Sensible Approaches to Avoid Needle Stick Accidents in Nuclear Medicine

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Objective: Needle sticks are a continuous concern in the health care environment because of the prevalence of blood-borne pathogens in today's society. Radioactive contamination is another concern with needle sticks during nuclear medicine and nuclear pharmacy procedures. In our institution, substantial efforts have been made to prevent needle sticks, but they still occur occasionally. The purpose of this project was to analyze different practices and products to determine the best protocol in an effort to avoid further needle sticks.

Methods: The nuclear medicine technologists were surveyed to determine how many needle sticks have occurred and the situation behind each occurrence. Using our initial survey, the circumstances involved in each incident were reviewed, suggestions considered, and various means of protection analyzed. Five options were presented in a second survey.

Results: The results of the second survey showed that technologists favored the newly designed needle-capping blocks for preventing needle sticks in their daily routine procedures.

Conclusion: The newly designed needle-capping block is best suited for both nuclear medicine and nuclear pharmacy laboratories. We will continue to monitor the effectiveness of this new approach in preventing needle sticks.

Key Words: needle stick accidents; blood contamination; radioactive contamination; needle-capping block; safety needle and syringe; sharps container

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The issue of needle sticks has been a concern of the medical professions for many years. It has been estimated that more than 1 million needle stick injuries are reported each year (*1*), and each needle stick has the potential to be infectious. There are more than 23 infectious diseases (Table 1) that can be passed on by a needle stick or a sharps injury, but those most frequently discussed are human immunodeficiency virus (HIV) and hepatitis (*2*). A health care worker has a 0.1%–0.4% chance of contracting HIV through an infected needle (*3,4*). The likelihood of contracting hepatitis B or C through a contaminated needle is 1.2%–40% per needle stick (*5–12*). Health care employees have varying potentials for exposure to needle sticks. It has been determined that those health care workers who are responsible for accessing venous blood have the highest potential for contracting a blood-borne infection, which includes nuclear medicine professionals. Nuclear medicine technologists are responsible for injecting the radiopharmaceutical into the patient's vein. Therefore, they are within the high-risk category of health care workers.

Other than the concern for transmission of blood-borne infection through needle sticks, radioactive contamination through needle stick injuries during nuclear medicine and nuclear pharmacy procedures is the other major risk for the nuclear medicine technologist. As with any other occupational accident, there are direct and indirect costs associated with each needle stick incident. However, no one will dispute the fact that any human cost associated with needle sticks is unacceptable. Health care facilities can easily adopt the use of the commercially available devices (e.g., needle-capping block, safety needle, or safety syringe) into their practice with little or no increase in cost and will achieve a dramatic reduction in needle stick exposure.

The purpose of this research project was to develop the best device and plan for the prevention of needle sticks in nuclear medicine and nuclear pharmacy. The unique aspects associated with a syringe shield for administration of a radiopharmaceutical presented a challenging task in the selection and design of an optimal device and mechanism for the avoidance of needle stick injuries during nuclear medicine and nuclear pharmacy procedures.

MATERIALS AND METHODS

Needle Stick Surveys

Our research project focused on the incidence of needle stick accidents that had occurred in the nuclear medicine and nuclear pharmacy areas of our institution. With regard to the issue of

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TABLE 1
Potential Blood-Borne Infectious Diseases

Twenty-three infectious diseases have been transmitted to health care workers by needle sticks and sharps injuries:	
Acquired immunodeficiency syndrome (AIDS)	Malaria
Blastomycosis	Malignancy
Brucellosis	Mycobacteriosis
Cryptococosis	Mycoplasmosis
Diphtheria	Rocky Mountain spotted fever
Ebola fever	Scrub typhus
Gonorrhea (coetaneous)	Sporotrichosis
Hepatitis B	Staphylococcus aureus
Hepatitis C	Streptococcus pyogenes
Herpes	Syphilis
Leptospirosis	Toxoplasmosis
	Tuberculosis

confidentiality, it was decided that the best way to determine the occurrence of needle sticks in our laboratory was to use a series of anonymous surveys distributed among the nuclear medicine technologists. The first survey was used to answer the following questions:

1. How many needle sticks have occurred with regard to each technologist surveyed and in approximately what time frame?
2. Did the needle stick occur in the nuclear pharmacy area or in a patient area?
3. How did the needle stick occur (e.g., during preparation of a radiopharmaceutical, during injection, while recapping, or during disposal of uncapped needle)?
4. What kind of injection equipment was being used at the time of the needle stick?
5. Was the needle stick reported, and were the proper steps taken to ensure the safety of the employee?

