

*This series brings you up-to-date information about medication safety issues and strategies to prevent medication errors. It draws on Australian incidents and US experience, including (with permission) material from ISMP Medication Safety Alert! a bulletin published by the US Institute for Safe Medication Practices <www.ismp.org>. This series is coordinated via the Committee of Specialty Practice in Medication Safety (Chair, Rosemary Burke, Director of Pharmacy, Concord Hospital, NSW). Australian incidents are collated and editorial recommendations made by Penny Thornton (Pharmacy Services Manager, The Children's Hospital, NSW; e-mail: pennyt2@chw.edu.au).*

## AUSTRALIAN INCIDENTS

### Oxy confusion again

A 78-year-old female with rapidly progressing motor neurone disease was referred to palliative care for management of her dyspnoea and anxiety. She was started on continuous morphine SC infusion and it was noted the next day that she had a large, itchy wheal at the infusion site. Her treatment was changed on Friday afternoon, to continuous oxycodone (Oxynorm) SC infusion 10 mg per 24 hours. The palliative care team discussed the changes with nursing staff and emphasised that although the oxycodone injection was new, it was available from the pharmacy. Everyone on the ward appeared happy with the order and the team withdrew and were off duty over the weekend. On Sunday afternoon the palliative care registrar was on-call for the hospital and was informed that an error had occurred in the patient's care. Ward staff had inadvertently made up the infusion with oral oxycodone (Oxynorm) liquid and this formulation had been delivered from Friday evening and was discovered after the third syringe had been prepared and infused for a short time. The patient was reviewed by the palliative care team on Monday morning. Her symptoms had ameliorated slightly but there were no adverse sequelae from the wrong formulation administration. She was afebrile throughout with no evidence of local or infective reaction. Root-cause analysis of the incident highlighted the following issues:

- inadequate hand-over between staff involved in the decision process on the Friday afternoon and staff working in the evening who were responsible for preparing the therapy;
- injectable medication not ordered at appropriate time from pharmacy;
- lack of knowledge and experience with oxycodone;
- lack of knowledge and experience with the administration of SC infusions of opioids;
- failure of checking processes to identify that an oral product was being administered parenterally;
- use of trade name in physician's order may have assisted a sound-alike medication error (same name used for both oral solution and injectable product); and
- lack of/inadequate specialist palliative care services over the weekend and out of hours

[Australian Incident 71, December 2007]

### How are verbal heparin orders translated?

Never assume parenterals are prepared the same way in every hospital. In one major hospital, a verbal order was given for heparin 25 000 units to be given at 20 mL/hour. A syringe was prepared and administered for 2 hours until the alarm was raised as the syringe was almost empty. It was discovered that the patient had received 10 000 units/hour for 2 hours (10 x overdose). Protamine was administered and the patient suffered no adverse consequences. It was found that at this hospital, usual practice was for heparin infusions to be prepared as 25 000 units in 50 mL (500 units/mL) and run through a syringe driver. The prescriber used to practice at a hospital where 25 000 units of heparin was added to 500 mL (50 units/mL) and had assumed that this would be similarly prepared. Over or

underdosing of parenteral medication may occur when prescribers move between institutions without being familiar with local practice. When new medical staff start, be alert for this type of error. This is a reason to avoid verbal orders and to ensure that orders are *always* prescribed in writing for clarity. [Australian Incident 72, December 2007]

### Insulin – a high-risk medication

Two incidents are reported in which 80 units of insulin was administered to patients when 8 units was the intended dose. An anaesthetist drew up what he thought was a dose of 8 units of Actrapid insulin in theatre. This was checked by the nurse and administered to the patient. The nurse later realised that a tuberculin 1 mL syringe had been used instead of an insulin syringe and that 0.8 mL, or 80 units had been administered. The patient required glucose infusion and increased monitoring. Only insulin syringes with units of insulin equivalents clearly marked or insulin pen devices should be used to measure insulin.

### ... and check unusually high doses

A medical registrar interpreted a verbal order by a consultant, for Protaphane insulin 8 units, for a newly diagnosed diabetic, as 80 units and wrote this on the medication order. The dose was administered by two graduate nurses. The consultant later rang to change the order to 16 units, at which point the error was realised. The staff were unaware of appropriate insulin doses and/or unaware that the patient was a newly diagnosed diabetic.

