

ISMP Canada Safety Bulletin

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Alert: Wrong Route Incidents with Epinephrine

ISMP Canada recently received reports of 2 critical incidents involving an epinephrine dose intended for subcutaneous (SC) or intramuscular (IM) injection that was inadvertently administered as an intravenous (IV) bolus to patients requiring the drug for hypersensitivity reactions.

Incident Examples

The first incident involved an adult patient who was being treated for status asthmaticus. A 0.5 mg dose of epinephrine was administered by IV bolus (i.e., IV push), which resulted in ventricular tachycardia (a potentially life-threatening, rapid and erratic heart rhythm).

In the second incident, an allergic reaction secondary to a prophylactic antibiotic was suspected in a patient starting labour. Epinephrine 1 mg was given as an IV bolus for the suspected reaction.

In both cases, the epinephrine dose should have been administered SC or IM, and the patients required multiple interventions to prevent further harm.

In one of the incidents described above, the medication order was given verbally, and the staff receiving the order felt a sense of urgency. Because of previous experience with administering epinephrine by IV push (i.e., in cases of cardiac arrest), staff members believed that this was the appropriate way to administer this medication.

Background

When given as an IV bolus, epinephrine produces an immediate and profound response, including a sharp rise in heart rate and blood pressure and an increase in ventricular contraction.^{1,2} As a consequence, IV epinephrine is generally reserved for extreme, immediately life-threatening situations such as cardiac arrest.¹⁻³

In contrast, for the treatment of hypersensitivity reactions, including allergic reactions and status asthmaticus, epinephrine should generally be given SC or IM.¹⁻⁴ If epinephrine 1 mg/mL (1:1,000) from an ampoule or the more dilute 0.1 mg/mL (1:10,000) from a prefilled syringe is erroneously given by IV push or is administered rapidly as an infusion in situations where SC or IM administration is indicated, severe harm (e.g., cardiac arrhythmia or cerebrovascular hemorrhage) or death can occur.^{1,2} Table 1 lists the usual recommended doses of epinephrine for selected indications relevant to this topic.