Options for Preventing Needle Stick Accidents

After the results of the first survey were reviewed, a second survey was developed to determine the most effective protocol for preventing needle sticks in the nuclear medicine and nuclear pharmacy areas. The second survey offered the following options with regard to a protocol for the prevention of needle sticks:

- Commercially available needle-capping block:

  Stand-alone capping block (# CB-1, Datar Inc., Minneapolis, MN or MDS workstation, PD 2500, Phlebotic, Grand Rapids, MI); or

  Clip-on capping block (Mobile Draw Station, MDS 1200, Phlebotic, Grand Rapids, MI)

- Safety needle and syringe (e.g., SafetyGuide™ shielding hypodermic needles and Safety-Lok™ safety syringes, Becton Dickinson and Co., Franklin Lakes, NJ)
- No recapping of needle
- Newly designed needle-capping block (Fig. 1).

RESULTS AND DISCUSSION

Survey Outcomes

Forty-one nuclear medicine technologists participated in our 2 surveys. The average length of work experience for the technologists surveyed was approximately 9 y. The response rate of our surveys was 71%, and the survey results indicated that there had been 27 needle stick incidents that occurred in our laboratory since 1987. Based on the prevalence of needle sticks and comments from our second survey, we have summarized the pros and cons of each of the proposed protocols for avoiding needle sticks as follows.

Commercially Available Needle-Capping Block

Stand-Alone Capping Block. This device has been in use in our nuclear medicine and nuclear pharmacy laboratories for preventing needle sticks. This inexpensive needle-capping block was designed originally at our institution. The capping block was specifically designed for use in a phlebotomy area and is well suited for that purpose. It was designed to hold test tubes in the larger holes and needle caps in the smaller holes. However, it is not ideal for use in a nuclear medicine or nuclear pharmacy setting.

We learned from our survey that these capping blocks do not have good support from our nuclear medicine technologists. This is because they tip easily, especially when a lead-shielded syringe is placed in a hole close to the edge of the capping block. Also, since the holes of the capping block are quite deep, the open end of the needle cap is almost flush with the surface of the block which makes it extremely difficult, or almost impossible, to recap the needle which is partially covered by the syringe shield. In addition, the capping block is not compatible with a butterfly needle because the holes are too large to securely hold the butterfly needle cover. The stand-alone capping block may be difficult to find when needed due to its small size and shape. These problems with the capping block

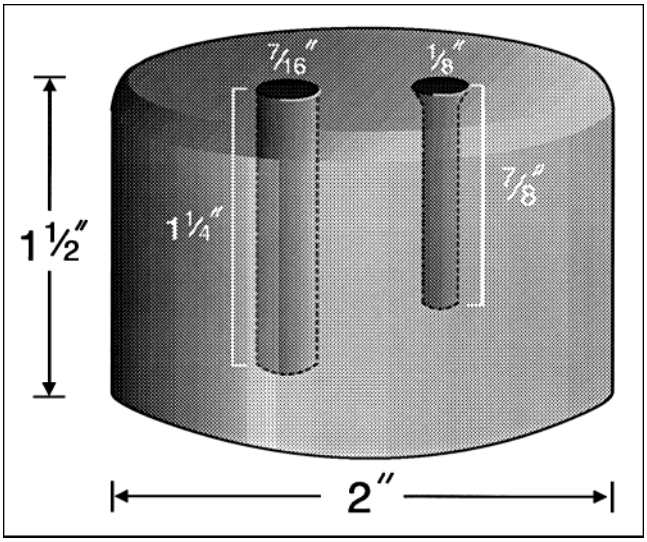

FIGURE 1. Cross-section of the newly designed needle-capping block.

