

Concentrated Potassium Chloride: A Recurring Danger

ISMP Canada has worked with hospitals across Ontario and other hospitals in other provinces to identify and implement strategies to promote the safe use of potassium chloride (KCl). A key example safeguard is the removal of concentrated KCl from all patient care areas. Even if hospitals have removed stock of this dangerous drug from their nursing units they must remain vigilant and not let their guard down. We have received reports of sentinel events involving other situations where potassium is used. These include inadvertent injection of other potassium salts (acetate, phosphate); wrong rates of infusion; and the use of potassium chloride as an incorrect additive.

ISMP Canada has recently learned of an adverse drug event resulting from the inadvertent addition of potassium chloride to a renal dialysis fluid for Continuous Renal Replacement Therapy (CRRT). The hospital has shared information about this case recognizing that a similar error could occur in other hospitals:

- A pharmacy technician, in the process of setting up a batch preparation of dialysis solution, picked up a carton of 12 x 250 mL Concentrated Potassium Chloride 2 mmol/mL bottles, instead of a carton of 12 x 250 mL bottles of 23.4 % Sodium Chloride (NaCl) for Injection. Since 85 mL of sodium chloride solution was needed for each 3-litre dialysis solution, and because one batch preparation was 35 bags, an entire carton of 12 bottles of 250 mL of NaCl solution was required. The cartons of

stock potassium chloride solutions were located near the sodium chloride solutions.

- The selected items for dialysis preparation were checked against the manufacturing or ingredient worksheet by a second pharmacy technician in the preparation area. The second technician did not notice that the carton was the wrong one.
- During the manufacturing process, 85 mL of potassium chloride 2 mmol/mL were added to the 3-litre bags of dialysis solution.
- A third technician later checked the completed batch of dialysis solutions. Again, the incorrect ingredient went unnoticed.

Each of the 3-litre solutions contained a total of 170 mmol potassium chloride. This amount given over a short period of time, such as 3 hours, is lethal. When one of the renal dialysis patients died suddenly, the physician identified a serum potassium of almost 8 mmol/L. An immediate laboratory test carried out on the dialysis solution revealed the error. The hospital then recalled the remaining bags of dialysis solution. Officials reviewed the charts of all other patients who had received continuous dialysis since the batch had been produced. It was determined that a second patient was probably exposed to this same batch and had died as a result of hyperkalemia. Five of the dialysis bags had been utilized for two patients and the other 30 bags were successfully retrieved from the patient care area.



Figure 1. Cartons containing 250mL size of Sodium Chloride and Potassium Chloride.



Figure 2. Bottles of Sodium Chloride and Potassium Chloride, by Baxter.

The hospital is undertaking an in-depth incident review of this tragic event. Interim findings have identified a number of contributing factors: (1) The cartons containing the 250 mL size bottles are similar in appearance. (2) The drug name text (critical information) on the carton has significantly smaller font size than both the product identification number and the manufacturer logo (Figure 1). (3) The glass bottles are identical in shape and size (Figure 2). (4) The cardboard box cartons were stored in close proximity to each other in the pharmacy storage area.

The hospital has instituted a number of immediate steps to safeguard against a similar error.

- The concentrated potassium chloride solutions have been moved to a completely separate and secured area.
- The sodium chloride solution is now purchased from a different vendor to avoid packaging similarities and thus help to better differentiate between the potassium and sodium products.
- A full review of the preparation and checking processes and workflow are being undertaken.

ISMP Canada has previously recommended the use of visible auxiliary labels and separate storage location of concentrated potassium chloride.¹ Hospitals may also wish to explore the use of commercially available dialysis solutions. The Hospital Medication Safety Self-Assessment™ (available from ISMP

References:

1. U D, Hyland S. Medication Safety Alerts. Pharmacists' role in preventing medication errors with potassium chloride. *Can J Hosp Pharm* 55(4):278-280.
2. ISMP's list of high-alert medications. Available at <http://www.ismp.org/MSAarticles/highalert.htm>. Accessed March 26, 2004.
3. The virtues of independent double checks – they really are worth your time! Available at <http://www.ismp.org/msaarticles/time.htm>. Accessed March 26, 2004.

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ISMP Canada is a national voluntary medication incident and 'near miss' reporting program founded for the purpose of sharing the learning experiences from medication errors. Implementation of preventative strategies and system safeguards to decrease the risk for error-induced injury and thereby promote medication safety in healthcare is our collaborative goal.

To report a medication error to ISMP Canada: (i) visit our website www.ismp-canada.org or (ii) email us at info@ismp-canada.org or (iii) phone us at 416-480-4099. ISMP Canada guarantees confidentiality and security of information received. ISMP Canada respects the wishes of the reporter as to the level of detail to be included in our publications.

Canada) is also recommended as a reference tool for evaluating and implementing medication system safeguards.

There has been a movement in some Canadian hospitals toward a "tech-check-tech" approach, where pharmacy technicians are responsible for checking the work performed by other technicians. This trend has been accelerated by the shortage of pharmacists and the concurrent demand for direct patient care pharmacy services. However, in order to delegate duties and responsibilities, it is important that protocols and supports be in place to ensure that processes are carried out accurately and safely. Pharmacy regulatory authorities need to work with professional organizations to better define the scope and standards of pharmacy technician practice in hospitals. ISMP Canada recommends that a pharmacist oversee the operations and be readily available to technicians.

Regardless of the type of personnel involved, it is crucial that a safety infrastructure be established. This should include appropriate policies and procedures, adequate staff training, competency validation and regular recertification. Particular attention should be paid to policies, procedures and ongoing staff training required for high alert drugs.² The training should include information about such drugs, how they can be hazardous, and the rationale for the safeguards.

ISMP Canada emphasizes the need for "independent check processes"³ in the preparation of batched products. Designing workflow to ensure that the checks are truly independent of each other is an ongoing challenge and a critical endeavour for all healthcare practitioners.

This incident brings to attention the benefits of bar coding. Ironically, in the year of 2004, grocery and sporting goods stores have implemented bar coding technology, but healthcare continues to function without it. Healthcare practitioners, administrators, manufacturers and regulatory authorities must move bar coding technology forward as a priority for implementation.

ISMP Canada has met with Baxter Corporation (Canada) to address the concern and discuss possible changes to the bottle label and carton of the concentrated potassium chloride product. Health Canada has also been informed of this important issue.

ISMP Canada acknowledges and is grateful to the hospital that provided the information about this event to allow for sharing and learning throughout our community.