Applications in Contrast Imaging

The Proper Use of Saline: Overview and Resources

Supported by an educational grant from Bracco Diagnostics, Inc.

The Proper Use of Saline: Overview and Resources

Summary

Pharmacy plays a significant role in drug selection and administration within hospitals.

"A key role in a hospital pharmacist's job is determining which form of medication best suits each patient," Josh Barnard, of Medacs Healthcare Senior Recruitment Consultants, a leading global healthcare workforce solutions provider, has written.

"Each decision must be made in a timely and efficient manner and requires significant input from doctors, nurses, and other healthcare professionals."

"Hospital pharmacists will often monitor the effects of the medications they prescribe and counsel their patients on the effects of the drugs. Another aspect of this role is to recommend administration routes and dosages, all of which are dependent on an individual's needs."*

Pharmacists are called upon to provide their expertise in the appropriate use of drugs as per US Food and Drug Administration (FDA)-approved indications and usage (labeled vs off-label use), selection of correct dosage and dosage form, and instructions for use. Therefore, they should be fully educated on the similarities and differences between contrast media agents and the associated safety practices for their administration. This includes staying current on any new developments that pertain to contrast media usage.

Often, pharmacists do not have access to the complete and critical information needed to make informed decisions. Relying on other pharmacy representatives, vendors, radiology personnel, and internal resources can be costly on many fronts and impact patient safety. A complete, concise, and current resource designed specifically for pharmacy personnel that reviews contrast media considerations and the proper use of saline is warranted.

* Original source: Barnard, J. The Role of a Hospital Pharmacist. Medacs Health Care Senior Recruitment Consultants. www.medacs.com/blog/2013/08/01/the-role-of-a-hospital-pharmacist. Cited in Contrast Media Basics: Considerations for the Pharmacist, a supplement to Applied Radiology. Available at https://www.appliedradiology.org/courses/4559/Interactive/Pharma_Mono_vMDFDECE_rev.pdf

Program Overview

Applied Radiology has developed this two-part, on-demand webinar and accompanying digital monograph to increase overall understanding of saline use and management in radiology. The goal of this program is to fully prepare pharmacy personnel to make informed decisions regarding saline management.

Learning Objectives

At the conclusion of this activity, participants should be able to:

- Describe the important safety considerations associated with saline administration in medical imaging;
- Explain the clinical benefits of administering saline with contrast media, including impacts on patient safety;
- Cite and reference such guidelines and standards as:
  - National Standardization of Intravenous (IV) and Oral Liquid Medications | FDA
  - United States Pharmacopeia (USP) Reference Standards
  - 2021 American College of Radiology (ACR) Manual on Contrast Media Contrast_ Media.pdf (acr.org).

Author

Rutu Patel, RPh, PharmD
Medical Content Strategist, PriMed Strategy, LLC

Disclosure Statements

Rutu Patel, PharmD, RPH, is a freelance medical content writer for Bond and Matter, a freelance medical writer for Open Health, Wesley Enterprise and Applied Radiology.

Program Reviewers

Mary Corry, MSN and **Kristi Hales, Rph** have no relevant financial relationships with ineligible companies to disclose.

All relevant financial relationships for faculty and program reviewers have been reviewed and mitigated.

Conflict of Interest Disclosure Policy

Identify, Mitigate, and Disclose Relevant Financial Relationships.

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Accreditation Statement

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In support of improving patient care, this activity has been planned and implemented by The Foundation for Care Management (FCM) and Applied Radiology. FCM is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC) to provide continuing education for the healthcare team.

This program is approved for 1.25 Contact Hours Pharmacy Credit.
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This program meets all criteria and has been approved by the AHRA, The Association for Medical Imaging Management for 1.25 ARRT Category A CE Credits and 1.25 CRA Credits.

Accreditation Periods

ACPE Pharmacy Credits:
Release: October 6, 2022
Expiration: October 6, 2024

ARRT Category A and CRA credits:
Release: October 13, 2022
Expiration: October 31, 2025

Obtaining Credits

To receive credits, participants must review the program materials in their entirety and complete the online post examination and evaluation.

Pharmacy credits require a post examination score of 70% or higher. ARRT Category A CE Credits and CRA Credits require a post examination score of 80% or higher.

Commercial Support

This program was supported through an educational grant from Bracco Diagnostics, Inc.

