Case Study

A central venous port was implanted in the left infraclavicular area of Ms. W, a 70-year-old woman with recurrent colon cancer. Two days later, she complained of pain in her left shoulder while receiving her first course of chemotherapy (irinotecan 125 mg/m², 5-fluorouracil 500 mg/m², and leucovorin 200 mg/m², all given as IV boluses weekly for four weeks followed by a two-week rest period). Ms. W’s nurse reassured her that shoulder pain was to be expected because the port had been inserted recently. The presence or absence of a blood return was not documented in the medical record; however, the port was described as “flushing easily, without resistance.”

When Ms. W’s port was flushed with normal saline prior to her second chemotherapy treatment, she told the same nurse that her left shoulder was starting to burn. The nurse pressed down on the noncoring needle and informed the patient that it was secure and flush with the bottom of the portal reservoir. The nurse then flushed the port with a second saline-filled syringe, documented that the port flushed easily and had a “slight pink-tinged blood return,” and told Ms. W that she was “just feeling the cold fluid going in.” When the nurse administered the chemotherapy, the woman complained of increasing discomfort but was reassured that it resulted from the cool temperature of the drugs being infused. On completion of the chemotherapy treatment, Ms. W reported that her shoulder “burned terribly.” The nurse replied that the area around the port “still must be sensitive” and suggested that the patient place a heating pad on her shoulder when she returned to her home.

Ms. W called the surgeon who had implanted her port, described her discomfort, and asked whether shoulder pain should be expected during future chemotherapy treatments. The surgeon ordered a contrast dye study (venogram) (see Figure 1), which showed that dye was leaking from the catheter of the port into the subcutaneous tissue. The port was removed and visually inspected by the surgeon. Although no catheter damage was discovered on first inspection, when the catheter tip was pinched closed and saline was injected into the port, saline squirted from the catheter (see Figure 2). A small linear slit was apparent on closer examination of the catheter.

Discussion

Patients with newly inserted central venous ports often experience localized pain secondary to the creation and closure of the incision and tissue tightening when a subcutaneous pocket is made for placement of the portal reservoir. However, postprocedure pain usually is experienced on the day of implantation, may persist for a few days, and is characterized as mild and superficial in nature. In contrast, moderate to severe pain that is felt deeper in the infraclavicular or shoulder area and occurs only when medications or fluids are administered needs to be investigated with a dye study. Possible causes of this type of pain are incomplete noncoring needle insertion, portal reservoir or catheter separation, and catheter damage.

If the tip of the noncoring needle is inserted incompletely and located above the port septum and below the skin surface, medications will be delivered into the subcutaneous tissue. Inadvertent subcutaneous administration of IV chemotherapy may cause discomfort or an extravasation injury if vesicants are administered (Schulmeister & Camp-Sorrell, 2000).

Shoulder pain on the side of an implanted port also may be caused by device separation or disconnection. Implanted ports consist of two main parts, the portal reservoir (or body) and catheter. Ports are manufactured as single-piece, preconnected devices or as two-piece devices that require attachment of the catheter to the portal reservoir during the implantation procedure. Separation of a two-piece port at the portal reservoir or catheter connection can occur if the two components are not fastened securely during implantation or separate at a later time. Slippage of the O-ring, which attaches the catheter to the reservoir in two-piece systems, was suspected to cause portal reservoir or catheter separation in a number of case reports (Carr, 1989; Hall, Cedermark, & Swedeborg, 1989; Kock, Pietsch, Krause, Wilke, & Eigler, 1998). In two other reported cases, the precise cause of the separations could not be ascertained (Saifi, MacDowell, Khouri, & Webster, 1987).

Implanted port catheters can rupture (develop a hole or tear) or fracture (shear completely and break apart) and embolize to various locations, such as the heart and lungs. Catheter compression between the clavicle and first rib over a prolonged period of time produces mechanical friction that weakens the catheter and is termed costoclavicular pinching or the “pinch-off syndrome.” When a catheter appears to be compressed or indented as it passes beneath the clavicle (i.e., the pinch-off sign), the risk of catheter rupture and fracture increases.

