The Institute for Safe Medication Practices Canada (ISMP Canada) is an independent national not-for-profit 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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Volume 10, Number 5

ISMP Canada Safety Bulletin

July 31, 2010

Vulnerabilities of Electronic Prescribing Systems: Height and Weight Mix-up Leads to an Incident with Panitumumab

The use of electronic prescribing systems with embedded clinical decision support is widely accepted as a way to improve safety in the medication-use process. However, these systems are not failsafe. An incident in which a patient's height and weight were transposed in an electronic chemotherapy prescribing system has been reported to ISMP Canada. This incident represents a critical failure in the safety structure for managing orders for oncology medications. It may also be relevant to other medications prescribed by weight. Information from the incident is shared as an alert about the potential vulnerabilities of electronic prescribing systems.

Medication Incident

A new order for panitumumab to be given every 3 weeks to an adult patient was entered into an electronic prescribing system. The usual dose of this drug is 6 mg/kg, but the protocol in this case was a clinical trial regimen of 9 mg/kg. During entry of data into the electronic prescribing system, the patient's height and weight were inadvertently transposed: the height (cm) was entered as the weight and the weight (kg) was entered as the height. As a result, for the first dose of panitumumab, the patient received about 650 mg more than intended. The error was detected before administration of the second dose, and the second and third doses were given according to the treatment plan. The patient was admitted to hospital with symptoms of pulmonary embolism a week after the third dose and died a few days later. Panitumumab is known to cause pulmonary emboli, but it is not known if the initial dose of medication in any way influenced the outcome.

Possible Contributing Factors

With the assistance of the facility where the incident occurred, several factors were identified as possibly contributing to the error:

- Panitumumab and other monoclonal antibodies are commonly dosed by weight, whereas dosing for most chemotherapy medications is based on body surface area (BSA).[1] In this case, the electronic prescribing system automatically calculated the BSA (which incorporates both height and weight); the BSA value looked normal and was within the expected range.
- The patient was to receive a higher-than-usual dose of panitumumab as part of a clinical trial protocol (9 mg/kg, rather than the usual 6 mg/kg). As a result, the miscalculated dose might have been attributed to the clinical trial protocol and therefore not investigated further.
- The electronic prescribing system in use at the facility alerts the prescriber when the height and/or weight are out of range; however, these two alerts appear identical except for the words "height" and "weight". The electronic prescribing system does not require the prescriber to specifically acknowledge the alert and enter a reason for overriding it.
- Warnings about height and weight being out of range appear only at the point of order entry in the electronic prescribing system. During order review, pharmacy and nursing staff manually review patient characteristics such as height and weight when double-checking the dose ordered.
- Despite the use of the SI (*Système international d'unités)* as the standard for healthcare in Canada, many practitioners continue to think in terms of inches and pounds. Thus, the incorrect height and weight entries were not immediately recognized as implying a person 3½ feet tall and weighing nearly 400 pounds.

Electronic prescribing can provide important safeguards during the ordering stage of complex treatment regimens, especially those used in the management of cancer. Electronic prescribing systems eliminate legibility issues associated with handwritten prescriptions, can offer clinical decision support to prescribers at the time of prescribing, and support the use of predefined order sets that enhance standardization of protocols and decrease the potential for omissions. However, concerns have arisen that their use may create a false sense of security among healthcare providers. Even the appropriate activation and programming of electronic alerts does not ensure that an individual alert will be read and understood when it appears on an order screen.[2] A human factors phenomenon called "inattentional blindness" is a failure to notice fully visible but unexpected information because attention is focused on other information or another task.[2] This phenomenon was discussed in detail in an *ISMP Medication Safety Alert!* published in 2009.[3]

Electronic systems may be configured in such a way that many of the triggered alerts are clinically insignificant, which leads to "alert fatigue".[5] In field studies of pharmacy

computer systems, ISMP (US) found that clinically insignificant alerts appeared routinely in 75% of the systems tested.[4] Over time, a pattern of clinically insignificant alerts reduces the cognitive impact of *all* alerts, increasing the likelihood that an important alert may be overlooked. In addition, if there is no requirement to acknowledge an alert or enter a reason for overriding it, warnings may be bypassed without full cognitive evaluation.

The facility where the incident occurred has implemented changes to its internal processes, including setting protocol-based minimum and maximum doses in the pharmacy information system for panitumumab and other monoclonal antibodies, with the goal of improving detection of this type of error in the future. In addition, the facility has worked with the software developer to improve the management of height and weight information within the information system. Planned changes include incorporation of updated height and weight tables, with warnings triggered for both very high and very low values; display of height and weight in both metric and imperial units, with entry maintained in metric units; and automatic calculation and display of body mass index (BMI), with a "hard stop" for warnings when BMI exceeds 50.

Recommendations

Given the potential vulnerabilities of electronic systems, stakeholders can take a variety of steps to enhance their effectiveness.

Hospitals and Cancer treatment centres:

- Share this bulletin with members of the oncology care team and review the potential for a similar incident in your organization.
- Where possible, set protocol-based maximum doses in the prescribing and dispensing modules of information systems that, at a minimum, require practitioners to enter a reason for overriding. The system should display the numeric value of the dose limit for comparison with the dose ordered.
- Monitor the existing electronic alert system to minimize the number of low-significance alerts, and test for inclusion of high-priority alerts.[5,6]
- Assess vulnerabilities in the existing check system and opportunities to enhance the effectiveness of safeguards. Consider forming a multidisciplinary team that includes direct care staff to identify existing checks in the processes for prescribing, order processing, dispensing, administration, and monitoring of cancer treatments and use this information to undertake prospective risk assessment (e.g., failure mode and effects analysis).

Software vendors:

- Enhance the monitoring capability of electronic information systems to alert practitioners to height and weight patterns that may indicate transposition of height and weight values, a function that is already available in some information systems.
- Assess the ability to develop software that will generate a pictograph of the patient's dimensions (along with a "normal" comparator) once height and weight data have been entered and that will be accessible to all practitioners through the electronic health record. A pictograph would quickly indicate a mismatch between the information entered and the patient's physical appearance.
- Enhance electronic systems so that the visual properties of the information (e.g., colour and size of type, use of typographic attributes) support the perception of relevance of the information being required or presented (referred to as sensory or cognitive conspicuity).[3]

Since studying the incident highlighted in this bulletin, ISMP Canada has learned of other incidents related to incorrect height and weight entries. Examples include typographic errors during entry of numbers (170 cm input as 107 cm) and use of outdated patient data (a system that did not require updating of a weight obtained 5 years earlier).

It is hoped that this bulletin will support organizations providing cancer treatment in their reviews of existing processes. Organizations are also encouraged to share this information widely, since learning from this incident could inform system improvements related to ordering other medications for which the patient's weight is critical to dose determination.

Acknowledgements

ISMP Canada gratefully acknowledges the expert review of this bulletin by (in alphabetical order):

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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.

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