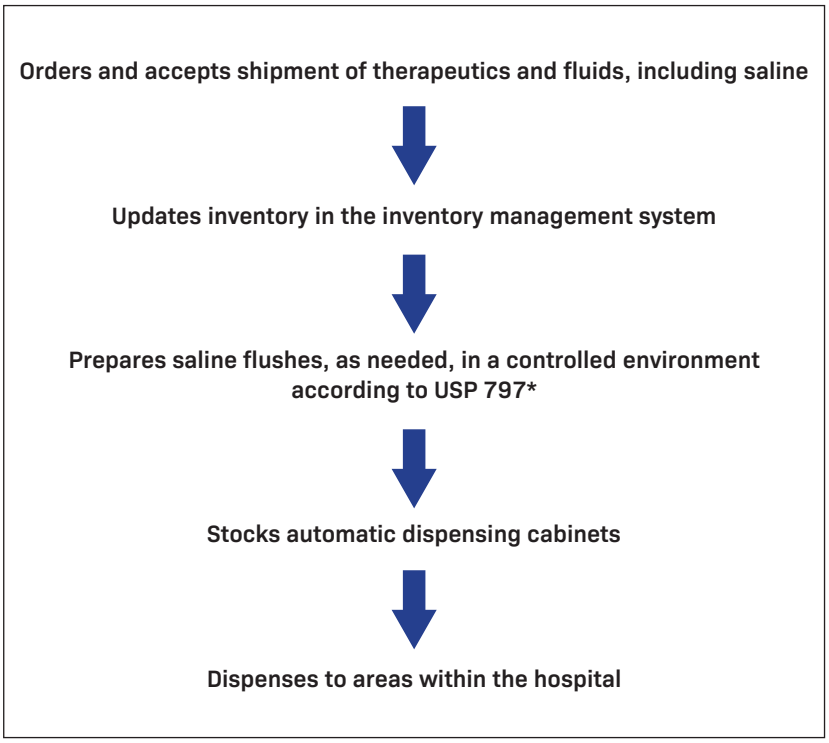
The Proper Use of Saline: Overview and Resources

By Rutu Patel, PharmD, RPh

As the burden of chronic illnesses continues to rise, imaging remains integral to diagnosing many diseases.[1] Imaging modalities—radiography, computed tomography (CT), ultrasound, nuclear medicine, and magnetic resonance (MR)—and specific protocols are selected by radiologists based on their ability to detect structural changes or abnormalities within the body. While many of these examinations are unenhanced, contrast agents can help increase their diagnostic value.[2] In addition, many protocols incorporate saline administration before or after contrast injection to mitigate safety risks and/or improve contrast delivery.[2]

While pharmacists are extensively involved in managing fluids and medications, contrast agents are usually overseen by radiologists. With changes in regulatory oversight in recent years, the role of pharmacists is expanding to include collaboration in selecting and managing the contrast media and adjunct therapeutics used in radiology. As such, pharmacists must directly lend their expertise to the radiology department. This article summarizes the utility of saline in medical imaging and provides resources for guiding management and distribution of saline for imaging. Webinars accompanying this article can be viewed at appliedradiology.org/pharmacy.

Figure 1. General Role of Pharmacists in Inventory Management[9]



USP, United States Pharmacopeia.
*Saline flushes prepared by pharmacy are not exempt from The Joint Commission's Medication Management standard. They are considered a medication and no longer a medical device as classified by the US Food and Drug Administration.[10]

The Role Of Contrast Agents

Contrast-enhanced images permit precise qualitative and quantitative examination of lesions and anatomical structures. Several classes of contrast agents are available, with each reserved for a specific imaging modality. Two of the most widely used classes are iodinated contrast agents used in CT imaging, and gadolinium-based contrast agents (GBCAs) used in MR imaging (MRI), which are the focus of this activity.[2]

