The Institute for Safe Medication Practices Canada (ISMP Canada) is an independent national nonprofit agency established for the collection and analysis of medication error reports and the development of recommendations for the enhancement of patient safety.

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Appropriate Anticoagulant Use – A Patient Safety Priority

In the February 2006 *Safety Bulletin*, ISMP Canada shared findings from its analysis of voluntary reports of medication incidents.[1] Heparin and warfarin were 2 of the top 10 drugs most frequently reported as causing harm as a result of a medication error. The occurrence of adverse events involving anticoagulants has been highlighted as one of the top patient safety issues in other countries, including the United States and the United Kingdom.[2,3]

There is evidence to support the finding of high numbers of preventable adverse drug events with use of anticoagulants.[4,5] There is also evidence that underuse of anticoagulants may lead to significant patient harm. Venous thromboembolism (VTE), which encompasses both deep vein thrombosis (DVT) and pulmonary embolism, is one of the most common serious complications of a hospital stay.[6] Thromboembolic complications were among the most common causes of extended hospital stay and excess mortality.[7] Approximately 10% of hospital deaths have been attributed to pulmonary embolism.[6] The rates of objectively confirmed DVT have been well defined in a number of patient groups. For example, if thromboprophylaxis is not used, the reported rates of objectively confirmed DVT are 10% to 20% in medical patients, 15% to 40% in general surgical patients, and 40% to 60% in those who have undergone major orthopedic surgery.[6] Although studies have demonstrated the value of thromboprophylaxis,[8] gaps persist with the provision of this patient safety intervention. The Agency for Health Research and Quality identified thromboprophylaxis as one of the top clinical practices supported by evidence for more widespread implementation.[9]

As part of a collaborative initiative to understand the patient safety issues related to the use of anticoagulants, ISMP Canada conducted an *Anticoagulant Safety Survey* of Canadian hospitals in spring 2006. The goal of the survey, the first pan-Canadian survey of its kind, was to gain information on the use of VTE prophylaxis in hospital patients, the storage and use of heparin products, and the management of patients receiving anticoagulants. Analysis of the results has recently been completed, and details of the results will be provided to participating hospitals early in 2007. A manuscript is also being prepared for publication.

The purpose of this *Safety Bulletin* is to provide initial feedback and to inform stakeholders of two key preliminary findings:

(i) vials of high-concentration heparin are widely available in patient care areas in many hospitals across the country, and

(ii) the use of VTE prophylaxis in Canada is variable and not well measured.

To optimize patient care and patient safety, strategies for system enhancements need to consider safe storage and handling of anticoagulants, as well as appropriate use. We share here the learning from two recently submitted medication incident reports.

Medication incident case report 1

> *An adult patient was admitted to hospital for surgery. A triple-lumen central venous access device (CVAD, also known as a central venous line) was inserted preoperatively. Postoperatively, each of the three ports of the CVAD was flushed three times a day with heparin flush solution. No other anticoagulant was prescribed. On postoperative day 5, the patient experienced a bleed and a hypotensive episode. Blood work revealed a significantly elevated activated partial thromboplastin time (aPTT) at >180 seconds and an elevated international normalized ratio (INR). Computed tomography (CT) of the head, the following day, revealed intracerebral hemorrhage. Although vitamin K, plasma, and protamine were given, the patient died within the next 24 hours.*

The hospital completed a detailed investigation in follow-up. While no specific event was determined to have directly contributed to the patient's death, a review of the circumstances of the case suggested the possible administration of a higher dose of heparin than was intended. The storage of high-concentration heparin vials close to low-concentration heparin flush products on the nursing unit was identified as a risk for error.

Patient injury as a result of a substitution error can occur in any hospital where vials of concentrated heparin, such as 10,000 units/mL, are available in patient care areas. An incident involving inadvertent administration of heparin 10,000 units/mL as a "flush" of a CVAD was previously described in an *ISMP Canada Safety Bulletin*.[10] The following **recommendations** have been developed from a review of reported incidents and consultation with reporting organizations.

- Eliminate the 10,000 units/mL formats of heparin from patient care areas whenever possible. Higher-concentration heparin products such as the 25,000 units/mL in 2 mL vials should not be available in patient care area medication stock.
  - Use marketed, premixed, dilute solutions of heparin for intravenous indications.
  - Use heparin 5,000 units single-dose ampoules or pre-filled syringes for subcutaneous administration whenever possible.
- Standardize the concentrations of heparin used in the hospital in an effort to limit heparin products needed in patient care

area stock. "Often, more concentrations than necessary are present in both the pharmacy and patient care areas."[11]

- Critically review existing protocols for the use and care of CVADs. Provide readily accessible protocols that outline procedures for flushing and locking of the various CVADs. Some hospitals have developed summary charts of protocols as a reference for use at the point of care.
- Educate practitioners about the association between unexpected clinical symptoms and medication incidents. Investigation of unexpected elevation of aPTT or INR, or of unexpected bleeding, should consider the possibility of medication error.
- Develop guidelines for reversal of excessive anticoagulation.

Medication incident case report 2 (The following report demonstrates the importance of identifying patients at risk for VTE to ensure appropriate thromboprophylaxis.)

