A Simple Solution to Prevent the Loss of Radioactive Spot Markers

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Objective: Most nuclear medicine technologists have experienced the misplacing and/or the loss of a radioactive spot marker. We report on a simple solution to prevent or at least minimize the loss of radioactive spot markers.

Methods: One end of a metallic beaded chain was attached to the side of ⁵⁷Co spot marker using repair putty. The other end of the beaded chain was attached to a lead shield that housed the radioactive source when not in use.

Results: This design has allowed easy, unobstructed use of the ⁵⁷Co spot marker for marking the right or left side and anatomical position during imaging while preventing its loss. **Conclusion:** A radioactive spot marker that is attached to a lead shield by a beaded chain is a simple way to prevent its loss while allowing it to be used easily during imaging.

Key Words: cobalt-57 spot markers; radioactive spot markers

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Several years ago it was discovered in our nuclear medicine department that a ⁵⁷Co spot marker was missing. One possible explanation for the spot marker's disappearance was that it was still on the imaging table when the sheet was removed and was placed in a soiled linen barrel with the sheet. Unfortunately, the linen had been picked up already for cleaning. Manned with 2 survey meters (one with a pancake probe and another with an internal 2.54×2.54 -cm sodium iodide detector), the search for the missing radioactive marker continued on the hospital's loading dock. After monitoring several bins of soiled linen bags, the ⁵⁷Co spot marker was located. The approximate activity of the ⁵⁷Co spot marker at that time was 370 kBq (10 µCi), therefore, its exposure level would have been approximately 0.1–0.2 µSv/h (0.01–0.02 mrem/h) at 30 cm (1,2). That is why it was not detected during the close-out surveys on the previous day. Its exposure level would have been at our background levels when the soiled linen barrel was monitored with a survey meter equipped with an energy-compensated probe.

Although this story had a happy ending, in that the ⁵⁷Co spot marker was found, a repeat of this same scenario was possible. Next time the radioactive source might not be found. We took action to prevent, or at least minimize, the loss of radioactive spot markers. We report on this simple solution.

MATERIALS AND METHODS

One end of an approximately 90-cm long, 2-mm round metallic beaded chain was attached to the side of a ⁵⁷Co spot marker using flexible plastic repair putty (Fig. 1) that was allowed to harden. A 5-mm thick piece of acrylic was attached to the bottom of a lead radiopharmaceutical shield (e.g., ²⁰¹Tl, ⁶⁷Ga). The acrylic was cut to cover the bottom of the lead shield and to have a small upturned lip on one side (Fig. 2). The other end of the beaded chain was passed through a small drilled hole in the upturned lip and secured using a beaded chain connector (Fig. 3). A notch for the beaded chain was placed in the top of the lead shield (Fig. 3) to permit the lead cap to fit securely while the ⁵⁷Co spot maker is stored in the shield when not in use.

All the materials required, except for the lead shield that the nuclear medicine department had available, were found in our hospital's engineering department. They should be available also through a hardware store. Our engineering staff cut the acrylic, formed an upturned lip by gently heating and bending the acrylic, and drilled a hole in the upturned lip. They attached the acrylic to the lead shield. We were able to complete the assembly by connecting the beaded chain to the ⁵⁷Co spot marker and the lead shield.

RESULTS

When the 57 Co spot marker is in use, the lead container is placed on the imaging table next to the patient while the spot marker is placed on or next to the patient (Fig. 4). This design has allowed unobstructed use of the 57 Co spot marker for marking the right or left side (Fig. 5) and anatomical position (e.g., thyroid nodule (Fig. 6) (*3*), suprasternal notch, umbilicus, etc.) while preventing its loss. Typically, when a spot marker view is used, the view is repeated without the marker(s). This eliminates any concern about the minimal attenuation caused by the metallic beaded chain in the spot marker view though it

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FIGURE 1. A small amount of flexible plastic repair putty (right) was used to cover four beads (arrow) of a metallic chain that were placed on the side of a ⁵⁷Co spot marker. After several hours the repair putty hardened, securing the marker to the chain. If necessary the beaded chain can be removed from the ⁵⁷Co spot marker at the beaded chain connector, placed close to the marker.







