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Note that the form of Lugols referred to is 5%--most nowadays is 2%

Look Out for Lugol's

Error-Prevention Strategies for This Strong Iodine Solution

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PROBLEM: A couple of years ago, ISMP (Institute for Safe Medication Practices) Canada published a safety bulletin on oral dosing errors associated with Lugol's solution (potassium iodide and iodine), also referred to as strong iodine solution.[1] The organization had received three reports involving incorrect oral dosing of Lugol's solution. A quick search of the ISMP's national Medication Errors Reporting Program (MERP) databases showed that a dozen oral dosing errors have been reported in the past six years. Most dosing errors involved prescribing, dispensing, or administering *milliliter* (mL) doses of Lugol's solution when just a few *drops* were indicated. One contributing factor may be that oral liquid medications for adults and young children are typically dosed in milliliters, while drops are typically reserved for infants. Thus, an adult dose expressed in *drops* is uncommon. Another factor is that the product is used relatively infrequently and may be prescribed during an emergency, so unfamiliarity with the drug has been linked to many dosing errors.

5%

Lugol's solution contains 100 mg/mL of potassium iodide and 50 mg/mL of iodine. Given orally, the product:

1. Reduces thyroid vascularity—hence its use to reduce blood loss during thyroid surgery.
2. Temporarily inhibits thyroid hormone synthesis and secretion—hence its use in treating thyrotoxic crisis and in reducing the risk of thyroid storm after thyroid surgery.
3. Blocks thyroidal uptake of radioactive isotopes, thereby reducing the risk of thyroid cancer—hence its use in a radiation emergency or therapeutic/diagnostic exposure of radioactive iodine.

Lugol's solution is also approved for use as a topical antiseptic.

Of the three errors reported to ISMP Canada, one was described in detail in the bulletin.[1] This event involved an adult patient with Graves' disease who was admitted to the hospital with thyroid storm. The physician prescribed 4 drops of Lugol's solution to be given orally every eight hours. The intended dose of 4 drops would require approximately 0.2 mL of Lugol's solution. But this patient was accidentally given an entire 100-mL container of the solution in a single dose, which amounted to a total of 5 g of free iodine. Acute toxicity of Lugol's solution is related to its iodine content,[1] although the high potassium concentration can cause extreme irritation of the mucosal membranes.[2] Patients with an iodine overdose can experience metabolic acidosis, renal failure, hypotension, circulatory collapse, and death. This patient received more than a potentially lethal adult dose of free iodine (2 to 4 g).[1] Although his condition deteriorated and required intervention to manage the overdose, the patient recovered.

ISMP learned of one error that involved a correct prescription for 5 drops of Lugol's solution per dose, but the pharmacy dispensed the product with directions to administer 5 mL of the solution for each dose. In two other cases, the physician prescribed Lugol's solution in the correct dose and pharmacy dispensed the drug in the smallest volume bulk bottle (15 mL) with the correct instructions for use, but nursing staff administered the entire bottle, believing it contained a single unit dose of the drug. In both cases, the pharmacist had included a dropper for administration, but the device was overlooked. Both patients recovered.

A similar error reported to ISMP more than two decades ago resulted in a tragic outcome—the death of a young infant.[2] A doctor had ordered 0.05 mL (approximately 1 drop) of Lugol's solution three times daily for this infant with hyperthyroidism. Because the dose was so small, the pharmacist decided not to dispense the drug in an oral syringe. Instead he dispensed a 15-mL bottle of Lugol's solution to the unit, with directions for administering each dose on the label. He also dispensed an oral syringe for measuring and diluting the drug, and showed the evening-shift nurses how to measure and administer the drug. The doses were administered correctly the first day. But the following night, a nurse who had been off duty the night before assumed the bottle of Lugol's solution contained a single dose and tried to administer the entire bottle to the infant. After receiving 5 mL, the infant vomited, aspirated, went into respiratory arrest, and died. An autopsy revealed esophageal erosion from the high potassium concentration in the Lugol's solution (0.6 mEq/mL).[2]

We've also noticed several errors in which drops of Lugol's solution were prescribed for oral administration, but the solutions were thought to be eyedrops and were instilled into the eye, causing burning and tearing. One of the errors reported more than a decade ago involved an order to administer 10 drops of Lugol's solution mixed with "OJ" (orange juice), but nurses misinterpreted "OJ" as OD (right eye). The patient received several doses of Lugol's solution in his right eye. The error was identified when the patient complained to the physician about how painful the eye drops were.

SAFE PRACTICE RECOMMENDATIONS: The potential for harmful errors with the oral administration of Lugol's solution suggests the need to review current prescribing, dispensing, administration, and storage of this product and other iodine solutions to identify vulnerabilities in existing processes, and to implement safeguards.

Establish protocols. Ensure that protocols include information about managing acute hyperthyroidism, protecting the thyroid during exposure to radioactive iodine, and preoperative use of iodine solutions. The protocols should be readily accessible and include treatment and dosing information.

Provide dosing information. In addition to dosing information in protocols,

include recommended options for oral dosing of iodine therapy in pharmacy and prescriber order-entry systems and in other accessible drug-information resources. Include information regarding indications, usual and maximum doses, instructions for preparation and administration, and potential adverse effects. Ensure that medication dosing information displays correctly on order-entry screens, on labels printed in the pharmacy, and on medication administration records. You may also want to include supplemental drug information with the product when dispensing it to units.

Dispense in unit doses. Dispense Lugol's solution in a quantity appropriate for the intended and safe use of the medication—never in quantities that could be lethal if consumed as a single dose. For oral treatment of an individual patient, the pharmacy should dispense prepared, diluted unit doses whenever possible (dilution of the solution eases measurement of unit doses dispensed in oral syringes). If a bulk bottle of the solution must be dispensed, provide an appropriate measuring device, clear dosing instructions, and visible warnings on the container as noted below. Keep in mind that nurses who are accustomed to receiving unit doses of medications from the pharmacy are more prone to accidentally administering the entire container when a bulk supply of a liquid medication is dispensed, even in large volumes and with visible label warnings. Providing the smallest volume possible in bulk supplies may make nurses even more susceptible to administering the full volume for a single dose. Thus, dispensing unit doses of Lugol's solution is highly recommended.

Affix warnings. Clearly identify bulk amounts of medication, especially if nurses are accustomed to receiving medications from the pharmacy in unit doses. Place a warning on Lugol's solution containers stating that the total volume in the container would be toxic if taken as a single dose. Also affix a warning not to use this product in the eyes.

Provide education. Review drug therapy for hyperthyroidism and other uses of iodine with a special focus on precautions related to prescribing, dispensing, and administering these drugs.

Seek safer packaging. ISMP Canada and ISMP strongly encourage manufacturers to make Lugol's solution available for purchase in smaller volumes that would contain less than a lethal dose of iodine. Manufacturers should also provide an oral measuring device, such as a calibrated dropper, to facilitate measurement of very small doses of Lugol's solution for oral administration. Warnings should be placed on bottles that contain a total volume of free iodine that could be lethal if given as a single dose.

REFERENCES

1. ISMP Canada. Iodine overdose with Lugol's solution demonstrates need for safeguards for infrequently used medications in urgent situations. *ISMP Canada Safety Bulletin* 2011;11(7):1–3.
2. Cohen M. Medication errors: Lugol's solution fatal lapse in communication. *Nursing* 1994;24(7):19. ■