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Intravenous Fluid Storage: Preventing Selection Errors

A recent safety bulletin highlighted the importance of designing systems to help prevent selection errors with parenteral solutions.[1] Such systems could reduce the risk of hospital-acquired hyponatremia associated with selection and administration of an incorrect intravenous (IV) fluid. The current bulletin describes a province-wide quality improvement (QI) initiative, which was implemented in various community, regional, and tertiary care facilities in Nova Scotia, to reduce IV fluid selection errors and subsequent administration errors.

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QUALITY IMPROVEMENT INITIATIVE

The provincial health authority in Nova Scotia reviewed reports of general infusion-related medication safety incidents from April 2021 to September 2022. A trend involving errors with large-volume parenteral (LVP) fluids was identified. Incorrect selection and administration of an IV solution was noted in 4.8% of infusion-related events, some of which led to patient harm.

The goals of the initiative were to evaluate how LVP fluids were labelled and stored in clinical areas, to determine the most commonly used LVP fluids, and to identify the processes that may have contributed to selection errors. Data analysis, audits, clinical observations, and interviews with staff were conducted to identify areas for improvement and strategies to reduce selection and administration errors. (Connor NA, Johnson SC. Standardizing parenteral solution ward stock and storage to reduce selection error. Nova Scotia Health. Unpublished report).

QUALITATIVE FINDINGS

IV fluids were found to be stored in various areas: clean supply rooms, medication rooms, cupboards or carts in smaller units, patient treatment areas, and fluid-warming cabinets (equipment used to warm fluids, so as to prevent hypothermia with administration of large-volume or rapid infusions).

Inventory Management in Storage Areas

The initiative identified the following problematic practices for inventory management:

- overstocking in some areas, in part due to a requirement to order a set quantity of IV fluids (e.g., by the case)
- availability of rarely used fluids on certain designated units (from which other units would have to retrieve the products if needed)
- different types of fluids stored together in one location (e.g., the same bin)
- presence of expired fluids
- presence of 1000 mL (1 litre) bags of sterile water for injection in patient care areas
- storage of IV fluids in fluid-warming cabinets without notation of the date when inserted, leading to uncertainty about the fluid's stability

Organization of Storage Areas

Almost half of the nurses interviewed stated that they had retrieved an incorrect IV fluid bag from a correctly labelled storage bin (i.e., the IV fluid bag had been stored in the wrong bin). Almost a third reported selecting an IV fluid from an incorrectly labelled bin.

Contributory findings related to the organization of storage areas included no distinct separation of fluids in bins or on shelves, use of look-alike storage bins for all types and sizes of fluids, overstocking of some bins causing excess bags to fall into different bins, and storage of fluids above head height level.

Labelling of Storage Areas

Findings included a lack of labelling for some storage areas and bins, fluid bags present in the bin not matching the bin label, handwritten labels covering older bin labels, unclear information on labels, and small or faded labels.

RECOMMENDATIONS

Learning from this QI initiative, along with previous recommendations related to management of IV fluid inventory and storage,[1] is shared to reduce the risk of selection errors. Utilizing the 5S (sort, set in order, shine, standardize, and sustain) technique, a key tool in Lean methodology,[2] may be helpful to improve safety and quality outcomes.[3] To support ongoing monitoring of improved processes, consider assigning the responsibility for oversight of IV fluid storage to a designated team or individual (e.g., pharmacy technician, member of nursing team, stores or materials management clerk).

Inventory Management in Storage Areas

- Determine minimum and maximum stock levels for each product according to typical usage.
- Use bar code scanning technology to verify that the correct IV solution is being provided by materials management, and that products are being stored in the correct storage location.[1]
- Identify mechanisms to allow stocking of small quantities of fluids through materials management (i.e., stores).
- Develop a practice of and process for regular rotation of stock:
  - Base the quantities for re-ordering and restocking on the minimum and maximum supply needed to promote rotation.
  - Review the need for products that have not been restocked for several months.
  - If a product is being replaced because the expiry date is approaching or has passed, re-evaluate the minimum and maximum stock levels needed.
- Standardize the available IV fluids stocked for each patient care area.
- Review fluids that are rarely used and stored in a patient care area; consider if they can be stored in automated dispensing cabinets.
- For IV solutions stored in fluid-warming cabinets, label the outer packaging of IV bags placed in the warmer with the date, time, and beyond use date. Monitoring and documentation of this information will reduce the risk of previously warmed IV fluids being returned to regular stock.[4]
- Eliminate 1000 mL (1 litre) bags of sterile water labelled "for injection" from all areas outside the pharmacy.[5]
  - Recent recommendations suggest to stock malignant hyperthermia carts with 100 mL vials of sterile water instead of 1000 mL (1 litre) bags to prevent inadvertent administration.[6]

- In patient care areas, use alternative products (e.g., bottles, vials or larger volume [2000 mL or 2 litres] bags) for sterile water used for irrigation or inhalation.[5]

Organization of Storage Areas

- Segregate bags of sterile water used for inhalation and irrigation from IV fluids in patient care areas.
  - Store sterile water for inhalation with respiratory supplies.
  - Designate the pharmacy department to coordinate with other departments to establish and implement guidelines for the safe provision of large volumes of sterile water in patient care areas, when needed.[5]
- Separate different fluid products, storing just one product per appropriately sized bin.
- Store fluids with additives separately from plain fluids (e.g., in medication rooms).
- Designate a "returns" container, if space allows, where staff can place unused bags of IV fluids for later restocking to the correct bin.

Labelling of Storage Areas

- Label storage areas (e.g., bins, shelving) with clear identifying information.
- Separate and clearly label the storage locations of fluid products that are commonly confused with one another.

CONCLUSION

Shared learning from a QI initiative identified system-based strategies to reduce selection and subsequent administration errors involving LVP fluids. Recommendations related to inventory management, storage of IV fluids, and labelling of storage areas are presented here and provide a reminder of the ongoing need for standardization, organization, and regular checks of items stored in patient care areas.

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