CASE STUDY

BACKGROUND

KC, a 65-year-old male, presented with changes in bowel habits for the past 3 months. A comprehensive physical examination was performed including a complete blood count, digital rectal examination, and fecal occult blood test (FOBT). After the patient was found to have positive FOBT and low hemoglobin, he was advised to undergo a colonoscopy, which revealed a 7 cm x 5 cm semi-obstructive tumor. The pathology report confirmed the presence of adenocarcinoma, and the patient was referred for surgery within the following few days. Upon surgery and further workup, the patient was found to have stage IV colon cancer and was subsequently referred to an oncologist for follow-up postoperative treatment recommendations. KC’s oncologist decided that FOLFOX (5-fluorouracil [5-FU], leucovorin, and oxaliplatin) + bevacizumab, repeated every 2 weeks, would be an appropriate regimen and scheduled KC to receive his first chemotherapy cycle 21 days postoperatively at an outpatient center of a major oncology institution. Chemotherapy orders were written, including:

- Oxaliplatin 85 mg/m² intravenous (IV) over 2 hours on day 1
- Leucovorin 400 mg/m² IV over 2 hours on day 1
- 5-FU 400 mg/m² IV push
- Fluorouracil 1200 mg/m²/day IV continuous infusion over 24 hours on day 1 and 2
- + Bevacizumab 5 mg/kg IV over 10 minutes on day 1

Upon receiving the chemotherapy order, which was signed by the attending physician and by the chemotherapy verification nurse, the pharmacist questioned the physician regarding use of bevacizumab in this patient, because based on the product labeling, use of the agent should be postponed for at least 28 days postsurgery. Because studies have shown that bevacizumab may affect wound healing, it is preferred to delay its use postoperatively, but to administer chemotherapy as planned. The physician agreed to postpone administration of bevacizumab for another week, at which point the patient would be 28 days out of surgery. As a result of this near-miss prescribing error, proper in-services were given to all healthcare providers regarding the importance of timing the initiation of certain chemotherapy agents in relation to surgical procedures.

During KC’s second chemotherapy cycle, a new pharmacist processed the chemotherapy order and misunderstood the dosing of 5-FU. The pharmacist entered the order in the computer system as “1200 mg/m² given over 2 days” rather than “1200 mg/m² daily for 2 days.” This error, which is commonly made by new practitioners, may be detected during the double-verification process that is currently implemented in many cancer centers. In KC’s case, the second pharmacist who was responsible for double checking the chemotherapy orders recognized that there was only 1 label for 1 day of therapy, instead of 2 labels. Normally, this particular chemotherapy regimen is given as a continuous infusion daily for 2 days. In recognizing the error, the second pharmacist took initiative in explaining the issue to other pharmacists and resolved the chemotherapy order entry error.

During KC’s third cycle of chemotherapy, he returned to the outpatient center on day 3 of the cycle to disconnect the infusion pump for 5-FU. At that time, the nurse noted that half of the 5-FU infusion still remained in the infusor. The port needle was intact, clamps were open, and the infusion pump sensor was taped to KC’s chest wall. The nurse flushed the port easily and obtained positive blood return. It was discussed that this problem could have been a result of an administering error, an incorrectly programmed machine, or a malfunction of the infusor.

ORDER PROCESSING, DISPENSING, AND ADMINISTERING ERRORS

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DISCUSSION

As in the illustrated case, chemotherapy errors affecting multiple phases of the medication-use process (eg, prescribing, dispensing, and administering) involve various healthcare providers, and as a result, all efforts aimed at reducing medication misadventures require multidisciplinary participation. Committees comprised of representatives from each discipline should develop policies and procedures for the medication-use process, including educational and competency requirements for persons with medication-use responsibilities and general system requirements that minimize vulnerabilities to errors. Near misses and errors should be analyzed, and problems in the procedures that place patients and staff at risk should be resolved.

