Vesicant Extravasation From an Implanted Venous Access Port

Case Studies [1] | April 09, 2009
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The patient, “JB,” is a 68-year-old woman who underwent a right lumpectomy and axillary node dissection for stage II breast cancer. Her oncologist suggested adjuvant chemotherapy (four cycles of cyclophosphamide [Cytoxan] at 600 mg/m² plus doxorubicin [Adriamycin] at 60 mg/m²) followed by local radiation therapy.

Vesicant extravasation can occur even in patients whose nurses have years of experience. Nurse-physician collaboration is key to appropriate management.

Following a lumpectomy and axillary node dissection for stage II breast cancer, the patient received adjuvant chemotherapy with four cycles of AC followed by local radiation therapy. A venous access port (VAP) was surgically placed for chemotherapy about 3.5 inches below the patient’s left clavicle. During cycle three of chemotherapy, following a 30-minute infusion of doxorubicin and during infusion of cyclophosphamide, the patient complained of breast pain. Her left breast was red, swollen, and firm. The nurse applied an ice pack to the breast. A venogram through the VAP showed no extravasation of contrast dye, and the remaining cyclophosphamide was infused. The patient was sent to a plastic surgeon on the same day. She was treated with antibiotics for presumed infection in the breast and the VAP was removed. Over weeks to months, a large area of necrosis developed.

The patient, “JB,” is a 68-year-old woman who underwent a right lumpectomy and axillary node dissection for stage II breast cancer. Her oncologist suggested adjuvant chemotherapy (four cycles of cyclophosphamide [Cytoxan] at 600 mg/m² plus doxorubicin [Adriamycin] at 60 mg/m²) followed by local radiation therapy. JB agreed to treatment, and had an implanted venous access port (VAP) surgically placed for chemotherapy. She was rather large breasted, and the port was surgically implanted about 3.5 inches below her left clavicle. Cycles one and two of chemotherapy were administered uneventfully.

Mrs. B. was accompanied by her adult daughter, a labor and delivery nurse, when she came to the office for cycle three. Her assigned nurse (nurse 1) tried to cannulate her VAP twice, but was unsuccessful and asked a more experienced nurse (nurse 2) to cannulate the port. Nurse 2 cannulated and flushed the VAP, started the intravenous rider (IVR) of dolasetron (Anzemet), and left the treatment room. After the antiemetic was finished, nurse 2 returned to the treatment room to start an IVR of doxorubicin (105 mg in 53 mL saline) to infuse over a period of 30 minutes by controller pump. Neither nurse stayed with Mrs. B. to observe the infusion or check for blood return. When nurse 2 returned to start the cyclophosphamide, JB’s daughter told the nurse that her mother was experiencing breast pain. The nurse pulled JB’s shirt down to assess the port site. JB’s entire left breast was ‘angry red,’ swollen, and firm. Nurse 2 stopped the infusion, applied an ice pack to the patient’s left breast, and notified the oncologist, who ordered that JB be sent to radiology for a venogram through the VAP. The radiologist recannulated the port to do the venogram, and phoned the oncologist to report no extravasation of contrast dye. JB returned to the oncologist’s office, where the remaining cyclophosphamide was infused.

Management Issues

JB was sent to a plastic surgeon that same day. He treated her with intravenous antibiotics for presumed infection in the breast and removed the VAP. Over weeks to months, the patient’s breast became more painful as a large area of necrosis progressively worsened. After 10 months without healing, she went to another surgeon, who performed a left total mastectomy with tram-flap reconstruction.

Though vesicant extravasation is uncommon, it has potentially devastating consequences for patients (and the nurses caring for them), because of ensuing local tissue damage. Anthracyclines
(doxorubicin, daunorubicin, epirubicin, and idarubicin) bind to nuclear DNA of cells in the area of extravasation and cause immediate cell death. Dead cells lyse and release bound anthracycline, which is then taken up into surrounding cells. This vicious cycle can continue for months and can lead to progressive destruction of subcutaneous tissues, tendons, and nerves, with this process evidenced by blistering, necrosis, and eschar formation.[1,2]

Naturally, prevention of extravasation is ideal, and many patients now have a VAP placed when vesicant chemotherapy is planned. In the past, extravasation was estimated to occur in 0.3% to 4.7% of VAP infusions,[2] but now the rate is probably lower because oncology nurses have become aware of the risks and adhere to standards of care. The most likely causes of extravasation from ports are incorrect needle placement (not within the port septum) or subsequent needle displacement from the port septum. Other causes are thrombus and fibrin sheath formation around the catheter that leads to backtracking, or catheter fracture secondary to pinch-off beneath the clavicle, which can lead to extravasation with tunneled catheters and VAPs.[3]

Although previous pharmacological antidotes for anthracycline extravasations were largely ineffective, in September 2007 dexrazoxane (Totect) received US Food and Drug Administration approval for treatment of anthracycline extravasation.

