“Smart” Infusion Pumps Join CPOE and Bar Coding as Ways to Prevent Medication Errors

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Computerized prescriber order entry (CPOE) and bar-code applications for drug dispensing and administration represent technologies that are capable of reducing medication errors. Unfortunately, because many hospitals have not yet implemented these systems, many errors that otherwise might be eliminated continue to put patients at risk. Yet even if the technology were fully installed, serious errors would still be possible, especially with intravenous (IV) “high-alert” medications. Even if the right drug and dose are at hand, a misprogrammed infusion pump can leave a patient only a button-press away from disaster.

Newer automated tools have emerged and are beginning to play a role in reducing the risk of errors. Infusion pumps allow hospitals to enter various drug-infusion protocols into a drug library with pre-defined dose limits. If a dose is programmed outside the established limits or clinical parameters, the pump stops working, or it provides an alert to inform the clinician that the dose is outside the recommended range. Some pumps have the capability of integrating patient monitoring and additional parameters such as the patient’s age or clinical condition. Other manufacturers are developing similar devices.

The Institute for Safe Medication Practices (ISMP) has received many reports in which the use of “smart pumps” has prevented errors. For example, a physician in the emergency department wrote an order for Integrelin (eptifibatide, Schering) but inadvertently prescribed a dose appropriate for ReoPro (abciximab, Lilly/Centocor). The Integrelin infusion was initiated and was continued for approximately 36 hours after the patient was transferred to a medical-surgical unit. During this time, the patient’s mental status was deteriorating.

At this point, the hospital was switching to the smart pump, which performs a “test of reasonableness” before the infusion can begin. As the nurse was transferring the infusion parameters from the old infusion system to the new system, safety software that was incorporated in the device alerted the nurse of a “dose out of range.” The nurse could not continue until a pharmacist was called and the mistake was corrected.

In another case, a hospital’s heparin protocol called for a loading dose of 4,000 units, followed by a constant infusion of 900 units/hour. The loading dose was administered correctly, but the nurse inadvertently programmed the continuous infusion dose as 4,000 units/hour. Because the pump limit for heparin as a continuous infusion was set at 2,000 units/hour, the infusion device would not start until the dose was corrected.

In each of these cases, these mistakes might have gone undetected without pre-programmed limits. For example, at the ISMP, we received a report about a nurse who attempted to program an infusion pump for an infant who was receiving total parenteral nutrition (TPN) by inputting 13.0 ml/hour. The decimal point key on the pump was somewhat worn and difficult to engage. Without realizing it, the nurse programmed a rate of 130 ml/hour. Fortunately, the error was discovered within one hour. The baby’s glucose level rose to 363 mg/dl. As a result, the rate of infusion for the TPN was decreased for a while and no harm was done.

A smart pump, programmed with patient and drug parameters, would have “recognized” the error and alerted the nurse before the infusion started. Organizations will need to develop standard concentrations for infusions to maximize the effectiveness of newer smart pumps as well as limits to infusion rates for medications so that nurses will receive alerts to unsafe dose limits and programming errors.

Clinical trials are under way to quantify the value of these infusion systems in reducing the rate of medication errors. The technology seems to hold great promise. With CPOE, bar coding, and smart infusion pumps, we may finally have a solid defense against the most serious medication errors.

The reports described in this column were received through the USP-ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP (www.ismp.org) or the USP (www.usp.org) Web site or communicated directly to ISMP by calling 1-800-FAIL SAFE or via e-mail at ismpinfo@ismp.org.