Nursing-2013

OMICS Group Conferences
Accelerating Scientific Discovery

International Conference on
Nursing & Emergency Medicine

December 2-4, 2013 Las Vegas, USA

Dosing errors related to improper use of syringes: Dead space and technique

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Abstract

Small volumes of medication are routinely drawn from sterile vials and administered to patients as either a single drug dose or a combination of drug doses from multiple vials. However, the error associated with the accuracy of syringes and needles in combination with variability in practitioner technique can result in administration of doses that are outside of an acceptable limit of error. Measurement of some medications, especially potent drugs and drugs with narrow therapeutic margins (e.g., chemotherapeutic agents, radiopharmaceuticals, or pediatric dosing) requires high precision and accuracy for patient safety.

The general rule of thumb in the measurement of liquids to measure at least 20% of the total volume of the instrument used in order to minimize error. However, no substantiated guidelines seem to exist for either the minimum or maximum volume for accurate measurement in a syringe. Clinically, unsubstantiated recommendations for measurement of small volumes in syringes varies including ranges of ±20%, similar to the guidelines for volumetric glassware, up to a minimum volume of 50% of the syringe capacity. These values differ significantly from the manufacturer specifications for syringes, which state a volumetric accuracy for syringes of ±5%. Current research from our laboratory validates the use of the so-called “20% Rule”. In addition, the dead space of a syringe tip and needle can be a source of error if not properly accounted for in dosage calculations, especially where a change of needle or mixing of multiple small volumes into a single syringe is concerned.

This presentation will review calculations and avoidance some of the common pitfalls associated with syringe use, especially in measuring small volume and potent medications. Participants will gain a better understanding of syringe use, which will promote improved dosing accuracy and ultimately patient safety.

Biography

Melanie A. Jordan obtained her Ph.D. from Virginia Commonwealth University-Medical College of Virginia in 2002. She is currently an assistant Professor at Midwestern University, College of Pharmacy-Glendale, where she teaches in the areas of dosing calculations, pharmaceutics, pharmacokinetics and sterile products preparation. Her professional memberships include the American Association of Pharmaceutical Scientists, the American Society of Pharmacognosy, and the American Association of College of Pharmacy, for which she currently serves as the Immediate Past Chair of the Pharmaceutics Section. Her current research focuses drug discovery from natural products, drug-herb interactions, and validation of sterile product preparation methods.

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