Preventing Intrathecal Chemotherapy Errors: One Institution’s Experience

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Very few medications, including chemotherapeutic agents, can be administered safely into the intrathecal space. Most intrathecal chemotherapy errors involve the accidental injection of vincristine; however, all of the vinca alkaloids (vinblastine, vindesine, vinorelbine, and vincristine) can cause fatal neurologic effects if given intrathecally (World Health Organization, 2007). Although the exact incidence is unknown, the World Health Organization has cited 55 incidents worldwide since 1968. Despite extensive labeling requirements and recommendations, accidental administration of vinca alkaloids into the intrathecal space continues to occur. As recently as 2008, an accidental injection of vindesine led to the death of a 25-year-old man with non-Hodgkin lymphoma (Institute for Safe Medication Practices, 2008).

The vinca alkaloids, if given intrathecally, cause rapidly progressing sensory and motor dysfunction, paralysis, encephalopathy, coma, and death (Al Ferayan, Russell, Al Wohaibi, Awada, & Scherman, 1999; Schulmeister, 2004). Central nervous system lesions are those of chemical leptomeningitis and ventriculitis (Al Ferayan et al.). Autopsy findings show loss of neurons, nerve axon degeneration, and myelin loss on the spinal nerves (Dettmeyer, Driever, Becker, Wiestler, & Madea, 2001; Kwack et al., 1999).

Process Problems

The most commonly reported reason for errors is that a syringe containing a vinca alkaloid is mistaken for a syringe containing an intrathecal medication (Schulmeister, 2004; World Health Organization, 2007). In such instances, the practitioners failed to verify the correct medications prior to administering them to patients. Many of the patients had leukemia or lymphoma, and their treatment regimens included intrathecal methotrexate (or cytarabine) and IV vincristine. Both the intrathecal medications and the IV vincristine were mixed in small syringes with approximately 3–5 ml total volume. In some cases, the syringes were sitting next to each other. A previous recommendation to prevent intrathecal chemotherapy errors is to dilute vinca alkaloid medications in larger volumes in syringes, such as 10–20 ml, to prevent confusion between syringes with the same volume. However, despite difference in syringe sizes, errors still occur (World Health Organization). Other reported problems include mislabeling of syringes and lack of knowledge about intrathecal chemotherapy by practitioners administering the medication (Schulmeister, World Health Organization). Although most errors occurred when medication was given by lumbar puncture, similar errors have occurred when vinca alkaloids were given into ventricular reservoirs (e.g., Ommaya reservoirs) (Meggs & Hoffman, 1998).

Recommendations for Prevention

More than 18 years ago, the United States Pharmacopeial Convention, Inc. developed requirements for manufacturers and pharmacies to label each dose of vincristine with the warning “FATAL IF GIVEN INTRATHECALLY. FOR INTRAVENOUS USE ONLY” (Institute for Safe Medication Practices, 2008). In addition to the syringe label, recommenda-
Implementing System Changes to Prevent Errors

Riverside Methodist Hospital in Columbus, OH, developed and implemented a process based on national recommendations to decrease the potential for intrathecal chemotherapy errors (see Figures 2 and 3). A multidisciplinary team of oncology nurses, pharmacists, oncologists, radiologists, and radiation technologists developed the process, which applies to inpatient and outpatient areas. The team first compiled recommendations from the World Health Organization, the Institute for Safe Medication Practices, and the Joint Commission. The recommendations were compared to current practice, and changes were implemented as necessary.

**Vinca Alkaloids and Minibags**

Because of concerns regarding extravasation, the institution initially chose to increase the total volume of vinca alkaloids to 20 ml mixed in a syringe, rather than the 3–5 ml volume used for intrathecal medications. However, reports of deaths from accidental injection with 20 ml syringes of vinca alkaloids (Alcaraz, Rey, Concha, & Medina, 2002) prompted the institution to change to minibags. In addition, results from studies became available indicating the low risk of extravasation when vinca alkaloids were infused as minibags (Gilbar & Carrington, 2006). Riverside Pharmacy standardized practices to place all vinca alkaloids in 50 ml minibags with instructions to run infusions over 15 minutes. Nurses were educated to (a) follow the same procedures for site selection as for IV push vesicants, (b) assess for blood return every five minutes, (c) remain with the patient for 15 minutes to continually assess the site for extravasation, and (d) use gravity to infuse the chemotherapy, rather than an infusion pump (Gilbar & Carrington).

**Intrathecal Order Forms and Order Verification**

According to recommendations in Figure 1, a separate intrathecal chemotherapy order form was developed. The...
Verify and document that the following information has been confirmed by the physician (for lumbar puncture) or chemotherapy-competent RN (for Ommaya reservoir) and another chemotherapy-competent RN or pharmacist.

1. The chemotherapy ordered and prepared is one of the following medications.
   a. Methotrexate
   b. Cytarabine
   c. Thiotepa
   d. Liposomal cytarabine
   e. Hydrocortisone

2. The chemotherapy dose is within an acceptable dose range and schedule.

3. The patient’s international normalized ratio, partial thromboplastin time, and platelets are within normal limits.

4. The medication is mixed in preservative-free normal saline or Elliot’s B solution.

5. The total volume of the chemotherapy or medication syringe is 3–5 ml.

6. The patient’s stated name and birth date match the patient’s name and birth date on the chemotherapy orders and the chemotherapy syringe label.

7. The chemotherapy has not expired.

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**Figure 3. Verification Process for Intrathecal Chemotherapy at Riverside Methodist Hospital**

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intrathecal order form ensures that intrathecal chemotherapy is ordered separately from systemic chemotherapy and only provides options for chemotherapeutic agents or medications that are safe to give intrathecally.

Radiologists at Riverside, not oncologists, give all inpatient and outpatient intrathecal chemotherapy by lumbar puncture under fluoroscopy; therefore, education and a dual-verification form were developed to promote safe practice. Because the radiation department has no chemotherapy-competent RNs or pharmacists, the department pages oncology to verify chemotherapy immediately prior to administration. For ventricular reservoirs, chemotherapy-competent/ventricular reservoir-competent RNs perform dual verification immediately prior to medication administration.

**Packaging, Delivery, and Storage of Intrathecal Chemotherapy**

At Riverside, intrathecal chemotherapy is labeled “For Intrathecal Use” and placed in a brown overwrap with a chemotherapy sticker. Pharmacy places intrathecal medication in a plastic, sealed bag with a chemotherapy label and, finally, in a plastic, sealed bag with a large intrathecal label.

For chemotherapy administered in the radiology department, the oncology pharmacist hand-delivers the chemotherapy and places it in a locked cabinet, with no other medications. For ventricular reservoirs, the chemotherapy-competent RN picks up the chemotherapy from the pharmacy immediately prior to administration.

**Education**

Nurses, pharmacists, oncologists, radiologists, and radiology technicains all received education regarding the potential consequences of intrathecal administration of vinca alkaloids, infusion of vinca alkaloids in minibags, and the institution’s process to prevent errors.

**Conclusion**

Because of fatal consequences, institutions should and can develop comprehensive safety programs to eliminate all potential risks for intrathecal chemotherapy errors.

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**References**


