

## Tubing Misconnections

The International Organization on Standardization (ISO) has developed ISO 80369 engineering standards to ensure small-bore connectors and tubing that are used for specific routes of delivery cannot be attached to those that are used for a different purpose. These include intravenous (IV), enteral, and neuraxial (i.e. spinal, caudal, and epidural) medication administration routes. These new connectors can reduce the tubing misconnections that result in wrong route errors.

The first new ISO connector introduced in 2016 was the ENFit enteral connector (ISO 80369-3). About 25% of all US hospitals have adopted the ENFit system as full integration is a complicated undertaking that can take several months. The second ISO connector which was released last year was the neuraxial NRFit connector (ISO 80369-6).

### NRFit

The NRFit connector diameter is 20% smaller than the Luer connector diameter. In addition, NRFit syringes have a smaller collar and tip making them incompatible with the Luer system, thus reducing the risk of misconnections. This new system was developed in response to a number of wrong-route errors such as inappropriate medications, enteral feedings, or air being administered neuraxially. Reports of wrong route errors also include:

- Nonepidural medications (potassium chloride, antibiotics, vinca alkaloids) erroneously administered into the epidural or intraspinal space.
- Regional anesthetic solutions (i.e. fentanyl and bupivacaine, ropivacaine) administered by the IV route. These wrong route errors can result in temporary cardiac and neurological impairments or permanent effects such as paraplegia and death.
- Anesthetic agent intended for IV administration infused into the cerebrospinal fluid via an external ventricular drain.
- Antibiotics administered into the cerebrospinal fluid.

These wrong-route errors continue to occur despite the use of special packaging and auxiliary warning labels. NRFit connectors reduce the risk of neuraxial misconnections and increase patient safety. NRFit adoption is only mandatory in certain states however many accrediting and regulatory agencies strongly recommend transitioning to ISO-compliant connectors as they become available.

NRFit devices that are currently available include: epidural and spinal needles, filters and filter straws, catheter connectors, and syringes (loss-of-resistance [LOR], slip, and lock), infusion pumps, epidural administration sets (yellow lines, without injection ports), infusion pump accessories including extension sets, spinal introducer and syringe caps.

NRFit connectors will help prevent:

- Inadvertent neuraxial administration of non-neuraxial medications, solutions, enteral feedings, and air since they are not compatible with Luer (or ENFit) connectors.
- Intravascular administration of neuraxial medications.

### Reference

1. Institute for Safe Medication Practices. (2020). *Nurse Advise-ERR*. Retrieved from Institute for Safe Medication Practices: <https://www.ismp.org/nursing/medication-safety-alert-august-2020>

However, wrong-route errors are still possible if the wrong medication is selected for preparation in a NRFit syringe, or if the wrong bag or bottle of medication or solution is spiked with an NRFit administration set. Strategies to reduce errors with NRFit tubing includes:

- Differentiate the vials, bags, syringes, and administration sets by label and label color.
- Bags or bottles of neuraxial medications (i.e. fentanyl and bupivacaine) should be stored or dispensed with NRFit administration sets (attached by a rubber band to the bag, or spiked and primed if immediate administration is anticipated) with an auxiliary label stating “Requires NRFit tubing”.
- For infusions, check by tracing the tubing from the source to the patient access site.
- Utilize auxiliary labeling at the site closest to the patient.
- Institute an independent double check before administering all epidural infusions or injections (outside the operating room).
- For neuraxial administration via syringe (or cerebral spinal fluid withdrawal) avoid using parenteral syringes with a Luer connector.
- Ensure IV lipid emulsion rescue is available where regional anesthetics are administered.
- Develop standardized emergency protocols and/or coupled order sets to treat inadvertent IV administration of regional anesthetics.

### **Implementation of NRFit**

Introduction of the NRFit to a healthcare institution should be planned and coordinated. Assemble a small multidisciplinary team of clinicians who work to transition from Luer connector to NRFit for intrathecal and epidural procedures. The cross-functional team should be well-informed and properly prepared and composed of organizational leaders, risk managers, anesthesia providers, other providers who perform neuraxial procedures (i.e. spinal taps), nurses who assist with neuraxial procedures, and pharmacists and pharmacy technicians who prepare neuraxial medications.

Implementation strategies include:

- Communication with the organization’s supplier of neuraxial devices and request samples from the supplier when available
- Familiarize yourself with product-specific changes
- Practice new connections with all products affected by the NRFit connector
- Develop a timeline and checklist for the transition
- Conduct failure mode and effect analysis (FMEA) before the transition to identify what could go wrong (i.e. staff unfamiliar with NRFit connector design changes, incorrect use, supply chain issues)
- Identify and address serious problems prior to transition
- Educate all staff who will be involved in neuraxial procedures on the devices and how to use the products
- Evaluate and update current procedures, related order sets, pharmacy preparation and dispensing processes

### **Reference**

1. Institute for Safe Medication Practices. (2020). *Nurse Advise-ERR*. Retrieved from Institute for Safe Medication Practices: <https://www.ismp.org/nursing/medication-safety-alert-august-2020>

Devices such as long spinal needles may be used for non-neuraxial procedures such as amniocentesis and joint injections. These needles will have a Luer connector and will still be required after transition to NRFit.

**Reference**

1. Institute for Safe Medication Practices. (2020). *Nurse Advise-ERR*. Retrieved from Institute for Safe Medication Practices: <https://www.ismp.org/nursing/medication-safety-alert-august-2020>