- Insulin doses range from 0.5–1 units/kg/day in type 1 diabetes and 0.3–0.6 units/kg/day in type 2 diabetes. Single doses are unlikely to be greater than 25 units for fast-acting and intermediate-acting insulin (long-acting insulin such as glargine and detemir may be seen in higher doses). High doses should be treated with *extreme suspicion* and questioned with the prescriber.
- Consider use of 50 unit syringes only in ward areas

[Australian incident 73, December 2007]

### Desmopressin – an unfortunate route substitution

A baby was discharged from a paediatric hospital on oral desmopressin 10 microgram. For each dose the mother was taught by the pharmacist to dissolve a 200 microgram tablet in 20 mL water, and administer 1 mL of the dilution to the baby. Five days supply was dispensed on hospital discharge and she was advised to see her GP for it to be prescribed for ongoing care. Having received the prescription she took it to her community pharmacist and described the process she undertook and how time consuming it was. The community pharmacist then dispensed desmopressin intranasal spray, explaining that it would be easier to administer a 10 microgram dose intranasally. She went away pleased but puzzled that this option had not been offered to her by the hospital pharmacy. The baby was readmitted to hospital a few weeks later suffering seizures due to decreased sodium levels. Intranasal desmopressin has a higher bioavailability than oral desmopressin. It would have been acceptable if intranasal desmopressin had been given orally to this patient. Although

the hospital pharmacist had chosen the most cost-effective option in view of the prospect of long-term use, she had not explained the rationale behind her decision. [Australian Incident 74, February 2008]

## US SAFETY BRIEFS

### Errors with unlabelled syringes are surprisingly common!

Research shows that the incidence of errors with injectable drugs is higher than with other forms of medications. Studies also suggest that half of all harmful medication errors originate during the drug administration phase; about two-thirds of these errors involve injectable drugs. Several factors can increase the risk of errors and harm with injectable drugs, such as:

- narrow therapeutic index drugs;
- concentrates requiring further dilutions;
- complex calculations, such as converting a dose from mmol to mg;
- multiple manipulations needed to prepare the drug (e.g. vial-to-syringe transfer, syringe-to-syringe transfer, filters);
- reconstitution of powders often requiring special diluents;
- use of part of a vial or more than one vial for a single dose;
- non-standard handling/special precautions (e.g. light protection, in-line filter, incompatibilities);
- inadequate and/or inaccessible drug information;
- drug preparation in clinical areas instead of the pharmacy, with limited or absent labelling of the product.

There is significant risk associated with preparation of injectable products in clinical areas. A 15-year-old boy with a history of malignant hyperthermia received the contents of an unlabelled syringe that a surgeon thought contained Marcain (bupivacaine with adrenaline). The syringe contained 30 mL of adrenaline 1:1000, which a nurse had drawn up to add to several bags of normal saline, but she was called away unexpectedly and left the unlabelled syringe on a tray near the patient. The patient's blood pressure increased after local injection of the adrenaline into his limb, initially leading staff to believe he was experiencing malignant hyperthermia. But the error was recognised after the patient developed ventricular tachycardia and pulmonary oedema. He recovered without permanent harm. Just before a Persantin (dipyridamole) stress test, a nurse prepared a syringe of aminophylline 75 mg from a multidose vial, but did not label the syringe. The aminophylline (for emergency reversal of the effects of dipyridamole) was not needed, and the unlabelled syringe was left in the room with the patient. The nurse stepped out of the room as a nuclear medicine technician stepped into the room to administer an IV dose of thallium. Since the unlabelled syringe had been placed where saline flushes were usually kept, the technician assumed that it was saline and used it to flush the patient's IV access port. The nurse returned to the room just as the technician finished giving the aminophylline. The patient was monitored but experienced no serious adverse effects. The American Nurses Association has released the results of an online survey about the challenges of labelling syringes containing injectable drugs. The 2007 survey of more than 1000 nurses across the US revealed that an overwhelming majority (97%) are worried about medication errors, and that more than two-thirds (68%) believe medication errors could be reduced with more consistent syringe labelling. Nearly half (44%) of the nurses said they inject drugs via a syringe more than five times each shift, and one-third (37%) administer injectable drugs at least once per shift. However, only one-third (37%) of nurses reported that they always label syringes. Equally concerning, was that more than one in four (28%) nurses never label syringes when administering medications. Nurses who responded to the survey report that the following factors

interfere with or prevent routine labelling of syringes:

- labels may cover the gradations on the syringe barrel (65%);
- lack of a suitable label (55%);
- labels may impair the ability to accurately check the dosage when comparing the order (39%);
- labels may make syringes hard to handle (31%);
- labels detach from the syringe (30%); and
- labels sometimes make it difficult to attach the syringe to a pump (24%).