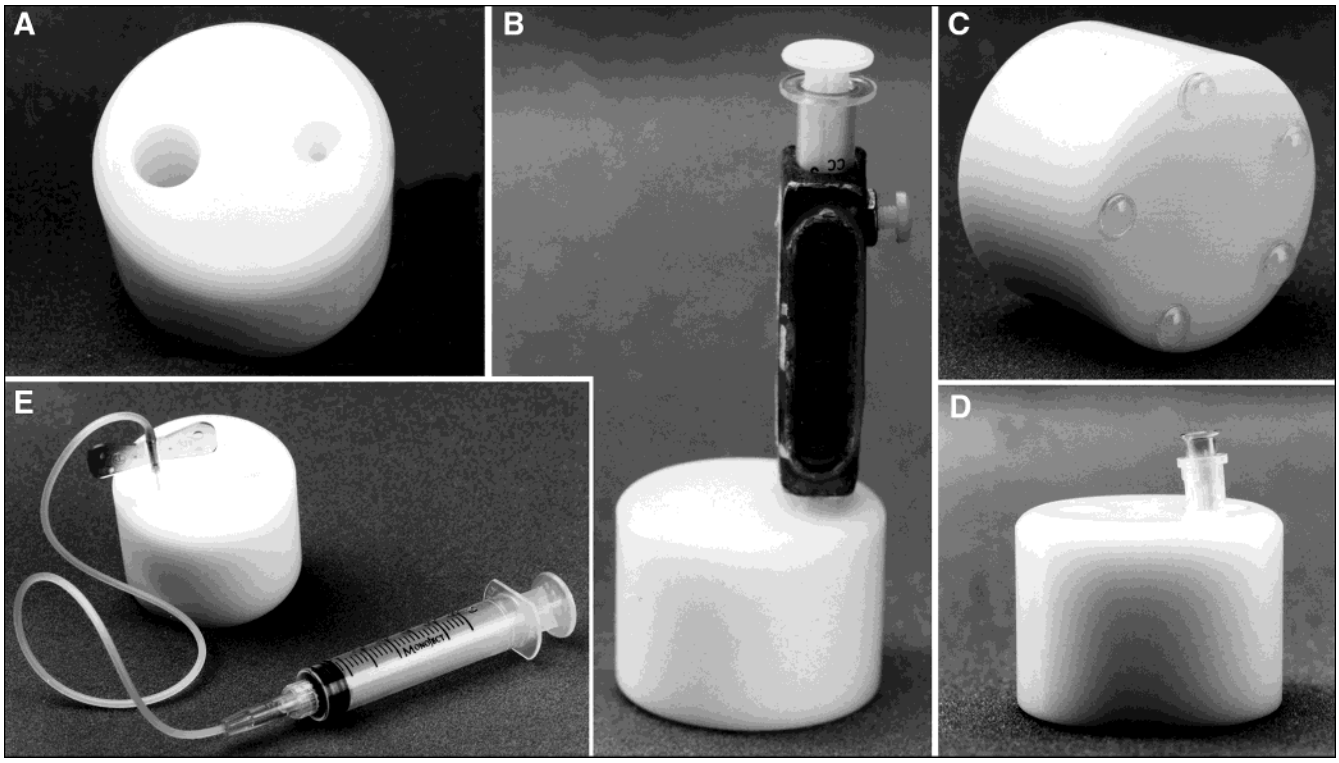

FIGURE 2. (A) The circular and compact new needle-capping block has 2 holes. The larger hole is designed to hold a regular needle cap and the smaller hole holds the plastic insert for a butterfly needle. (B) A shielded syringe can be placed upright without tipping over. (C) The bottom of the new needle-capping block is equipped with nonslip feet. (D) A significant portion of the regular needle cap is exposed for easy recapping. (E) The capped butterfly needle of the winged infusion set sitting in the smaller hole of the new needle-capping block.

have led our technologists to avoid their use, thereby increasing the risk for a needle stick.