> *A patient was admitted with a bowel obstruction secondary to ovarian cancer. She underwent laparotomy to remove a recurrent tumour. Her medical history included DVT associated with her previous cancer surgery, for which she had required anticoagulant treatment for 3 months. No thromboprophylaxis was initiated during the current 4-day hospital stay. Two days after discharge, she returned to the emergency department with acute onset of shortness of breath. She also had tachycardia, tachypnea, and hypoxemia. CT of the chest revealed bilateral pulmonary embolism. Therapeutic doses of anticoagulants were initiated. Later in the day, the patient suddenly became unresponsive and hypotensive. Resuscitation efforts were unsuccessful. Autopsy revealed massive pulmonary embolism as the cause of death.*

A review of this case indicated that the key contributing factor leading to the patient's death was failure to use thromboprophylaxis in a high-risk patient. The risk factors included previous DVT, major abdominal surgery, and cancer.

The following **recommendations** have been derived through collaboration with clinical experts and take into account preliminary anticoagulant survey data.

- Assess every patient for risk of VTE. (An initiative of the Joint Commission on Accreditation of Health Care Organizations [JCAHO] suggests that this assessment take place within 24 hours of admission.[12])
- Provide every patient at significant risk for VTE with evidence-based thromboprophylaxis consistent with the degree of risk.[6]
- Develop a formal written policy on the prevention of VTE, with supporting protocols and order sets (pre-printed or electronic).
- Develop quality measures and regularly assess compliance with the thromboprophylaxis policy. If compliance is suboptimal, implement quality improvement actions, followed by re-assessment.

In collaboration with Dr. William Geerts of the Thromboembolism Service at Sunnybrook Health Sciences Centre, a pilot project is under way in Ontario (supported by the Ontario Ministry of Health and Long-Term Care) to explore methods to enhance the application (i.e., knowledge translation) of evidence-based guidelines for VTE prophylaxis. The goal is to develop, implement, and evaluate a multi-component intervention to increase the adoption of evidence-based clinical practice guidelines for thromboprophylaxis in hospital patients. The results will be shared nationally.

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Look-Alike Product ALERT

Concentrated Potassium Chloride (10mL) and Heparin Lock Flush Solution 10 units/mL (10 mL)

ISMP Canada has received two 'near miss' reports describing replenishment of patient care area stock with concentrated potassium chloride instead of the intended heparin product. The packaging and labelling of the 10 mL concentrated potassium chloride product appear similar to the packaging and labelling of 10 mL heparin 10 units/mL "lock flush solution" (shown in Figure 1).

Potassium chloride is fatal if administered intravenously in undiluted form. As a result of initiatives to remove concentrated potassium chloride from patient care areas, the risk of substitution errors with these two products has been lessened. However, the risk remains in pharmacy departments.

After meeting with ISMP Canada to discuss the problem, the manufacturer, Hospira, is assessing options to enhance the distinction between the vials and cartons of the two products. In the interim, the following strategies are suggested to reduce the risk of substitution errors:

1. Ensure distinct and separate pharmacy processes, including segregated storage for concentrated potassium chloride.
2. Apply auxiliary labels and alerts in storage areas for concentrated potassium chloride.

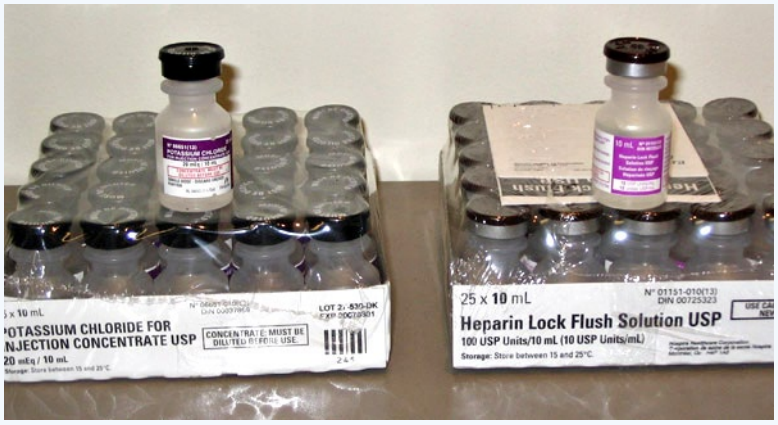

Figure 1. Concentrated potassium chloride, 20 mmol (mEq) in 10 mL vials, with a purple and white label and black cap (at left). Heparin, 10 units/mL in 10 mL vials with a purple and white label and dark brown cap (at right). Both products are manufactured by Hospira. Hospira is the only Canadian manufacturer of small volume concentrated potassium chloride. ISMP Canada gratefully acknowledges the reporter who submitted this photograph.

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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.

Medication Incidents (including near misses) can be reported to ISMP Canada:

(i) through the website http://www.ismp-canada.org/err_report.htm or

(ii) by phone: 416-733-3131 or toll free: 1-866-544-7672.

ISMP Canada can also be contacted by e-mail: cmirps@ismp-canada.org. ISMP Canada guarantees confidentiality and security of information received, and respects the wishes of the reporter as to the level of detail to be included in publications.

A Key Partner in the Canadian Medication Incident Reporting and Prevention System