

**High-Alert
Medications: Safeguarding
Against Errors
(Part 1)**

Learning Objectives

- Discuss the concept of high-alert medications
- Identify the many drug classes considered to be high-alert status
- Describe various strategies for safeguarding the use of high-alert medications

High-Alert Medications

- High-alert medications are drugs that bear a heightened risk of causing significant patient harm when used in error
- Errors may not be more common with these than with other medications, but the consequences of errors may be devastating

ISMP's List of High-Alert Medications

- Adrenergic agents
- Anesthetics
- Antiarrhythmics
- Anticoagulants
- Cardioplegic solutions
- Chemotherapy
- Dextrose $\geq 20\%$
- Dialysis solutions
- Electrolytes (concentrated)
- Epidural/intrathecal agents
- Epoprostenol
- Inotropic agents
- Insulin/hypoglycemics
- Liposomal products
- Narcotics
- Neuromuscular blocking agents
- Nitroprusside
- Oxytocin
- Parenteral nutrition
- Promethazine
- Radiocontrast agents
- Sedatives
- Sterile water for injection

High-Alert Status of Drugs: Differences Between Nurses' and Pharmacists' Beliefs

Medication	% Nurses	% Pharm
Dialysate solution	66	26
IV adrenergic agonists	92	63
IV adrenergic antagonists	81	43
Liposomal forms of drugs	68	39
Hypertonic sodium chloride	73	94
Warfarin	59	75
Subcutaneous insulin	63	72

Drugs Most Frequently Considered High-Alert by Practitioners

Medication	High-Alert?
Parenteral chemotherapy	98%
IV potassium chloride	96%
Neuromuscular blockers	94%
Hypertonic sodium chloride	91%
IV insulin	90%
IV potassium phosphate	90%
IV heparin	87%
IV thrombolytics	82%

Framework for Safeguarding High-Alert Medication Use

Primary Principles

- Reduce or eliminate the possibility of errors
- Make errors visible
- Minimize the consequences of errors

Key Concepts in Safeguarding High-Alert Medications

- Simplify
 - Reduce steps and number of options
- Externalize or centralize error-prone processes
- Differentiate items
 - Appearance, location
 - Touch, color, smell, etc.

Key Concepts in Safeguarding High-Alert Medications (continued)

- Standardize
 - Communication and dosing methods
- Redundancy
 - Check systems, back-ups

Key Concepts in Safeguarding High-Alert Medications (continued)

- Reminders
- Improve access to information
- Constraints that limit access or use
- Forcing functions
- Fail-safes
- Use of defaults
- Patient monitoring
- Failure analysis for new products and procedures

Implement a Safety Checklist for High-Alert Drugs

- Develop policies regarding the use of high-alert drugs
- Assess and implement storage requirements of high-alert drugs
- Develop and institute standardized order sets
- Ensure the process of evaluating potential formulary additions identifies high-alert medications

Simplify

Probability of no error when each step is 99% reliable

Number of Steps in the Process	Error Probability Rate
1	1%
25	22%
50	39%
100	63%

Simplify

- Reduce the number of steps and options
 - Computerized order entry
 - Unit-dose dispensing
 - Dosing charts
 - Limited choice of concentration
 - Premixed solutions
- Do not eliminate crucial redundancies

Key Concepts in Safeguarding High-Alert Medications (continued)

Simplify and reduce number of options through standardization

- Use a single heparin size/concentration
- Standardize concentrations of critical care drug infusions
- Use weight-based heparin protocol

Key Concepts in Safeguarding High-Alert Medications (continued)

*Externalize or centralize error-prone processes:
IV drug preparation*

- Use commercially prepared premixed products
 - Premixed magnesium sulfate, heparin, etc.
- Centralize preparation of IV solutions
 - Prepare pediatric IV medications in pharmacy
 - Outsource of TPN and cardioplegic solutions

Key Concepts in Safeguarding High-Alert Medications (continued)

Differentiate items that are similar but dangerous if confused

- Purchase one of the products from another source
 - If hydroxyzine and hydralazine injections look alike, purchase one from another company
 - Use “TALL-man” lettering
 - hydrOXYzine versus hydrALAZINE
- Use other means to “make things look different” or call attention to important information
 - Use stickers, labels, enhancement with pen or marker

Key Concepts in Safeguarding High-Alert Medications (continued)

Differentiate items by touch, color, etc.