- Observe peripheral IV VAP site during infusions for any signs of extravasation, particularly swelling around the needle site. Do not rely on slowed/stopped infusion, as a large amount of solution may extravasate subcutaneously before tissue pressures are exceeded.

- With each vesicant infusion, remind patients to promptly report any symptoms that might indicate extravasation, particularly pain or burning.

- With rapid IV infusions or side-arm injections (<1 hour) of vesicants, check for blood return with peripheral IVs every 2–3 cc and at least every few minutes with a VAP or central catheter.

Dexrazoxane may prevent damage by interfering with topoisomerase II and by chelating iron, as these effects may prevent formation of iron-doxorubicin complexes and iron-mediated hydroxyl radicals that damage cell proteins and membranes.[3,4] There have been several case reports of successful prevention of anthracycline-related necrosis with administration of dexrazoxane within 6 hours of extravasation and repeated for two more doses, including patients with VAPs.[5]

Approval of dexrazoxane for extravasation was based on two prospective single-arm studies that included a total of 54 evaluable patients who had experienced tissue-confirmed anthracycline extravasation.[6] These patients received 3 days of IV dexrazoxane (at doses of 1000, 1000, and 500 mg/m2) starting within 6 hours of extravasation. Only one patient (1.85%)—who experienced a very large extravasation—required surgery to resect necrotic tissue. Conversely, Kane and others estimate that 10% to 25% of these patients would have required surgery if they had not received dexrazoxane.[7]

**Specific Nursing Considerations**

Nurses who are unaware of, or do not otherwise implement correct interventions for suspected or actual extravasation may be accused of negligence if subsequent necrosis occurs, and they may be subject to malpractice suit.[8] High concentrations of doxorubicin are usually administered via syringe through the sidearm of a running intravenous infusion (IV) or as a direct IV push (preceded by and followed with normal saline). In either case, close observation of the port site and chest is necessary to detect any new swelling or redness, and appropriate monitoring includes checking for easily obtained vigorous blood return every few minutes and reminding the patient to report any change in sensation during infusion.

Because the extent of anthracycline-induced injury is directly related to the concentration and amount of drug extravasated, the nurse must stop the vesicant infusion or IV push if extravasation is suspected. Applying an ice pack to an anthracycline extravasation site is recommended, to decrease the spread of drug within local tissues. Documentation should include the details of the infusion, as well as the amount of vesicant agent left in the IV bag and tubing and in the IV catheter (to estimate the amount extravasated), the patient reports and site evaluation, nursing measures, physician notification, and follow-up instructions.[9]

Patient education is key because patients with extravasation do not always have discomfort during the time that the extravasation is occurring, and blistering usually occurs within a few days to 10
days after the incident.[3] Patients should have clear instruction that if they develop blisters or ulcers in the area of extravasation, one or more surgeries will be needed to resect all involved tissue.

**Practice Pearls**

JB’s extravasation occurred before dexrazoxane for extravasation became available. Nonetheless, it is important for nurses to take into account that difficult cannulation— which in the case described possibly occurred because of VAP placement under breast tissue rather than just beneath the clavicle—may indicate the need for a longer (ie, 1 ½ inch rather than ¾ or 1 inch) deflected-point needle. Correct needle placement within the port septum and appropriate infusion into the VAP could have been confirmed when JB reported discomfort while the nonvesicant antiemetic was infusing. Nurses must be aware of the current standard of practice, which has always included diligent monitoring of highly concentrated vesicant solutions, particularly when administered over a short period of time (less than 1 hour).[10] Furthermore, nurses and physicians need to act in a collaborative fashion to ensure appropriate patient care after an extravasation occurs.

