

## Cases & Commentaries

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# Is that solution for IV or irrigation?: Fluid administration errors in the operating room.

Commentary By Christian Bohringer, MD

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## The Case

Two different patients experienced similar events.

Event #1: A 28-year-old woman was admitted for deceased donor renal transplant surgery. A bag of 1000 mL normal saline with 160 mg gentamicin bladder irrigation solution was prepared prior to surgery and was hung on the patient's IV pole. When the nurse went to connect the irrigation solution to the patient's urinary catheter, it was found to be already connected and attached to the patient's IV tubing, though it had not yet been infused.

Event #2: A 50-year-old woman was admitted for deceased donor renal transplant surgery. A bag of 1000 mL normal saline with 160 mg gentamicin bladder irrigation solution was prepared in the operating room (OR) prior to surgery. The solution was labeled with the contents, date and time and placed in the warmer. When the nurse went to retrieve the solution, it was missing from the warmer. It was found hanging on the patient's intravenous (IV) pole attached to her IV, though it had not been infused.

## The Commentary

By Christian Bohringer, MD

These two incidents describe a common type of error that has the potential to lead to significant adverse events for patients. Accidentally administering irrigation fluid intravenously is always a potential risk whenever both irrigation and intravenous therapies are administered simultaneously. This type of error has been reported previously with heparinized irrigation solutions.<sup>1</sup> Diluted sodium hypochlorite (bleach) solutions intended for topical wound irrigation have also been erroneously administered intravenously.<sup>2</sup>

A dose of 160mg gentamicin is commonly administered intravenously by anesthesiologists or nurse anesthetists as prophylactic antibiotic therapy for urological procedures. The addition of this amount of antibiotic to a 1L bag of normal saline therefore does not immediately trigger an alert in the mind of these anesthesia care providers that this fluid is intended for bladder irrigation rather than for intravenous therapy. Even if they recognize that 160 mg gentamicin has been added to the bag, they may continue to assume that the fluid bag on the pole is for intravenous infusion because this dose of gentamicin is frequently administered during other urologic operations. A large brightly colored label clearly identifying the bag of fluid as "For Irrigation Only" is therefore necessary.

Neither of these patients was harmed in these two incidents because the error was detected before the bladder irrigation fluid was administered intravenously to the patient. However, they do constitute near miss events that should serve as a catalyst to change institutional workflows to improve patient safety in the future.

### Risk arising from these incidents

Gentamicin is an aminoglycoside type antibiotic that is one of the leading causes of drug-induced nephrotoxicity.<sup>3</sup> This drug is therefore particularly dangerous if it is erroneously administered intravenously to a patient undergoing kidney transplantation because it can damage the newly transplanted kidney. Prophylactic gentamicin has recently also been shown to be a significant cause of acute kidney injury in orthopedic surgery.<sup>4,5</sup> On the other hand systemic absorption of gentamicin after bladder irrigation is usually minimal.<sup>6</sup> Bladder irrigation with this drug therefore does not pose any risk to the newly transplanted kidney. Inadvertent intravenous administration of gentamicin in this clinical context therefore constitutes a significant unnecessary risk for the transplanted kidney. Intravenous gentamicin has also been associated with ototoxicity. The ototoxicity in the cases presented may be vestibular rather than cochlear in nature and therefore may produce permanent loss of balance rather than hearing loss.<sup>7</sup> Given these significant side effects of intravenous gentamicin therapy, the erroneous intravenous administration of this drug represents a "never event" that must be prevented.

The inadvertent administration of 1L of normal saline to a dialysis patient also increases the risk of iatrogenic fluid overload resulting in pulmonary edema, which may result in the need for urgent unscheduled dialysis. This risk is especially significant in patients whose native kidneys no longer produce any urine and who therefore need to be maintained on tight fluid restriction. The risk of fluid overload in this case was less important than the risk of gentamicin nephrotoxicity because anesthesiologists usually titrate intravenous fluids to effect and aim for generous hydration to ensure optimal perfusion of the newly transplanted kidney.<sup>8</sup>

### Approach to Improving Safety & Patient Safety Target

Several work practices led to these near miss events and will need to be addressed to prevent similar problems in the future.

In the first case, the irrigation fluid was not clearly labelled as "For Irrigation Only" and was stored in the same location as the intravenous fluids. The labelling on the bag was not conspicuous enough to prevent a staff member from pulling it out of the warming cabinet, spiking it, and setting it up for intravenous administration. To the anesthesia provider, the irrigation bag looked just like all the other intravenous fluid bags in the cabinet.

In the second case, intravenous fluids and irrigation fluids were hanging on the same IV pole without being connected to any tubing. This is a scenario that begs for errors to be made because it is very easy to inadvertently spike the irrigation bag with the intravenous tubing. There was also no communication between the scrub staff and the anesthesia team about the presence of the irrigation solution on the IV pole. The scrub staff assumed that it would be obvious to the anesthesia staff that the bag they were hanging on the pole was their irrigation fluid because 160mg of gentamicin had been added to it. This assumption by the scrub staff was wrong and resulted from a lack of knowledge of how frequently anesthesia staff administer this dose of gentamicin intravenously at the beginning of a urologic procedure.

### Systems Change Needed/Quality Improvement Approach

#### Adequate labelling and storage of irrigation solutions

Irrigation fluids should be clearly labelled as "For Irrigation Only". The label should be made in a bright noticeable color. This label should also be large and ideally cover about a third of the size of the fluid bag. The label should be attached to the bag of fluid as soon as an additive has been injected because this additive now has effectively converted the bag of intravenous fluids into an irrigation solution. Irrigation solutions should not be stored in the same location as intravenous fluids once they have been prepared. Consideration should be given for irrigation solutions to be prepared in pharmacy and appropriately labelled there.

#### Connecting the irrigation bag to the correct tubing when hanging it and using a dedicated irrigation pole

Intravenous fluids and irrigation fluids should ideally not be suspended together from the same IV pole. Intravenous and irrigation fluid bags should always be spiked with their respective tubing right after they are hung on the pole. It should be easy to visually distinguish the irrigation tubing from the IV tubing. Irrigation specific tubing and connectors should be employed whenever available. Designating a pole for exclusive use with irrigation fluid also has been described as a useful strategy to prevent this type of error.<sup>1</sup> Hanging bags of fluid from poles when they are not connected to any tubing is bad practice and should be avoided.

Industry should be encouraged to develop bags and tubing of different colors for irrigation solutions in the same way that they have developed yellow tubing to clearly distinguish epidural infusion lines from intravenous lines. This color coding has been very helpful for anesthesiologists to prevent errors resulting from erroneously infusing epidural medications intravenously.<sup>9</sup>

Clear communication between the scrub and the anesthesia staff could also have prevented these errors. Communication about relevant matters needs to be repeated whenever there is a change of staff in the operating room and unnecessary turnover of staff should therefore be avoided as much as possible.<sup>10</sup>

Implementing these changes to the operating room workflow will prevent this type of error in the future and help all operating room staff to achieve their shared goal of patient safety.

## Take Home Points

- Irrigation fluids should be clearly identified as "For Irrigation Only" with large bright labels
- Irrigation fluids should not be stored together in the same place as intravenous fluids
- Irrigation bags should not be hung on a pole without being connected to appropriate irrigation-specific tubing that should be easily distinguishable from IV tubing.
- A designated pole for irrigation fluids can also help to prevent this type of error.
- Clear communication between staff members during the huddle and throughout the procedure needs to be maintained- especially during hand-offs in care.

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