To reduce risks associated with unlabelled syringes, consider the following: **Pharmacy dispensing.** Have pharmacy dispense ready-to-administer or ready-to-use injectable products in labelled syringes for individual patients. **Use prefilled syringes.** When possible, use commercially available, prefilled syringes of medications, which are already labelled. **Provide labels.** Commercially available labels for syringes should be provided and stocked in all drug preparation areas. Offer nurses the opportunity to assess several label formats and select a standard format that best meets their needs. Tape is not suitable for labelling syringes. **Define label placement.** Establish guidelines regarding the placement of labels on syringes, including directions on how to avoid interference with viewing gradations on the syringe barrel and the contents of the syringe, or interference with use/function of the syringe. The label should be applied directly below gradation lines so that the scale, name, and strength/dose of the drug remains visible during administration. The label should be oriented in a manner that facilitates viewing when a right-handed person holds the syringe. **Syringe safety features.** Promote the procurement of syringes that offer inherent safety features. For example, for certain clinical areas, explore the possibility of using commercially available syringes that offer a write-on stripe that allows annotation of critical information directly onto the syringe barrel using typical writing instruments. **Discard unlabelled syringes.** Do not assume that you know what is contained in an unlabelled syringe. Discard unlabelled syringes and report the event as a hazardous condition. No syringe should leave the practitioner's hand unless it is labelled. **Monitor labelling practices.** Reinforce and monitor compliance with a policy that requires all syringes containing injectable drugs to be properly labelled. [ISMP Medication Safety Alert! 15 November 2007]

**Australian note:** The NSW Therapeutic Advisory Group SAFER committee is finalising recommendations for labelling all source, conduit and entry portals through which parenteral medication is administered.

### Persistence saves patient's life

An 85-year-old man was admitted to hospital with a 3 week history of confusion, forgetfulness, and weakness. He had also been receiving methotrexate for psoriasis. A home medication reconciliation sheet listed the patient's medications, including oral methotrexate 25 mg every Saturday at breakfast and lunch. The medication reconciliation sheet was also used at the hospital as an order sheet. A physician ticked a box on the form to continue the order and signed the sheet. A typical dose of oral methotrexate for psoriasis is 2½ mg 12-hourly for 3 doses once a week. Doses may be gradually adjusted to achieve optimal clinical response but should not ordinarily exceed 30 mg/week. When the pharmacist received the order, he recognised that the 50 mg weekly dose of methotrexate was high, so he asked the nurse to confirm it. The patient verified that the dose was 25 mg. Based on information available in the computer system, the pharmacist was unaware that the patient was confused. He entered the prescribed dose and dispensed

the medication. Before any doses were administered, a second pharmacist questioned the order. The patient continued to state that he was taking 25 mg for each dose. Still not satisfied, the second pharmacist called the patient's family and asked them to look at the prescription container, which noted that the patient was taking 2.5 mg, not 25 mg, for each dose. The order was changed, and the patient received the correct dose. Had the error gone undetected, the wrong dose would have continued on discharge and severe adverse effects would have occurred. In fact, the persistence of the second pharmacist probably saved this patient's life. Use of the admission medication reconciliation sheet as an order sheet may foster prescribing without careful consideration of each drug order. When a patient is confused or is a questionable historian, they should not be relied on as the sole source of information when obtaining medication histories or completing medication reconciliation. Continue to ask questions and be persistent when something does not look right, whether obtaining the patient's medication history, or prescribing, dispensing, and administering a drug. Tell patients to bring medication containers along when admitted to hospital. Also note that the first time we mentioned the actual methotrexate dose, we referred to it as 2½ mg; this reduces the potential for confusion with 25 mg (a 10-fold overdose). *[ISMP Medication Safety Alert! 13 December 2007]*

