Color-Coded Syringes for Anesthesia Drugs—Use With Care
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Problem: Readers of P&T have probably seen advertisements for, or might have even used, color-coded syringes that contain anesthesia drugs from major repackaging companies, such as PharMEDium, Ameridose, CAPS, and others (Figure 1). Since 2007, the companies have been marketing these syringes, which are now in demand by anesthesia providers (e.g., anesthesiologists, anesthetists, nurse-anesthetists) who previously had to prepare and label all drug syringes themselves.

A word of caution, however. Unless precautions are taken to prevent mixups with color-coded syringes, the Institute for Safe Medication Practices (ISMP) has concerns about the potential risks associated with devices. For many years, rolls of color-coded labels have been available to anesthesia providers. The colors are based on a standard set by the American Society for Testing and Materials (ASTM) for labels that the user applies in the operating room (OR).1 The colors are used to differentiate products, and each color refers to a particular drug class. For example, blue labels are used to indicate opioids (Figure 2), fluorescent red, neuromuscular blockers; yellow, induction agents; orange, tranquilizers; violet, vasopressors; and green for anticholinergics.

Although the ISMP has promoted color coding for user-applied labels among anesthesia providers, this system was not designed for labels used on commercial products. The ISMP, the American Medical Association (AMA), and the American Society for Health-System Pharmacists (ASHP), as well as other organizations, oppose color coding for commercial drugs and have voiced concerns about overrelying on color-classification systems as the primary way to identify a drug and about bypassing the recommended three readings of the drug label. The more colors that are used, the greater the risk of confusing a color and its meaning. Colors can also fade because of the quality of the label materials or printers.2,3

In 2005, Michael Cohen, ISMP President, testified before the FDA that scientific research was needed to determine whether such a system was safe.2,3 He explained that color could be used to differentiate products, to emphasize important information, or to enhance recognition of unique letter characters. He said that color coding should be reserved for high-alert drugs (e.g., insulin) but only after testing and feedback about prototypes. Color, he noted, can be effective but only when it’s one of several variables.

When anesthesia providers prepare drugs in the OR, they retrieve the needed medication from a cart, read the vial or ampule label, draw up the medication, and apply a color-coded adhesive label to the syringe. In most cases, only a single agent within each drug class is needed. Each drug has its own color, and anesthesia providers know what is in each syringe because they prepared it.

Commercially packaged, color-coded syringes also have different, easily recognizable colors for various drug classes of anesthetics. However, a risk remains: often there are multiple drugs within a class, each with very different properties. These drugs are all available in syringes of the same color—and sometimes in the same size.

Unlike anesthesia providers, who typically use a single drug within each class, commercial systems, when used to the fullest extent, can result in the use of many different agents within a class that share syringes of the same color, thereby raising the risk that the clinician will select the wrong drug. For instance, it’s possible to have three drugs—morphine, fentanyl, and hydromorphone—each with significant potency variations, all in blue syringes in the same physical area. A mixup of any one of these drugs can cause serious harm to the patient. A similar problem exists with same-colored syringes that contain vasopressors, tranquilizers, neuromuscular blockers, and so on.

Color-coding strategies have led to repeated product mixups ever since the FDA allowed ophthalmologists and manufacturers of eyedrops to use a color-coded classification system for this drug class. This practice can be especially problematic when staff members other than ophthalmologists dispense or administer these medications. Even though injuries might not be serious when a mixup occurs between various eye drops, a mixup between powerful parenteral anesthesia drugs—mostly high-alert medications—can prove fatal.

The ISMP is particularly concerned about mixups between various anesthesia drugs when color-coded syringes are available outside the OR, such as in ambulatory surgery units, emergency departments, or intensive-care units. Within the OR, most patients are intubated and monitored, and immediate care is available in case of a medication mixup. Outside the OR, mixups can often be difficult to recognize and manage.

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quickly; an error can go unrecognized if syringes are accidentally returned to the wrong storage area or if they are placed on a table with other syringes of drugs in the same class.

The testimony that the ISMP provided to the FDA mentioned how easily drugs within a color-coded class could be misidentified. People do not always read labels as carefully as they should. Instead, they might depend on a single variable, such as the color, shape, or size of the container, when selecting a drug. In a newsletter published by the Anesthesia Patient Safety Foundation, a letter to the editor mentioned that anesthesia providers do not always read the label because they think that they have time only to recognize the color, shape, or size of the intended drug or syringe.

SAFE PRACTICE RECOMMENDATIONS. To minimize the risk of syringe mixups, the ISMP would like to see commercial repackagers add a warning to the label to encourage anesthesia providers to use the syringes only within the OR. Repackagers should also consider modifying the ASTM standard by including the medication’s name along the borders and additional colors along the label’s edge to help differentiate products within each drug class.

Bar-coding systems would probably prevent confusion in most cases; currently, a bar code is applied to commercially available syringes. If the companies do not implement significant label changes or if health care facilities do not incorporate bar-coding capabilities, pharmacists who purchase prefilled syringes should have a system in place to ensure that the syringes are not used outside the OR.

The ISMP encourages hospitals that have not yet implemented bar-coding systems to work with anesthesiology departments to limit the variety of medications within a class. For example, prefilled syringes should be purchased for a specific opioid that is used most often in the OR, and the anesthesia staff should be required to prepare other opioids and affix labels that are applied by the user.

REFERENCES

The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site (www.ismp.org) or communicated directly to ISMP by calling 1-800-FAILSAFE or via e-mail at ismpinfo@ismp.org.