Clip-On Capping Block. This needle-capping device is equipped with a large plastic clip that can securely attach the entire block to a metal rod or to the edge of a table or tray. The clip-on capping block has the advantage of being sturdier than the stand-alone needle-capping block. The clip-on capping block also allows for easy location when clipped to a routine injection spot. Although the clip-on capping block solves the tipping problem when a shielded syringe is used, it still has all of the other disadvantages associated with the stand-alone capping block (i.e., needle cap submerged in the deep hole and no holes that are small enough to securely hold the small butterfly needle cover). If the administration of the radiopharmaceutical must be performed in the imaging area while the patient is lying on the imaging table, this type of capping block cannot be clipped to the majority of thick imaging tables. A mobile cart with a metal rod or thin table tray has to be used for holding the clip-on capping block.

Safety Needles and Syringes

The commercially available safety needles and syringes work well for administering nonradioactive materials. However, the safety needles are not ideal for use in the nuclear pharmacy area. Once the safety needle is activated (i.e., with an attached plastic cover to lock up the needle), the safety cover cannot be reopened to expose the needle. Thus, this safety mechanism does not allow for later injection of a dispensed radiopharmaceutical since the radioactive drug is kept in a safety syringe with the needle activated.

As for the safety syringe, needle sticks are prevented by sliding an outer plastic tube upward to cover the sharp needle. However, the plastic tube that comes with the safety syringe presents a radiation protection dilemma. The thicker safety syringe (due to the plastic safety tube) not only requires the use of a wider opening for the syringe shield, the activation process for the lead-shielded safety syringe also presents a practical problem. In addition, the safety syringe is equipped with a permanently attached needle, which is not suitable for nuclear pharmacy practice because the needle typically is changed more than once to adjust the dosage or to dilute the radioactivity in the syringe. Even though the requested amount of a radiopharmaceutical can be obtained in a single withdrawal process, the needle must be covered before dispensing the injection to the patient. Unfortunately, once the safety syringe is activated by pushing the outer tube upward to cover the needle, the locked tube cannot be moved downward to expose the needle to administer the radiopharmaceutical to the patient.

No Recapping of Needles

No recapping of needles is a simple and easy-to-follow practice and is possible in daily phlebotomy practice. However, recapping is a necessary part of nuclear medicine and nuclear pharmacy practice due to the potential for radiation contamination from dripping. There also is the chance of a needle stick

when removing the used syringe with an exposed needle from the syringe shield.

Newly Designed Needle-Capping Block

After studying the pros and cons of the available devices and procedures for preventing needle sticks, we designed and produced a new needle-capping block (Fig. 1). The application of this new needle-capping block was mainly for use in nuclear medicine and nuclear pharmacy.

According to our second survey, the majority of technologists chose the new capping block as the most favorable option for the prevention of needle sticks. The advantages of the new needle-capping block are:

- Small circular size and shape (Fig. 2A) allow the capping block to fit into any area where injections may be given to a patient, even where space is limited.
- Sturdy design with the capping block constructed of heavy plastic, which adds extra weight to the block and allows it to hold a shielded syringe in the upright position (Fig. 2B), whereas other capping blocks are unable to support the extra weight of the syringe shield.
- Nonslip feet on the bottom make the capping block steady on any kind of surface (Fig. 2C).
- Two different sized holes allow the larger hole to hold regular needle caps for safe recapping postinjection (Fig. 2D) while the smaller hole allows recapping butterfly needles (Fig. 2E).
- Shorter height of needle-cap holes allows the hub of the needle cap to be exposed, thereby allowing a shielded syringe to be easily and securely recapped (Fig. 2E).

CONCLUSION

The newly designed needle-capping block is the optimal choice for use in both nuclear medicine and the nuclear pharmacy laboratories. The follow-up survey that we conducted among our technologists showed the new needle-capping block to be the favored device for preventing needle sticks in daily routine procedures. In addition to developing a more useful needle-capping block, our research has generated 2 positive outcomes within our area: (a) increased usage of needle-capping blocks; and (b) highlighted awareness of needle stick prevention.

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