In KC's case, the near-miss prescribing error involving premature postsurgical initiation of bevacizumab was handled appropriately from an educational perspective. The pharmacist who detected the error presented the prescriber with appropriate cautionary medical literature (product labeling) and, in preempting similar errors from occurring in the future, followed up with a more global educational initiative, in which numerous oncology healthcare providers were given a broader review of the issue. In general, chemotherapy prescribing is often complicated by preliminary studies and anecdotal evidence that report therapeutic specifics (eg, dosage/administration schedules) that may conflict with US Food and Drug Administration-approved product labeling. Although oncology prescribers must consider all this information when making therapeutic decisions, they should exercise great caution in correctly interpreting data and clearly communicating orders with other healthcare providers. In numerous published literature, it is advised that healthcare providers with prescribing privileges undergo an orientation to their institution's local chemotherapy policies, in addition to education regarding error prevention. Other general guidelines that should be incorporated into diligent chemotherapy prescribing practices include the following:

- Having a pharmacist verify an order against a given protocol;
- Having a pharmacist verify a dose with a provider (eg, principal investigator or study chairperson) who is independent from the prescriber;
- Eliminating trailing zeros (eg, 5 mg instead of 5.0 mg) and requiring leading zeros (eg, 0.125 mg instead of .125 mg) on orders;
- Identifying dosage, calculated dose, and, parenthetically, the total dose (based on body surface area or other factors) on all orders; and
- Using day 1 as the day of treatment initiation.

The near-miss order entry error involving KC's order for 5-FU demonstrates the critical need to hold pharmacy-specific orientations and ongoing educational programs that include a review of medication errors commonly associated with antineoplastic drugs. As such, the pharmacist who detected the 5-FU dosing error acted accordingly, using the near-miss incident as an opportunity to educate other pharmacists regarding the potential dosing confusion that may occur with this agent. Education on common dosing pitfalls is especially critical in oncology, because the doses of antineoplastic agents may vary considerably for different conditions and, therefore, it is virtually impossible to develop fail-proof computer systems for verifying chemotherapy doses. Another way of potentially minimizing dosing errors is to eliminate any inconsistencies among the frames of reference used by pharmacists versus prescribers. Physicians, for example, speak in terms of doses given over an entire chemotherapy cycle, whereas pharmacists think and prepare 1 chemotherapy dose per treatment. Poor communication between the 2 providers may potentially lead to a total dose for a course of chemotherapy given in 1 dose.

The order-entry error also underscores the value of the double-verification process, which, in order to optimize the opportunity for detecting errors, requires 2 pharmacists to review a chemotherapy order during different phases of preparation. Although most oncology pharmacy sites currently have in place a double-verification system, this “best practice” policy is not always enforced, especially if staffing is an issue. But as illustrated in this case, in which the 5-FU dosing error was prevented from reaching the patient by the second verifying pharmacist, double verification should be a mandatory rather than an optional practice. Other notable error pre-
vention strategies include use of computerized prescriber order entry, preprinted order forms, a product preparation card with a checklist that is verified by 2 pharmacists, a technician’s assistance in checking calculations, and patient education upon dispensing of oral chemotherapy.²

The potential administering error involving the infusion pump should be addressed with nurses, who are often the last link in the chain of healthcare professionals who provide chemotherapy. Nurses also commonly employ a double-verification process for reviewing chemotherapy orders and should evaluate and confirm the functional integrity of vascular access devices, medication pumps, and other devices that control medication delivery.¹ For programmable devices, such as an infusion pump, electronic programming for delivering the correct dose should be verified with another healthcare provider before administration of medication. In KC’s case, the exact cause of the incorrect infusion of 5-FU is unclear, but enforcing the double-verification policy of having another provider check pumps for correct programming and functional integrity before use may detect future similar problems.

Just as it sometimes takes more than 1 healthcare provider to make an error, it often takes a team of healthcare providers to fix the system failures that lead to errors. The entire medical staff, with full support from administration, must be engaged in medication error prevention and encourage error reporting by promoting a nonpunitive environment.

REFERENCES