Accidental IV Infusion of Heparinized Irrigation in the Operating Room

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Problem

The accidental intravenous (IV) administration of a solution intended for bladder or wound irrigation is a frequent occurrence, and one that has been the topic of numerous ISMP reports. Typically, the errors involved confusing unlabeled solutions on the sterile field, mix-ups between irrigation and parenteral solution bags, or confusing irrigation and venous-access lines while connecting or reconnecting the solutions. These errors have occurred both inside and outside the operating room (OR).

Our sister organization, ISMP Canada, published two similar cases involving the inadvertent IV infusion of heparinized lactated ringer’s solution that was intended for intraoperative irrigation.1 We share these cases with U.S. health care practitioners to raise awareness of the prevalence of this type of wrong-route error and the harm it can cause.

Medication Incidents Reported in Canada

A circulating nurse in the OR added 50,000 units of heparin to a 1,000-mL bag of lactated ringer’s solution, anticipating that it would be needed for intraoperative irrigation. The OR scrub nurse confirmed that the correct drug, correct dose, and correct solution were used during preparation. Because of workspace congestion, the circulating nurse was unable to access a red “Medication Added” auxiliary label, which is typically applied in this situation; thus, there was no indication that the bag contained heparin. This bag, labeled as containing only lactated ringer’s solution, was then stored on an IV pole outside the sterile field in the OR.

When a patient required fluid replacement during surgery, a different circulating nurse retrieved the mislabeled bag from the pole and gave it to the anesthesia provider, who administered it intravenously. When the surgery team requested the heparinized irrigation solution, staff discovered that it was missing and recognized the error. The patient was treated with protamine intraoperatively and recovered without complication.

On the second occasion, a circulating nurse in the OR used a small piece of gray tape to label a 1,000-mL bag of lactated ringer’s solution to which 50,000 units of heparin had been added (Figure 1). The poor contrast between the gray background and the handwriting made the label hard to read. The heparinized solution intended for irrigation was believed to be a plain bag of lactated ringer’s solution and was subsequently infused via the IV route. When the patient was transferred from the OR, staff in the post-anesthesia care unit (PACU) recognized the error immediately and administered protamine as ordered. The patient was monitored carefully and recovered without sequelae.

Background

Ideal solutions are not always available in ready-to-use packaging designed for irrigation. During surgical procedures, a sterile IV solution may be used as is or it may be mixed with an additive for wound irrigation to remove debris.2 Using IV bags and tubing creates a hazardous situation that can result in the unintended IV infusion of the irrigation solution. The packaging for IV and irrigation solutions, both with and without additives, looks very similar, and the current compatibility of access ports intended for differing routes of administration makes misconnections possible. Other contributing factors that can cause mix-ups include: unlabeled/poorly labeled solutions; overreliance on the expected location of solutions on poles or on the sterile field; failure to read labels; repetitive task designs that foster automatic behavior with little conscious attention; a changeable, chaotic workspace; and workflow problems.

Using heparin in irrigation solutions can help prevent thrombosis,3 but the inadvertent IV administration of heparinized irrigation solution can increase the surgical patient’s risk of bleeding. Unintended IV administration of plain hypotonic, sterile water-based irrigation solutions, or ones containing additives other than heparin (e.g., Dakin’s solution4), has also resulted in patient harm. Therefore, the potential for this type of error is a serious concern.

Safe Practice Recommendations

By analysing such incidents, we identified several opportunities for reducing the risk of error and/or potential for harm.

Pharmacy preparation. Whenever possible, have the pharmacy prepare, label, and supply commonly used irrigation mixtures for the OR.

Figure 1 Poor legibility of gray-tape label on bag of lactated ringer’s solution (from Canada) with added heparin.
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Use the lowest effective heparin concentration. Use the lowest effective concentration of heparin in irrigation solutions, and standardize the strength and base solution to enable the pharmacy to prepare irrigation mixtures. Commercial irrigation solutions are also available.

Consider sodium chloride 0.9%. Sodium chloride 0.9% is available in pour bottles and is known to be stable when mixed with heparin. If heparinized irrigation solutions are required, consider using sodium chloride 0.9% instead of lactated ringer’s solution: the latter may make it necessary to use an IV bag, which risks being confused with an IV solution.

Differentiate containers. Purchase or prepare sterile solutions for irrigation in pour bottles or other route-specific packaging. Also, utilize different-sized fluid bags for irrigation solutions (e.g., 2-L or 3-L bags). Container shapes and bag volumes provide a visual cue for differentiating the route of administration.

Store safely. Segregate products intended for fluid replacement from products intended for irrigation by storing them in different areas of the OR or in different sections of the warming cabinet. Prominently label these areas “IV Use Only” or “Irrigation Use Only.”

Label immediately. Label all irrigation solutions immediately when an additive is mixed into the solution. Ensure that the name and amount of any medication added to the irrigation solution are clearly visible on the labeled solution. Ensure that all required supplies, including labels, are readily available in areas where medications or solutions are prepared.

Affix auxiliary warning. Affix a unique, prominent auxiliary label (Figure 2) marked “FOR IRRIGATION ONLY” to any irrigation solution (including plain ones without additives), whether it is a commercial one or one that pharmacy/OR personnel have prepared.

Use irrigation tubing. When preparing or dispensing solutions intended for irrigation, attach irrigation-specific connectors and tubing, if available, rather than IV connectors and tubing, to help prevent inadvertent IV administration.

Designate “irrigation poles.” Use only designated “irrigation poles” if irrigation fluids must be hung for decanting. Mixtures intended for irrigation are usually decanted into a sterile basin on the sterile field; the solution, pole, and basin must all be labeled.

Communicate during transitions. Incorporate verbal communication tools such as a transition-of-care report when a patient is transferred from OR to PACU, and/or when staff are being relieved during a case. In one of the incidents described earlier, the procedure for transfer of care from OR to PACU included the reconciliation and verification of all medications and fluids. The process worked as intended, the error was detected upon transfer, and the appropriate intervention was implemented promptly.

Establish reversal protocols. Establish standard protocols to manage the adverse effects of high-alert medications such as heparin. In the cases discussed in this article, the facilities had a protocol to manage heparin overdose/toxicity by administering the reversal agent, protamine.

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REFERENCES