#### **Mix-ups—sterile water and sodium chloride bags**

A bag of 1000 mL of sterile water for injection was mistakenly dispensed to a dialysis unit and administered instead of 1000 mL of 0.9% sodium chloride injection. The packaging is similar for both products. Although the sterile water bag has a red, boxed warning under the name (in Australia this box is not used but the bag label states 'Caution Hypotonic'). The IV fluids were obtained by a pharmacy technician, checked by a pharmacist, delivered to the dialysis unit, and later taken from stock and administered by the nurse. The error was discovered after 400 mL was administered. We have previously mentioned errors related to the IV administration of sterile water for injection and the harm that can result from haemolysis when administering this hypotonic product. Sterile water is necessary for compounding IV solutions, but sterile water products should never leave the sterile compounding area. Contributing factors in this case were that both bags contained the same volume, same colour lettering in the same size font, packaged in clear bags and stored in the IV room. Sterile water for injection should be segregated and stored with warnings that the bags should never leave the pharmacy. The hospital where this occurred now places a fluorescent warning sticker on sterile water bags. Sterile water for injection is available in 2 L (or larger) containers for IV compounding. The difference in size of these larger bags can help reduce the risk of confusion with other 1 L IV solutions. Labelling on sterile water products is inconsistent among the various manufacturers. The USP requires a statement that these products are not suitable for intravascular injection without first being made isotonic by the addition of a suitable solute. However, the warning blends in with other label text and is not readily seen on all containers. We are aware of other cases of direct injection of sterile water, and have asked the FDA and manufacturers to place easily recognisable warnings on all large volume parenteral containers of sterile water for injection. Manufacturers have begun to respond.

*[ISMP Medication Safety Alert! 13 December 2007]*

#### **Refrigerator monitoring**

Various patient safety standards and state regulations note the importance of reliable temperature monitoring for refrigerators and freezers. Manual checks are the rule in many pharmacies and patient care areas; these checks are cursory and problems are not recognised until after patients are adversely affected. The Center for Disease Control estimates that hundreds of thousands of doses of vaccines are wasted each year because of poor refrigeration at clinics, hospitals, and doctors' offices. A December 2007 USA Today article <[www.usatoday.com/news/health/2007-12-04-spoiled-vaccines\\_N.htm?loc=internalskip](http://www.usatoday.com/news/health/2007-12-04-spoiled-vaccines_N.htm?loc=internalskip)> mentioned that more than 1000 Iowa families were notified that they needed to get their children revaccinated. State officials found that the refrigerator at the clinic where the vaccines were administered repeatedly dropped below freezing during a 17 month period in 2005 and 2006, potentially destroying the vaccines stored there. For similar reasons, a Minnesota clinic had to revaccinate 8600 patients. Of the \$20 million a year in waste incurred by the federal Vaccines for Children program, refrigeration issues account for the largest causative factor. As the cost of drug therapy continues to rise and concerns for patient safety mount, electronic systems that document temperature ranges and provide immediate problem notification to an area staffed around the clock should be standard. Written procedures on how to handle any breach of a safe temperature range should be developed and followed. One more note about refrigerator monitoring: during proactive risk-assessments, ISMP consultants often observe medication refrigerators on patient care units that need to be defrosted. Ice build-up affects the ability of the refrigerator to maintain a consistent temperature range. Occasionally, the defrosting process leads to puddles of water on the bottom of the refrigerator. Please monitor the defrosting process to avoid temperature fluctuations and damaged medication packages.

*[ISMP Medication Safety Alert! 17 January 2008]*

#### **Camphor and childhood seizures**

Earlier this month, the New York City Department of Health and Mental Hygiene issued an alert about the use of unapproved camphor products in children. Three children were hospitalised with seizures after ingestion and contact with over-the-counter camphor products. One case involved a 15-month-old child who presented to the ED with intractable vomiting followed by a generalised tonic-clonic seizure approximately 40 minutes after licking a cube of camphor. The camphor had been placed in a bowl of water on the floor of the child's room and added to the humidifier water. In another case, a 22-month-old boy presented to the ED with status epilepticus one hour after his parents found him with a piece of camphor in his mouth. The family had been using the product to control cockroaches by placing it along the wall and in the corners of rooms. In the third case, a 15-month-old girl presented to the ED with a second seizure after her mother applied a camphor chest rub to the child's chest, back, and head every hour for 10 hours to treat cold symptoms. The Department is investigating seven additional cases. Camphor is used in many cultures for the treatment of respiratory symptoms and to ward off illness. It is also used as an insecticide and an air freshener. Camphor is rapidly absorbed into the body from the skin, gastrointestinal tract, and respiratory tract, and readily crosses the blood-brain barrier. Physicians should have a high index of suspicion for the excessive use of camphor-containing products by parents of children with new onset seizures and/or unexplained seizures. Counsel parents on the dangers of camphor-containing products, and advise them to keep these products out of the reach of children.

*[ISMP Medication Safety Alert! 31 January 2008]*