Iodinated contrast agents contain iodine, the high atomic weight of

Table 1. Resources for Pharmacists

RESOURCE	DESCRIPTION	WHERE TO OBTAIN MORE INFORMATION
American College of Radiology (ACR) Manual on Contrast Media	Guide to enhance the safe and effective use of contrast media	▪ Full copy available at: https://www.acr.org/Clinical-Resources/Contrast-Manual
Association for Professionals in Infection Control and Epidemiology (APIC)	Provides resources to mitigate the risks associated with saline and its different presentations	▪ APIC Website: https://apic.org/
Centers for Medicare & Medicaid Services (CMS)	Seeks to strengthen and modernize the US health care system to provide access to high-quality care and improved health at lower costs. As such, CMS puts forth regulations and guidance to establish how programs are administered	▪ CMS Website: https://www.cms.gov/
Contrast manufacturer representatives	On- or off-label information available through product manufacturers	▪ Manufacturer medical information phone numbers ▪ Sales representatives for on-label information ▪ Medical science liaisons
US Food and Drug Administration (FDA)	Safety notifications/updates and information pertaining to drug products, including prescribing information, medication guides, approval history, and FDA letters, as well as information related to medical devices like saline	▪ Medical device information available at: https://www.fda.gov/Medical-Devices ▪ Drug safety and availability notices available at: https://www.fda.gov/drugs/drug-safety-and-availability ▪ Drugs@FDA database available at: https://www.accessdata.fda.gov/scripts/cder/daf/
Institute for Safe Medication Practices (ISMP)	Runs the only national voluntary practitioner medication error reporting program, publishes newsletters with real-time error information read and trusted throughout the global healthcare community, and offers a wide range of unique educational programs, tools, and guidelines	▪ ISMP Website: https://www.ismp.org/
Joint Commission	Sets accreditation/certification standards to improve "health care for the public, in collaboration with other stakeholders, by evaluating health care organizations and inspiring them to excel in providing safe and effective care of the highest quality and value"	▪ Joint Commission Website: https://www.jointcommission.org/
Peer-reviewed publications	Key journal articles evaluating the safety and efficacy of contrast agents	▪ Abstracts and some full-text publications accessible at: www.PubMed.gov ▪ Publisher/journal websites ▪ Reprints may be available through contrast manufacturers via sales representatives
Prescribing information	FDA-approved indications and usage, dosing recommendations, how supplied (fill sizes, NDC numbers), important safety information	▪ Specific to product ▪ Housed on manufacturer website or can be searched on FDA website: https://www.accessdata.fda.gov/scripts/cder/daf/index.cfm
State boards of pharmacy	Established to ensure that pharmacists and pharmacies meet minimum requirements for safe practice	▪ Complete list of state boards and their websites available at: https://nabp.pharmacy/about/boards-of-pharmacy/
United States Pharmacopeia (USP) reference standards	Primary standards for helping to ensure quality in pharmaceutical development & manufacturing	▪ Reference standards available at: https://www.usp.org/reference-standards

NDC=national drug code.

which impedes the ability of x-rays to pass through tissue. This blockage attenuates vessels and tissue, allowing radiologists to visualize anatomical structures and abnormalities.[3] The imaging properties of iodinated contrast agents do not vary; instead, the attenuation they produce correlates to the total iodine delivered to the imaging site.[3] GBCAs contain gadolinium (Gd), a heavy metal with paramagnetic properties, that is bound to a ligand in a chelate to minimize its toxicity.[2] The Gd ion forms a 3+ charge with unpaired electrons that attract nearby protons, such as those found in water.[4] In MRI, the resulting Gd3+ complex produces tissue differentiation and enhanced signal intensity by reducing the relaxation times of nearby protons within a magnetic field.[5]

Many CT and MRI protocols that utilize iodinated contrast and GBCAs incorporate saline administration.[2] Radiologists work closely with technologists to develop protocols dictating the amount and rate at which contrast and saline are injected. These protocols are reviewed regularly.

Saline Use in Imaging

There are multiple clinical benefits to using saline in imaging. As in other areas of medical care, intravenous saline is frequently used to hydrate patients in radiology. In patients with impaired renal function, saline hydration before or after contrast-enhanced CT imaging can help limit the risk for contrast-induced acute kidney injury.[2] Administered before CT or MRI, a small volume of saline helps confirm the integrity of the vein and prevent injury caused by contrast extravasation into surrounding tissues.[2]

As Richard Hallett, MD, explains in his presentation, saline can also increase contrast utility, particularly during CT procedures.[2] Saline administered as a "chaser" can push the tail end of contrast from the tubing, through the central veins, and into the area of interest. The saline chaser allows for a compact contrast bolus and improves its efficiency and level of enhancement. It also reduces the volume of contrast required per exam by 20% to 40%, as contrast remaining in the tubing is used for imaging instead of being wasted.[6] According to one cost analysis, administering 40 mL of a saline chaser after injecting 100 mL of contrast for abdominal CT can reduce costs by $7.30 per patient versus administration of 120 mL of contrast alone.[7] In terms of image quality, a postcontrast saline chaser can also prevent streaking artifacts that diminish the diagnostic value of some examinations.[8]

Role of the Pharmacist in Saline Management

Pharmacy inventory management is necessary to maintain the proper flow of patient care within healthcare systems. Pharmacists have long been acknowledged as the experts tasked with ensuring safe prescribing and dispensing of medications. However, in recent years they have been playing more prominent roles in areas not traditionally considered within their scope of practice. Pharmacists are increasingly collaborating with radiologists to manage contrast and oversee adjunct therapeutics and fluids such as saline. As Stephanie Allen, MBA, RT(R)(MR), CJCP, explains in her presentation, pharmacists are often responsible for all aspects of inventory management, including medication procurement, stock maintenance, and contracting, in compliance with regulatory mandates (**Figure 1**). As such, pharmacists seeking additional resources related to contrast or saline oversight should consult **Table 1**.

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