

## Chemotherapy Error Prompts Review of Medication Order Processing

A hospital has shared an error that involved the preparation and administration of a 10-fold higher dose than intended of cyclophosphamide to a pediatric patient. Included in the error submission was a detailed flow diagram of the medication order process, as well as a root cause analysis of the incident. The reporting hospital hopes that publication of the incident will assist others in avoiding similar problems.

Orders for a chemotherapy protocol were written on a nursing unit in anticipation of a patient's admission for treatment. A cyclophosphamide dose of 169.3 mg was ordered, and noted in parentheses were the patient's weight and the mg/kg dose. The NCR copy of the doctor's orders was sent to the pharmacy. A pharmacy technician misinterpreted the dose as 1693 mg and calculated the volume of cyclophosphamide to be 84.6 mL. The volume calculation was noted in the margin of the doctor's orders form. The technician remarked to himself that the volume appeared high and therefore requested a check of the calculation by a pharmacist. The pharmacist double-checked the mathematics of the calculation only, commenting that the order was yet to be screened by a pharmacist. Because the computer system did not allow medication order entry for pre-admitted patients, the labels for the three daily doses (including a weekend) were then prepared by the technician on a "stand-alone" computer, which has neither patient profiling nor dose checking. The cyclophosphamide label indicated a dose of 1693 mg in accordance with the calculation noted in the margin of the NCR doctor's orders form.

The chemotherapy order was screened by a pharmacist, who verified that 169.3 mg of cyclophosphamide was accurate for the patient's weight and was the appropriate protocol dose. The dose calculation noted in the margin of the order was not checked. The labels were also not checked. Another pharmacist checked the labels against the doctor's orders and, not noticing that there was a missing decimal point on the label, verified that the labels matched the dose ordered. (This is described as "confirmation bias". The individual sees what he expects to see and overlooks any disproving evidence.) A technician then prepared the day's dose according to the

volume calculation and label strength of 1693 mg. When the prepared dose of cyclophosphamide was checked by a third pharmacist the discrepancy between the labels and the physician order was again not identified. The 1693 mg dose of cyclophosphamide was administered to the patient.

At the time of administration of the second dose the pediatric oncology nurse called the pharmacy and stated that she could not see a decimal point on the cyclophosphamide label. The error was then discovered.

In order to determine the factors contributing to the medication error described here, the pharmacy initiated a meticulous review of medication order processing. They detailed the steps involved, the system weaknesses and the contributing factors to the error. Among the weaknesses identified were:

- No guidelines were in place to round doses to significant figures during order writing and dose verification.
- Stand-alone label generation was used because orders cannot be entered into the medication order entry system until a patient is admitted. As a result, there was no computer-generated profile, labels, or calculations and "fill list" or "preparation list" for the order.
- Mathematical calculations and order checking was fragmented and did not provide complete independent checks.
- The work area was congested and busy.
- There were inconsistencies in the order and product preparation and checking.
- Although there was a clinical pharmacist team member for provision of pharmacy services to adult oncology patients, there was no pharmacist member of the pediatric clinical team.

The hospital identified corrective actions in follow-up to a root cause analysis and the identification of contributing factors. Work groups were established to tackle specific issues and recommend solutions.

Designated responsible persons and timelines for completion were clearly outlined. The planned actions included:

- Development of guidelines for dose rounding during prescribing and order review. The protocol-specific pre-printed medication orders will be reviewed to incorporate such guidelines.
- Enhancement of the medication order entry system to allow processing of pre-admission orders. When designing medication order entry systems it is imperative that functionality allows for the entry of orders for outpatients and pre-admitted patients.
- Enhancement of the medication order entry system with programmed dose checking function and warning for dose maximum. Maximum dose information needs to be readily available to all those involved in the handling of a medication order.
- Reconfiguration of the pharmacy work area.
- Redesign of the pharmacy workflow to ensure the thorough checking of protocols, profiles and labels against the original doctor's orders for each dose. Thorough independent checks are recommended for high alert medications such as chemotherapy.
- Development of on-line protocol information. Lack of drug knowledge can contribute to medication errors and is especially dangerous in oncology and pediatrics.
- Hospital's strategic plan to include the implementation of computerized physician order

entry. Medication order entry systems can assist the practitioner in prescribing and can assist in the review of medication orders. Such systems should include mandatory fields for patient weight, body surface area and the protocol dose calculation.

- Plans include the addition of a pharmacist dedicated to enhancing pharmaceutical care services to the hospital's pediatric population.

In addition to the above planned actions by the hospital, ISMP Canada further emphasizes the importance of independent double checks for high alert medications such as chemotherapy. In this error example the chemotherapy order processing was handled by several individuals without thorough independent checks. All information necessary for a complete double check needs to be available, and needs to be thoroughly reviewed, in full, by each individual responsible for providing medication order checking. The value of independent double checks is explored in an issue of the ISMP Medication Safety Alert.<sup>1</sup>

Chemotherapy drugs are highly toxic, dose ranges are narrow and errors can be serious. Since chemotherapy errors can occur in any one of the medication system stages – prescribing, interpretation, dispensing, administration and monitoring – the reader is also provided with a short bibliography on the subject<sup>2-5</sup>

#### References:

1. ISMP Medication Safety Alert. The Virtues of Independent Double Checks – They Really are Worth Your Time. March 6, 2003 issue. <http://www.ismp.org/MSAarticles/time.htm> Accessed August 15, 2003

#### Bibliography:

2. Beckwith MC, Tyler LS. Preventing medication errors with antineoplastic agents, Part 1. *Hosp Pharm* 2000;35:511-523.
3. Beckwith MC, Tyler LS. Preventing medication errors with antineoplastic agents, Part 2. *Hosp Pharm* 2000;35:732-747.
4. Goldspiel BR, DeChristoforo R, Daniels CE. A continuous-improvement approach for reducing the number of chemotherapy-induced medication errors. *Am J Health-Sys Pharm* 2000;57(Suppl 4):S4 – S9.
5. Ogletree RL. Preventing medication errors in oncology. *Hosp Pharm Report* 2001;15:47-52.

*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 <http://www.ismp-canada.org>, (ii) email us at [info@ismp-canada.org](mailto: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.*