident, the RSO determined, after consulting with NRC Region III, that the NRC Operations Center should be notified of the incident as a possible medical event pending final estimation of the dose to the injection sites. The RSO notified the Operations Center on May 22, 2012. The medical event notification can be retracted after final assessment of the injection site dose, if considered appropriate.

Dose Evaluations

Initially, when the error was discovered on May 17, 2012, the Nuclear Medicine personnel knew that the rapid distribution of Medronate would not result in any significant dose to the whole body or to internal organs of the patient. The DraxImage FDA-approved package insert for Medronate lists the largest organ dose to be about 6.2 rad per 20 mCi administered to bladder wall with a 4.8 hr void and a whole body dose of 130 mrad per 20 mCi. However, over the weekend, the Nuclear Medicine Clinical Physicist began to consider the dose to the skin tissue at the three injection sites. Medronate is normally administered by IV and the package insert does not list a dose to the injection site. He determined initially -- based upon various assumptions and comparisons to sulfur colloid -- that it was possible using the most conservative assumptions that the dose to a single injection site may have exceeded 50 rad. The Clinical Physicist notified the Radiation Safety Officer on May 21, 2012. Because of the uncertainty in the dose estimation and the complex nature of arriving at a better estimate, the RSO elected to treat this as a possible medical event pending a final evaluation.

Subsequent to notification of the NRC, additional refinements of the calculations and base assumptions by the Clinical Physicist resulted in a dose estimate of about 40 rad to each injection site due to the inadvertent administration of 8.3 mCi of Medronate per site instead of 1 mCi of sulfur colloid per site. Specialists at NRC's Region III office are conducting confirmatory calculations. The decision regarding the status of this incident as a medical event remains pending at this time.

Cause of the Event

The Nuclear Medicine Pharmacy drew up the correct dosage of the Tc-99m sulfur colloid into a syringe and the syringe, shield and carrier were all properly labeled and identified per 10 CFR 35.69. Similarly, the Pharmacy drew up a proper dosage Tc-99m Medronate for another patient and it, too, was properly labeled in accordance with 10 CFR 35.69.

Prepared dosages are normally placed by Pharmacy staff in a locked and shielded passbox that opens through the wall between the Pharmacy and a general area in the Nuclear Medicine facility. Technologists normally collect prescribed dosages needed for patients from the passbox. Written procedures require technologists to confirm the identity of the patient by two independent means and to verify the label on the syringe before administering radiopharmaceuticals to patients.

In this instance, the NMT verified the patient's identity per procedure but when he went to collect the dosage, the Pharmacy was in the process of drawing it up along with dosages for other patients. The NMT mistakenly heard someone comment about his dosage likely being the next one. Without further checking, he took the next syringe carrier placed into the passbox and returned to the injection area. When he removed the syringe he noticed the needle was a 26 gauge needle -- too large (26 ga) for an intradermal colloid dose which uses a 30 gauge needle. (The syringe needle was the correct gauge for the Medronate IV). He presumed the wrong needle was attached to the syringe and went to the Pharmacy to obtain the proper size needle. He was possibly distracted by this and subsequently failed to follow procedure. For whatever reason, he did not confirm that the label on the syringe matched the prescribed material and dosage for his patient.

This NMT is certified, is very experienced and has a good record of following protocols. He asserts that in the past he would always confirm the dosage against the prescription. He admits the needle issue may have been a distraction but cannot explain with certainty why he made the error. In any case, he acknowledges the mistake without equivocation.

Determination of No Significant Medical Effect

The Chief of Nuclear Medicine made a determination that the incorrect administration of diagnostic doses of Tc-99m (sulfur colloid) and Tc-99m (Medronate) did not result in any adverse significant medical effect to the patient. Very importantly, the skin tissue where the injections are made is routinely excised by the surgeon as part of the cancer treatment. In this instance, the patient returned for the lymphoscintigraphy surgical procedure on May 22, 2012. He was administered the correct radiopharmaceutical in the correct amount. Surgery for removal of affected lymph nodes followed later that day and included excision of the skin tissue at the injection site per routine surgical procedure.

Corrective Action

The incident and the policy for administering radiopharmaceuticals were reviewed by the Supervisor of Nuclear Medicine Technologists with all the NMT staff at their weekly staff meeting on May 23, 2012. This policy will be reviewed with staff more frequently and spot checks will be performed to monitor for proper procedures.

Current Status

The Nuclear Regulatory Commission conducted an on-site reactive inspection on May 24, 2012 to investigate the facts and circumstance surrounding the incident. The NRC inspector met with all the pertinent individuals involved as well as with the RSO and members of his staff. The inspection remains open as of this date. The NRC is also conducting confirmatory dose estimates to determine if this incident meets the regulatory definition of a medical event.

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