Mishaps Involving In-Line or Closed System Suction Catheters

Several PA-PSRS reports indicate problems with in-line suction catheters—also called closed system suctioning (CSS). The reports suggest errors in catheter selection or misconnection with other tubing. In either case, patient care can be compromised, though in these cases permanent injury was averted.

Patient with tracheostomy was found to have the incorrect in-line suction system. The endotracheal tube in-line suction catheter was attached to the tracheostomy. Error was immediately corrected.

An incorrect in-line catheter was applied to the patient’s tracheostomy by respiratory therapist to help control secretions. The patient experienced respiratory distress within approximately 20 minutes. Respiratory therapist was called to see the patient again and realized what had happened. The catheter used would not allow the patient to exhale. This was recognized and the patient was bagged, arterial blood gases were done immediately ($CO_2$ 133, PH 7.089). The patient was transferred to the ICU and placed on a ventilator. Blood gases normalized within 90 minutes. The patient was removed from the ventilator the following day.

The child’s nasogastric feeding was connected to the in-line suction port. Within a minute the nurse realized the error. The patient had a brief oxygen desaturation to 88%. There was 1.5 cc of the feeding in the port and this was removed by suctioning. The in-line suctioning device was changed. The child’s oxygen saturation returned to 100%. A chest x-ray was done.

Patient found attached incorrectly to in-line suction. Aerosol tubing was attached to the T-piece with the blue cap on the opposite end of the T-piece. This did not allow the patient to exhale properly. Excess flow from the aerosol had no place to drain. Cuff was deflated at the time. Patient experienced tachypnea and diaphoresis but was also febrile. No desaturation occurred.

In-line suction catheters are used to remove airway secretions. This method of tracheal suctioning was first developed in the late 1970’s by a respiratory care practitioner. The closed suctioning technique is currently used in the majority of ICUs in the United States and is considered safer and more cost-effective than traditional open-suctioning systems.

CSS reduces the patient’s risk of infection and protects the caregiver from exposure to the patient’s secretions. Unless the catheter becomes soiled or malfunctions, CSS can be used for 24 to 72 hours depending on the model. The catheter is maintained within a clear plastic sleeve and is rinsed between use with sterile saline.

Catheter Selection Problems
Two events were reported by the same institution in which the wrong types of catheters were used. In one case an in-line suction catheter for patients with endotracheal tubes (ETT) was used for patients with tracheostomy tubes. In the other case, the mix-up was between in-line suction catheters for tracheostomy patients receiving ventilator support and those for tracheostomy patients not receiving ventilator support.

Following the second report, the reporting organization shared the details of the situation and sent to PA-PSRS the samples of the two types of catheters that were confused possibly because of look-alike packaging (see Figure 1 on page 3).

Knowledge Deficit
Proper education on patient suctioning includes technique and product selection. Catheters used in an ETT are longer to accommodate for the oral and pharyngeal space before reaching the trachea.
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Catheters used for a patient with a tracheostomy tube are shorter as the trachea is entered directly.

Catheter length was not the problem in the second case, which occurred on a medical/surgical unit. If ventilated patients were not routinely managed on this unit, the staff may not have recognized the difference between the catheter types. Both in-line catheters are for patients with a tracheostomy. However, one type is used for mechanically ventilated patients, while the other is for patients who are not mechanically ventilated.

In each of these cases, the expert team members responded with immediate action to correct the error and address patient needs.

Look-Alike Packaging
A potential contributing factor may be look-alike packaging. The packaging for the two tracheostomy catheters is very similar and colored similarly.

PA-PSRS has reported on incidents in which look-alike packaging contributed to patient safety hazards. While that seems to be the case here, we do not believe the problem of poorly differentiated packaging is limited to the brand shown in Figure 1. Other manufacturers’ lines also poorly distinguish between types of suction catheters.

Strategies that may help to minimize product selection errors include:

- Teaching staff responsible for patient suctioning about catheter selection, emphasizing the differences between specific types of catheters and the consequences of choosing the wrong catheter.
- Using bold print on storage bins to alert staff to differences between products.
- Providing helpful hints to facilitate early recognition of selection errors. For instance, informing staff that endotracheal catheter length is greater than the tracheostomy catheter length and that the ventilator tracheostomy catheter has a flexible connector to attach to the ventilator circuit.
- Encouraging team assessment as a “safety net” to ensure early identification of errors.
- Using an alternate vendor for one of the products when items have dangerously similar packaging.
- Notifying staff when two products have similar packaging.
- Engaging staff in identifying look-alike packaging and encouraging reporting of situations in which such packaging is noted.
- Storing look-alike items away from each other and keeping them on separate shelves.
- Labeling the package with a colored dot or other mark to catch the eye of the user.
- Displaying a poster board alerting staff to look-alike packages (for example, indicating the difference between the packaging of catheters for use with patients on ventilator support and that of catheters for patients who do not require a ventilator).
- Assessing all packages that come into the facility for similarity with other packages already stored.
- Reporting problems to ensure that attention is brought to the identified problem and lessons learned are shared.

Tubing Misconnections
PA-PSRS has received two reports in which CSS catheters were inadvertently misconnected. In one, the in-line suctioning was attached briefly to a feeding tube. In the other, the aerosol tubing obstructed the patient’s ability to exhale.

Recently published guidance from ECRI on preventing misconnections emphasizes taking extra precautions to minimize the risk of inadvertent misconnection by:

- Tracing lines to their source prior to making connections.
- Increasing lighting to improve visualization.
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- Revising policies to include positioning of specific lines on different sides of the patient.
- Educating staff on the risks of using adapters or force fitting connections.
- Reporting all misconnections even when no injury or harm is caused.

Figure 1. Poorly Differentiated Packaging May Contribute to Errors in Catheter Selection

A proactive approach that organizations can take to address misconnections is to conduct a pre-purchase evaluation which allows clinicians the opportunity to work with equipment and uncover any real or potential misconnection possibilities.⁸

Conclusion
There are many possible reasons for these CSS catheter mishaps such as knowledge deficits, failure to follow the protocol, lack of familiarity with available equipment and supplies, work overload, distraction, and fatigue. The most im-

Notes
8. ECRI. Preventing misconnection of lines and cables. Health Devices. 2006 March.
The Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error (“Mcare”) Act. Consistent with Act 13, ECRI, as contractor for the PA-PSRS program, is issuing this newsletter to advise medical facilities of immediate changes that can be instituted to reduce serious events and incidents. For more information about the PA-PSRS program or the Patient Safety Authority, see the Authority’s website at www.psa.state.pa.us.

ECRI is an independent, nonprofit health services research agency dedicated to improving the safety, efficacy and cost-effectiveness of healthcare. ECRI’s focus is healthcare technology, healthcare risk and quality management and healthcare environmental management. ECRI provides information services and technical assistance to more than 5,000 hospitals, healthcare organizations, ministries of health, government and planning agencies, and other organizations worldwide.

The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP’s efforts are built on a non-punititive approach and systems-based solutions.