- Tactile cues
 - Place tape on regular insulin vial for blind diabetic patients
 - Octagonal shape of neuromuscular blocker container
- Use of color
 - Use red to “draw out” warnings
 - Color coding also can be a source of error

Key Concepts in Safeguarding High-Alert Medications (continued)

Bar code scan or separate problem products as effective deterrent for product selection errors

- Look-alike packaging
 - Store hydroxyzine and hydralazine tablets apart
- Look-alike drug names
 - Design computer mnemonics so similar names do not appear on same screen
 - Avoid placing similar names (carboplatin/cisplatin, vinblastine/vincristine) next to one another on a preprinted chemotherapy form or order entry computer screen

Key Concepts in Safeguarding High-Alert Medications (continued)

Standardize order communication

- Create, disseminate, and enforce ordering guidelines
 - Standardize read-back procedure for verbal orders
 - Standardize dosage units in smart pumps and autocompounders
- Eliminate acronyms, coined names, apothecary system, use of nonstandard symbols, etc.
 - TPN: IV nutrition or Taxol, Platinol, Navelbine
 - Irrigate wound with TAB

Key Concepts in Safeguarding High-Alert Medications (continued)

System of independent checks (redundancies)

- Probability that two individuals will make the same error is small; therefore, having one person check the work of another is essential
 - PCA pump rate and concentration set by one person with independent confirmation by another
 - Calculations for pediatric patients, select high-alert medications, etc., performed independently by at least two individuals, with identical conclusions

Key Concepts in Safeguarding High-Alert Medications (continued)

Use reminders

- Place auxiliary labels on containers for clinical warnings and error prevention messages
 - Dilute Before Use
 - For Oral Use Only
- Incorporate warnings into computer order processing and selection of medications from dispensing equipment
- Labels on IV lines to prevent mix-ups between IV lines and enteral feeding lines
- Protocols, checklists, visual and audible alarms

Key Concepts in Safeguarding High-Alert Medications (continued)

Improve access to information

- Computerized drug information resources (handheld)
- Computer order entry systems that merge patient and drug information, provide warnings, screen orders for safety, etc.
- Readily available texts in current publication
- Pharmacists present in patient care areas
- Internet connection

Key Concepts in Safeguarding High-Alert Medications (continued)

Use constraints that limit access in risky conditions

- Reduce access to dangerous items by careful selection of medications and quantities in storage
- Limit or prohibit access to pharmacy in nonaccredited facilities
- Move problem products out of reach
 - Remove concentrated potassium chloride from clinical units
 - Sequester neuromuscular blockers from other medications

Key Concepts in Safeguarding High-Alert Medications (continued)

Limit drug use

- Peer reviewed drug approval process
- Staff credentialing with restricted access or usage rights
- Automatic reassessment of orders
- Institute automatic stop orders
- Use medications with reduced dosing frequency
- Establish parameters to change IV to PO as appropriate

Key Concepts in Safeguarding High-Alert Medications (continued)

Forcing functions (“lock and key design”)

- Makes errors immediately visible; ensures that parts from different systems are not interchangeable; forces proper methods of use
 - Enteral feeding tubes without Luer connection combined with systems that will not fit vascular access devices
 - Oral syringe should not be able to fit onto an IV line
 - Preprinted order forms or computer options that “force” selection from limited number of medications, available dosages, etc.

Key Concepts in Safeguarding High-Alert Medications (continued)

Fail-safes

- Use products that design error out of the system
 - Implementation of automatic fail-safe clamping mechanism on IV infusion pumps has protected patients from free-flow and saved many lives
 - Dangerous order cannot be processed in computer system

Key Concepts in Safeguarding High-Alert Medications (continued)

Use of defaults

- Pre-established parameters take effect unless action is taken to modify
 - Clinical pathways
 - Device defaults
 - Morphine concentration default for PCA pump
 - Pharmacy IV compounder defaults to drug concentrations available in pharmacy

Key Concepts in Safeguarding High-Alert Medications (continued)

Patient monitoring

- More frequent and closer attention to vital signs, including quality of respirations
- More frequent and closer attention to neurological signs and laboratory results
- Include patient monitoring parameters in all protocols and order sets

Key Concepts in Safeguarding High-Alert Medications (continued)

Failure analysis for new products prior to use

- Formal safety review (e.g., formulary committee, risk management committee) of new medications and drug delivery devices
 - Examine for ambiguous or difficult-to-read labeling, error-prone packaging, sound-alike product names, etc.
 - Conduct a failure mode and effects analysis to proactively anticipate and prevent errors

References

Institute for Safe Medication Practices. ISMP's list of high-alert medications. *ISMP Medication Safety Alert!* March 27, 2008;13(6).

Institute for Safe Medication Practices. Survey on high-alert medications. Differences between nursing and pharmacy perspectives revealed. *ISMP Medication Safety Alert!* October 16, 2003;8(21).