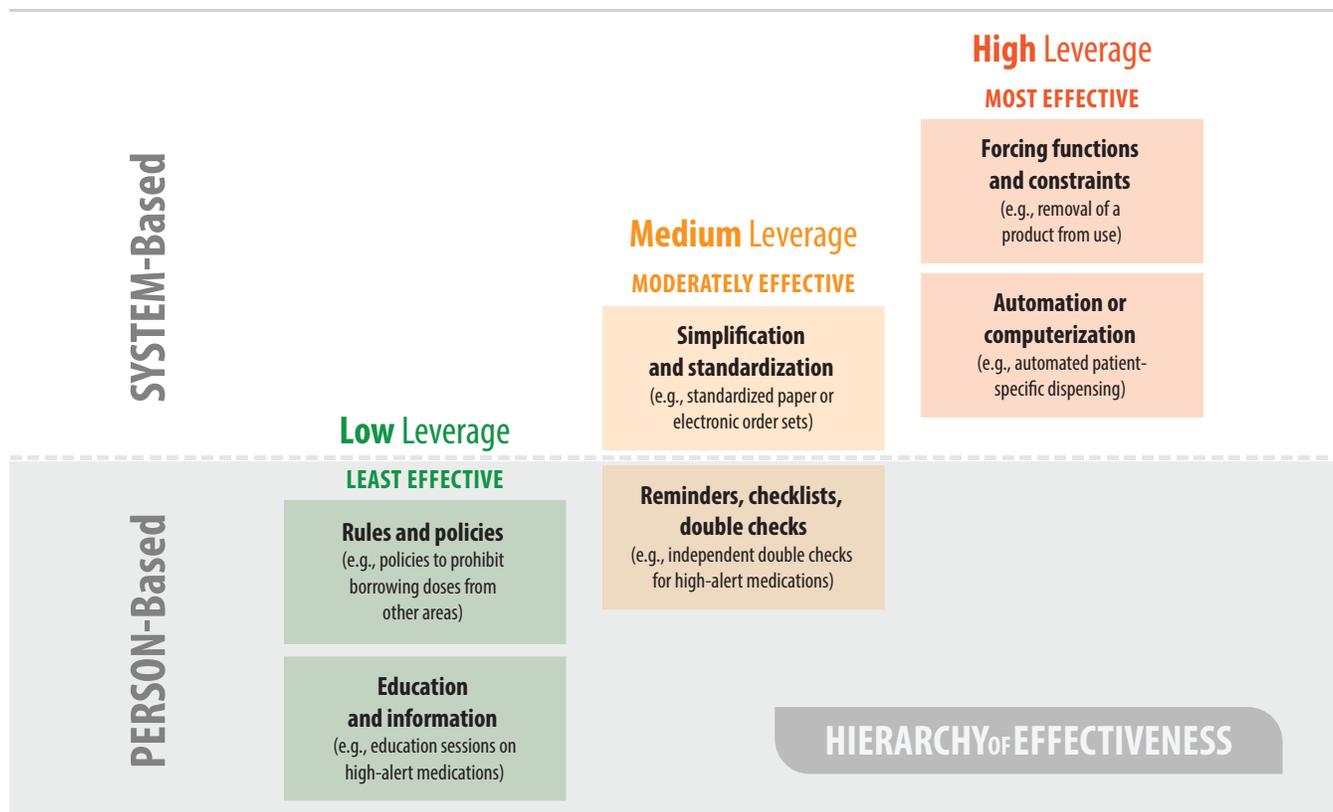
Discussion

When implementing error-prevention strategies (see Figure 1), consider a variety of strategies that focus on system issues and incorporate human factor principles.^{5,6} Lower leverage strategies may be easier and quicker to implement.⁵ But the most effective error reduction strategies involve forcing functions and constraints as they do not rely on individual attention and vigilance.⁶

Table 1. Usual Recommended Adult Dose of Epinephrine for Selected Indications

Indication	Recommended Route of Administration	Usual Adult Dose ^{2,4,7}
Hypersensitivity reaction		
Allergic reaction, status asthmaticus	SC or IM	0.2 to 0.5 mg
In patients with profound hypotension or those with inadequate response to previous epinephrine doses	IV infusion (intermittent, continuous)	In accordance with hospital policies and guidelines
Cardiac arrest	IV push	1 mg

Figure 1. Hierarchy of Effectiveness for Error Prevention Strategies

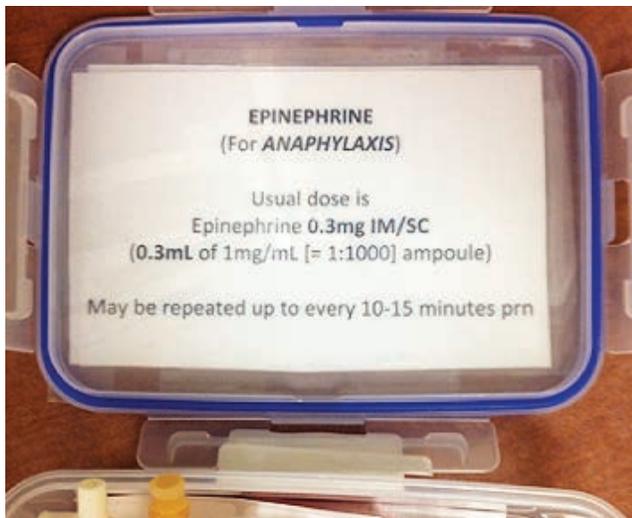


ISMP Canada is aware that some facilities are considering replacing epinephrine 1 mg/mL (1:1,000) ampoules with autoinjectors for treatment of hypersensitivity and anaphylactic reactions as a strategy (i.e., forcing function strategy) to prevent inadvertent IV administration of epinephrine in these situations. The organization where these incidents

occurred is also considering other strategies, such as the use of ampoules when IM or SC administration of epinephrine is required and vials when IV infusion is needed; creating anaphylaxis kits containing epinephrine ampoules with auxiliary labels to indicate that use of these ampoules should be limited to IM or SC administration; and physical segregation of

ampoules and vials in storage areas. Other facilities have implemented similar strategies (see Figure 2).

Figure 2. Example of an adult anaphylaxis kit containing epinephrine from one acute care facility (shared with permission). The epinephrine dose and route are both highlighted.