Most oncology nurses (and oncologists) will probably never be involved in a vesicant extravasation. However, nurses and physicians prepare for other critical events that have potentially deadly consequences, such as sudden cardiac arrest. We practice getting the crash cart, pulling the correct medications, going through a planned sequence of events, and documenting the event. Furthermore, when a serious untoward event occurs, we generally recognize that it happened because of systems issues, and we use it as a learning opportunity to correct systems issues and lapses that led to the event. We should use the same type of thinking for potential extravasation of vesicant agents by incorporating current guidelines and evidence into oncology nursing policies regarding nurse education and demonstration of clinical proficiency to administer anticancer treatments, and our policies should recognize the collaborative nature of vesicant extravasation management.

With the availability of dexrazoxane and other pharmacologic agents for extravasation of various vesicant antineoplastic drugs (eg, hyaluronidase for vinca alkaloid extravasation, sodium thiosulfate for mechlorethamine) we might also practice ‘mock extravasations’ to be better prepared to act in the patient’s best interest if extravasation—particularly of an anthracycline—occurs, and to critically evaluate practice in a safe setting. In such an exercise, a person on staff might be enlisted to act as a patient receiving an anthracycline through a peripheral IV or a central catheter. The ‘patient’ would report symptoms of extravasation and the mock extravasation plan would be called. This practice drill would entail involvement of other nurses (infusion nurses, triage nurse, nurse manager, advanced practice nurse); an oncologist; and, if available, the oncology pharmacist.

**Patient Management Essentials**

- Teach and enlist patient and family to advocate for themselves in terms of reporting signs and symptoms of extravasation.

- Collaboratively review extravasation policies and procedures; poorly managed extravasations reflect on systems issues within the practice setting—not on the nurse administering a vesicant agent that extravasated.

- Follow-up care is critical, especially if blistering or skin breakdown develops at the extravasation site; physicians caring for the patient may need information that is best known to oncology nurses.
The nurse(s) would open the clinic extravasation kit, which would include extravasation procedures, and would follow the procedures to obtain drugs that are refrigerated or held in a central pharmacy. In addition, a small clinic might not have dexrazoxane on site because of costs and concerns regarding drug expiration, but would need to have a well-known mechanism to obtain it (from their pharmacy supplier) within 1 to 2 hours. Actual drugs would not be drawn up, but the procedures for doing so would be reviewed by at least two nurses working together. Another nurse might assist with the necessary documentation of the event, by taking a photo of the extravasation site (perhaps with a disposable camera) and making certain that patient teaching materials were ready to review with the patient and family. Ideally, a short time later, the staff who were involved in the exercise would discuss and evaluate the activity in order to improve the process. A ‘mock extravasation’ could take place in the clinic setting when patients were receiving therapy; it would serve to reinforce the teaching that nurses give to patients about extravasation and highlight how concerned the same nurses are to safeguard patients.

**Conclusion**

Oncology nurses are well aware of the risk of extravasation resulting from vesicant administration, and extravasation can occur even when experienced practitioners take appropriate precautions in administration of chemotherapy.[11] With implanted ports, for example, needles can be of insufficient length or can become dislodged, and the devices can break. Careful patient monitoring is of particular importance under circumstances that can increase a patient’s risk of extravasation, such as deeply implanted or abdominally implanted ports; peripheral intravenous devices inserted in small veins; patients who have cognitive problems or are combative and/or very active (excessive movement increases the chances of needle dislodgement, which may necessitate sedation); and infusions of highly concentrated vesicant solutions over a short period of time. When a dreaded extravasation does occur, optimal management clearly depends on focused attention to the patient’s reports and appearance of the injection site (eg, pain, discomfort, or other change in sensation, swelling, redness, temperature changes); prompt documentation, assessment (eg, physical appearance of the injection site, determination of range of motion if an extremity is involved), and intervention. Appropriate patient education and follow-up are critical also, especially because manifestations of an extravasation sometimes do not become apparent until after the patient has left the clinic. Oncology nurses can work together to enhance their own and their colleagues’ knowledge and skills regarding management of extravasations, and this process ultimately will enhance patient care.

**Financial Disclosure:** The author has no significant financial interest or other relationship with the manufacturers of any products or providers of any service mentioned in this article.

**References:**

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