



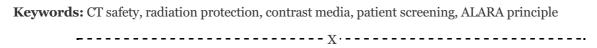


# Patient Safety in CT Imaging: Best Practices for Technologists

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**Abstract:** Computed Tomography (CT) imaging is a vital diagnostic tool in modern medicine, but it carries inherent risks, including radiation exposure, contrast-related complications, and procedural errors. Radiologic technologists play a critical role in ensuring patient safety by adhering to best practices in protocol optimization, radiation dose reduction, patient screening, and emergency preparedness. This paper reviews key safety strategies, presents evidence-based recommendations, and provides actionable guidelines for technologists to minimize risks while maintaining diagnostic efficacy.



#### INTRODUCTION

CT imaging provides high-resolution anatomical details, aiding in accurate diagnosis and treatment planning. However, concerns regarding ionizing radiation exposure, contrast-induced adverse reactions, and human errors necessitate strict safety protocols. Technologists must balance image quality with minimal risk, following the ALARA (As Low as Reasonably Achievable) principle.

This paper examines:

- Radiation dose management
- Contrast media safety
- Patient screening and preparation
- Emergency response protocols
- Technologist competency and continuing education

### RADIATION SAFETY IN CT IMAGING

Understanding Radiation Risks

CT scans contribute significantly to medical radiation exposure. Potential risks include:



- Stochastic effects (cancer risk from cumulative exposure)
- Deterministic effects (tissue damage at high doses)

## **Dose Optimization Techniques**

**Table 1: Key Radiation Dose Reduction Strategies** 

Strategy	Implementation	<b>Expected Benefit</b>
Automated Exposure Control (AEC)	Adjusts mA based on patient size	Reduces unnecessary radiation
Iterative Reconstruction (IR)	Replaces FBP with noise-reducing algorithms	Allows lower dose without compromising quality
Tube Current Modulation	Varies mA based on body region	Minimizes overexposure in thinner areas
Limited Scan Range	Restricts coverage to necessary anatomy	Decreases total dose
Paediatric Protocols	Adjusts kVp/mA for smaller patients	Reduces paediatric exposure by 50-80%

# **Paediatric and Pregnancy Considerations**

**Children**: Higher radiation sensitivity; use age/weight-adjusted protocols.

Pregnant Patients: Avoid abdominal/pelvic CT unless critical; use lead shielding if unavoidable.

# **CONTRAST MEDIA SAFETY**

**Types of Contrast Agents** 

Iodinated Contrast Media (ICM): Used in most CT scans; risk of allergic reactions and nephrotoxicity.

Non-Ionic Low-Osmolar Agents: Preferred due to lower adverse event rates.

**Pre-Screening for Contrast Reactions** 

**Table 2: Contrast Reaction Risk Mitigation** 

Risk Factor	Management Strategy
Previous allergic reaction	Premediate with steroids/antihistamines



Renal impairment (eGFR <30)	Hydration, consider alternative imaging
Asthma/Multiple allergies	Monitor closely, have emergency drugs ready

# **Emergency Management of Contrast Reactions**

**Table 3: Contrast Reaction Management** 

Reaction Type	Immediate Action
Mild (rash, itching)	Antihistamines, observation
Moderate (bronchospasm)	Oxygen, β-agonists, corticosteroids
Severe (anaphylaxis)	Epinephrine (0.3 mg IM), call code team

# **Patient Screening and Preparation**

### **Pre-Procedure Checklist**

- Verify patient identity and clinical indication.
- Assess allergies, renal function, and pregnancy status.
- Confirm NPO status for contrast studies (if required).

#### **Communication and Informed Consent**

- Explain risks/benefits in layman's terms.
- Obtain written consent for contrast administration.

# TECHNOLOGIST COMPETENCY AND CONTINUING EDUCATION

- Annual training on dose optimization and contrast safety.
- Certification in advanced CT protocols (e.g., cardiac CT, perfusion imaging).
- Incident reporting for near-misses to improve protocols.

### **CONCLUSION**

Patient safety in CT imaging requires a multifaceted approach, including dose optimization, contrast risk management, thorough patient screening, and emergency preparedness. By adhering to evidence-based best practices, technologists can enhance diagnostic outcomes while minimizing harm.

# References

- 1. American Association of Physicists in Medicine (AAPM). (2021). AAPM Report No. 204: Size-Specific Dose Estimates (SSDE) in Paediatric and Adult Body CT Examinations. AAPM.
- 2. International Commission on Radiological Protection (ICRP). (2017). ICRP Publication 135: Diagnostic Reference Levels in Medical Imaging. Annals of the ICRP, 46(1).
- 3. McCollough, C. H., et al. (2019). Radiation Dose Management for CT: What Do Clinicians Need to Know? Radiology, 293(3), 554-563.
- 4. European Society of Radiology (ESR). (2020). EuroSafe Imaging: Guidelines on Radiation Dose Optimization in CT. Insights into Imaging, 11(1), 65.
- 5. American College of Radiology (ACR). (2023). ACR Manual on Contrast Media (v11). ACR Committee on Drugs and Contrast Media.
- Davenport, M. S., et al. (2020). Contrast Material–Induced Nephrotoxicity and Intravenous Low-Osmolality Iodinated Contrast Material: Risk Stratification by Using Estimated Glomerular Filtration Rate. Radiology, 297(3), 607-617.
- 7. Beckett, K. R., et al. (2015). CT Radiation Dose and Risk: What the Radiologist Should Know. Radiographics, 35(6), 1719-1730.
- 8. Strauss, K. J., et al. (2017). Image Gently: Ten Steps You Can Take to Optimize Image Quality and Lower CT Dose for Pediatric Patients. AJR, 194(4), 868-873.
- 9. Frush, D. P., & Goske, M. J. (2018). Image Gently: A Campaign to Reduce Children's and Adolescents' Risk for Cancer During Adulthood. Journal of Adolescent Health, 62(5), 505-507.
- 10. Bush, W. H., & Swanson, D. P. (2019). Acute Reactions to Iodinated Contrast Media: Types, Risk Factors, Recognition, and Treatment. AJR, 213(4), 888-894.
- 11. American Society of Anesthesiologists (ASA). (2022). Practice Guidelines for the Prevention and Management of Contrast Media Reactions. Anesthesiology, 136(3), 523-549.
- 12. Society of Radiologic Technologists (ASRT). (2021). CT Practice Standards: Guidelines for Technologists. ASRT White Paper.
- 13. The Joint Commission. (2022). Radiation Safety in Diagnostic Imaging: Compliance Strategies for Healthcare Facilities.
- 14. Smith-Bindman, R., et al. (2019). Rising Use of Diagnostic Medical Imaging in a Large Integrated Health System. Health Affairs, 38(9), 1561-1568.
- 15. Kalra, M. K., et al. (2020). Strategies for CT Radiation Dose Optimization. RadioGraphics, 40(6), 1714-1728.