Dangerous Connection Mix-Ups Between Tracheostomy Pilot Balloon Ports with IV Infusions

Several tubing systems have been developed for a variety of administration routes such as intravenous (IV), enteral, and neuraxial infusion within the hospital setting. Most of the systems have been designed with a luer taper system which creates a secure, leak-free connection between the male-end and female-end of the tubing. While each system is dedicated to a different route of administration, some have the same inter-locking luer design which has resulted in dangerous connection mix-ups.

The International Organization for Standardization (ISO) has developed manufacturing standards for small bore connectors to prevent misconnections between tubing intended for different functions. The ISO is rolling out these standards in phases and began with enteral feeding connectors (ENFit) followed by neuraxial connectors (NRFit) for anesthesia administration. Implementation has been gradual and design changes for respiratory systems such as limb cuff inflation and driving gases applications have not started. Until unique designs are integrated into each tubing system, misconnections will continue to occur between many catheters and devices.

One major issue that has been reported is the confusion between IV tubing luers and a tracheostomy pilot balloon port (cuff inflation port). The pilot balloon port is connected to the tracheostomy tubing that is used to inflate the cuff of the tracheostomy tube to secure it in place in the trachea, without occluding the patient's airway. The pilot balloon port has a luer connector to which a syringe can be connected to inflate and deflate the cuff with air.

In one instance, a nurse accidentally attached IV tubing to administer an antibiotic to the tracheostomy pilot balloon port instead of the triple lumen central line IV catheter port. The infusion inflated the tracheostomy cuff and occluded the patient's airway. The balloon ultimately burst and leaked fluid into the patient's lungs. The patient went into respiratory arrest but was resuscitated. In another report, an enteral pump tubing set was connected to the tracheostomy pilot balloon causing the endotracheal tube cuff to overinflate and completely occluding the tracheal tube. The patient's ventilator alarm sounded and patient experienced respiratory arrest. In these two cases, the patients survived. However there have been many other reports of death following this error.

Several factors may contribute to these misconnections:

- The nurse traced and labeled the lines but did not repeat the safety check prior to connecting the antibiotic.
- Dim lighting and positioning of the IV pump on the opposite side of the IV lines made visualization difficult.
- An unsecured triple lumen catheter located in close proximity to the tracheostomy pilot balloon port contributed to confusion.
- Triple lumen lines are very thin and look similar to tracheostomy pilot balloon tubing.
- The pilot balloon port is not typically capped and the IV extension tubing easily connected to the tracheostomy pilot balloon port.
- The antibiotic was administered as a primary infusion as opposed to a secondary infusion piggy-backed onto another IV line.

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR.* Retrieved from Institute for Safe Medication Practices: http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201810.pdf

- High-volume, low-pressure cuffs, which can hold a large volume of air or fluid, are used to minimize long-term risk of tracheal injury. Infusion pumps will not alarm as long as the cuff will continue to inflate. The cuff may hold up to 70 mL of fluid before rupturing.

The following strategies may help reduce the risk of tubing misconnections:

- Evaluate all new supply purchases and verify that clinicians cannot inappropriately connect tubes, catheters, connectors, syringes, and tracheostomy/endotracheal tubes. Avoid purchasing devices that are unsafe, which may force manufacturers to improve their device designs.
- If possible, restrict luer-compatible connectors to IV routes only. If it is not possible to purchase IV luer connectors only, alert staff to the potential for misconnections and encourage patient monitoring such as dropping pulse oximetry, capnography, cardiac monitoring and observation.
- Educate all staff on the risks for misconnecting devices such as enteral tubing or parenteral syringes to a tracheostomy pilot balloon port or other luer-compatible connector.
    - Include this education in orientation and training programs.
    - Use simulation to reinforce the education.
- Place labels on lines proximal to insertion sites when the patient has multiple connections into the body (i.e. IV, enteral, epidural, tracheostomy).
- Place the respective delivery system (pump) on the same side of the patient where the catheter exits. When possible, position catheters and tubes used for different purposes on different sides of the patient's body.
- Always trace lines from their source (i.e. pump) to the patient's access site into the body before making connections or administering medications or solutions.
- Ensure you have adequate lighting before connecting or reconnecting tubes and devices.
- Limit the number of times tubes and devices are disconnected and reconnected to decrease the risk of misconnections and infections.
- Establish a protocol to reconcile all lines, recheck all connections, and trace all tubes and catheters to their source when patients are transferred to a new location or as part of the hand-off process. Label all tubes and catheters at the points of connection.
- Double check all line attachments for certain high-alert medications or solutions, or if administering products to high-risk patients, and verify correct line attachment before administration.
- Conduct annual facility-wide evaluations of all devices for potential tubing misconnections. Develop mitigation plans to reduce the risk of errors.
- Report potential and actual misconnections to the patient, medication safety officer, risk management, device manufacturer, the Institute for Safe Medication Practices (ISMP), and ECRI Institute.

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR.* Retrieved from Institute for Safe Medication Practices: http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201810.pdf