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Onset of the pinch-off syndrome averages 9–12 months and may occur as late as 24 months (Klotz, Schopke, Kohler, Pestalozzi, & Largiader, 1996; Koller, Papa, Zweig, & Ben-Ari, 1998; Maisey, Sacks, & Johnston, 2003; Mirza, Vanek, & Kupensky, 2004; Zieren, Thul, Romanik, & Muller, 1998). Catheter rupture also may occur when small-diameter syringes (e.g., 1 ml, 3 ml) are used for flushing or medication administration. The excessive force stretches a catheter and may cause it to rupture or fracture. Signs and symptoms of a ruptured catheter are not always present. Patients may report that they heard a “popping” sound when their silastic catheters were flushed (especially if resistance was encountered previously) or may notice that their once-sluggish catheters now flush very easily (Camp-Sorrell, 2004).

Implanted port catheters can become damaged prior to or on insertion. Because catheters are soft and flexible, they inadvertently can be nicked, pierced, or sliced by surgical instruments when they are being prepared for insertion. During the insertion procedure, surgical instruments, guide wires, and split-sheath introducers may damage catheters. Damage to a catheter may go undetected, especially if the damaged area is small (Gemlo et al., 1988; Liu, Tseng, Chen, Chern, & Chang, 2004).

Few reports of catheter damage that inadvertently occurs prior to device insertion have been published (Kirvela & Satokari, 1989; Liu et al., 2004), but it has been observed in clinical practice. This type of catheter damage is believed to occur more often than it has been documented in the literature (Montreuil, 2004). In Ms. W’s case, portal reservoir or catheter separation can be ruled out because the dye study showed that the catheter was connected securely to the portal reservoir. The distance between the location of the contrast dye leak and the portal reservoir or catheter connection was approximately 5 cm. The timing of the patient’s complaints and type of observable damage to the catheter suggest that costoclavicular pinching was not the cause of the catheter damage. Costoclavicular pinching is a chronic process that erodes the catheter over a period of weeks to months, and irregular rough-appearing catheter damage, not a smooth slit in the catheter, would be expected. The nurse caring for Ms. W used syringes that were 10 ml or larger in diameter to flush the port and administer chemotherapy. Neither the patient nor the nurse recalled any signs or symptoms that would suggest that excessive force caused the catheter to rupture. The presumed cause of the patient’s shoulder pain is accidental slicing of the port catheter prior to insertion.

The central venous port insertion procedure was reviewed with the operating room staff, where the routine practice to place ports on instrument trays alongside sharp items, such as unsheathed scalpels and cutting needles on suture material, was discovered. The procedure has been changed, and implanted ports now are placed in sterile bowls, on separate instrument trays, or on trays containing only nonsharp items.

**Conclusion**

This case study illustrates several key points about catheter damage that may occur prior to insertion of venous access devices. First, this type of catheter damage is completely preventable by segregating sharp items from venous access devices during insertion. Second, a slice in the portion of a catheter lying in the subcutaneous tissue has the potential to allow medications such as chemotherapy to leak into the tissue, and if vesicants are infused, extravasation injury could result. Fortunately, in this case study, none of the chemotherapy agents administered was a vesicant. However, the amount of chemotherapy that was deposited into the tissue cannot be determined, and the inadvertent subcutaneous administration of this unknown amount of chemotherapy may impact the effectiveness of the patient’s treatment. Third, whenever patients complain of atypical pain during chemotherapy administration, their complaints need to be investigated and not dismissed. Chemotherapy administration via an implanted port should not be a painful procedure. Nurses need to carefully assess venous access devices and never assume that a recently inserted device is safe to use simply because it is brand new and appears to function well. Critical thinking is essential in detecting venous access device-related problems and their underlying causes.

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**References**


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