FIGURE 3. The other end of the beaded chain that was attached to the ⁵⁷Co spot marker was passed through a small drilled hole in the upturned lip. The chain was secured with a beaded chain connector (open arrow). A small washer between the connector and the lip was used so that the connector would not slip through the hole. A notch for the beaded chain was placed on the top of the lead shield. This allows the lead cap to fit securely on the lead shield when the ⁵⁷Co spot marker is not in use.

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FIGURE 4. The ⁵⁷Co spot marker is placed next to the patient to mark the patient's right side on this scan. The chain is long enough so that the lead shield can be placed at the patient's side on the imaging table.



FIGURE 5. A posterior bone scan with ⁵⁷Co spot marker noting the patient's right side.



FIGURE 6. The anterior thyroid image on the left has a ⁵⁷Co spot marker (open arrow) placed on a palpated thyroid nodule. Since it was taken using a pinhole collimator, the marker was placed in the center of the field of view. This eliminates any image distortion (3) due to different magnifications caused by pinhole collimator at varying source distances from the camera (i.e., 57Co marker at level of skin is magnified more than the thyroid that is at a greater distance from the camera). The image on the right demonstrates this distortion. It is the same anterior view with the marker still on the nodule but the thyroid is now in the center of the field of view. Note that the ⁵⁷Co marker (closed arrow) no longer appears over the palpated nodule.



FIGURE 7. (A) The image on the left has the 57 Co spot marker (arrow) at the top of the image (128 \times 128). The beaded chain attached to the marker was placed directly on the collimator's y-axis. A 57 Co flood source was placed on the chain and the collimator. (B) The image on the right is the same image except the beaded chain was removed from under the 57 Co flood. No attenuation artifacts caused by the chain can be seen in the image (A).



FIGURE 8. A similar set up of a ¹³⁷Cs check source that is used to check the proper operation of survey meters from several research labs. The lead shield is attached by a beaded chain to the countertop in a common research equipment room. This allows access to the source at all times and reminds the staff that the source is to remain in that room for each lab's use.

probably does not cause any detectable attenuation artifacts (Fig. 7). If the study requires that the marker(s) stay on the patient during the entire imaging procedure, the beaded chain is positioned so it is not over the imaging area of interest. If this is not possible, the ⁵⁷Co spot marker can be disconnected temporarily from the beaded chain at the spot marker's connector (Fig. 1), which only leaves a small portion of the beaded chain on the side of the spot marker. After its use, the ⁵⁷Co is reconnected promptly to the beaded chain.

When the ⁵⁷Co spot marker has decayed to the point where it cannot be used during imaging, it can be replaced easily. The hardened repair putty can be removed by cutting it off with a knife or scalpel. The old spot marker now can be removed from the beaded chain so the new spot marker can be attached with new repair putty.

The lead shield allows for the storage of the 57 Co when not in use. Though spot markers only contain very low activities, usually calibrated for 1.85 MBq (50 µCi), the lead shield provides more than adequate shielding when the marker is not in use. When the 57 Co spot marker is in use, the lead shield can be seen easily on the imaging table by the technologist. If by chance the spot marker and the lead shield are caught up in the sheet when it is removed after imaging, the increased weight will alert the technologist and prevent its loss. A similar design is being used also with a 370 kBq (10 µCi) 137 Cs check source that is used with several survey meters (Fig. 8).

DISCUSSION

Most nuclear medicine technologists have experienced misplacing or losing a radioactive spot marker. Valuable time can be lost attempting to locate the missing spot marker. This time can be unpleasant, such as monitoring several bins filled with soiled linen. Although spot markers contain only very low levels of sealed radioactivity and do not pose any risk to the general public or hospital staff, it is poor procedure to lose or misplace them. The loss of a spot marker also is an additional expense to the department to replace the marker before its regular replacement period.

CONCLUSION

A radioactive spot marker that is attached to a lead shield by a beaded chain is a simple solution to prevent its loss while allowing it to be easily used during imaging.

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