Healthcare facilities could also consider the following in combination with higher leverage strategies to minimize these types of errors:

- Using a preprinted order set for the management of anaphylaxis

- Recognizing that verbal orders may still be given (e.g., in the emergency room), establishing standardized processes for managing verbal orders may help decrease the potential for misunderstanding. For example, when verbal orders are required, prescribers and recipients of the verbal order should expect that the order will be repeated back and should listen actively to ensure that errors are intercepted and corrected before they reach the patient.⁸
- Ensuring that all healthcare professionals who may need to prescribe or administer epinephrine are aware of the appropriate dose range and corresponding route of administration for epinephrine in various clinical situations. Providing written reminders at the point of care (for example, a dosing chart where the epinephrine is stocked) may be helpful.⁹

If your organization has successfully implemented any of the above mentioned or other strategies that have enhanced the safe use of epinephrine (e.g., by preventing errors associated with inadvertent IV administration of epinephrine doses intended for SC or IM use), please contact ISMP Canada at cmirps@ismp-canada.org to share your experiences.

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More Reports of Eye Injuries Involving Clear Care

Clear Care solution contains 3% hydrogen peroxide and should not be used directly in the eye or as a rinsing solution for lenses. Instead, it must be used with a special lens case that neutralizes the hydrogen peroxide. In numerous incidents reported to SafeMedicationUse.ca, consumers have experienced pain and burning when Clear Care solution that was not neutralized came into direct contact with their eyes.

ISMP Canada has published three [SafeMedicationUse.ca alerts](#) warning consumers about this problem, and an [alert for health professionals](#) was published in a 2013 issue of the ISMP Canada Safety Bulletin. In April 2013, a [Health Canada Advisory](#) warned consumers and healthcare professionals about the issue, and Health Canada asked manufacturers to update the labels of Canadian products to highlight the risks of improper use. Since then, warnings have been added to the outer and inner labels of the Clear Care product. However, ISMP Canada has received a report of an incident that occurred despite the new labelling. The consumer used Clear Care solution directly from the bottle to rinse a contact lens and suffered severe pain caused by a corneal burn.



Figure 1. Photo of a consumer's eye after an injury with Clear Care

The latest SafeMedicationUse.ca alert, [More Reports of Eye Injuries Involving Clear Care](#), reminds consumers not to assume that all contact lens solutions are the same, to check product labels and inserts carefully, and to follow the product instructions step by step. The alert also suggests that, to avoid mix-ups at home, lens cleaning solutions containing hydrogen peroxide should be kept in a location separate from solutions used to rinse or moisturize lenses. The alert also provides “Tips for Practitioners” and encourages vendors of hydrogen peroxide-based contact lens cleaning solutions (such as Clear Care) to consider ways of separating these solutions from multipurpose contact lens solutions in retail settings.

ISMP Canada is urging healthcare practitioners—particularly eye care practitioners and community pharmacists—to share the SafeMedicationUse.ca alert [More Reports of Eye Injuries Involving Clear Care](#) with consumers and patients. Please consider posting a copy of the alert near displays of hydrogen peroxide-based lens cleaning solutions.



Consumers Can Help Prevent
Harmful Medication Incidents

SafeMedicationUse.ca



The Canadian Medication Incident Reporting and Prevention System (CMIRPS) is a collaborative pan-Canadian program of Health Canada, the Canadian Institute for Health Information (CIHI), the Institute for Safe Medication Practices Canada (ISMP Canada) and the Canadian Patient Safety Institute (CPSI). The goal of CMIRPS is to reduce and prevent harmful medication incidents in Canada.



The Healthcare Insurance Reciprocal of Canada (HIROC) provides support for the bulletin and is a member owned expert provider of professional and general liability coverage and risk management support.



The Institute for Safe Medication Practices Canada (ISMP Canada) is an independent national not-for-profit organization committed to the advancement of medication safety in all healthcare settings. ISMP Canada's mandate includes analyzing medication incidents, making recommendations for the prevention of harmful medication incidents, and facilitating quality improvement initiatives.

Report Medication Incidents

(Including near misses)

Online: www.ismp-canada.org/err_index.htm

Phone: 1-866-544-7672

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