International Journal of Computational and Experimental Science and ENgineering (IJCESEN)

Vol. 10-No.4 (2024) pp. 3147-3154
http://www.ijcesen.com

ISSN: 2149-9144

Research Article

Rad Patient Preparation and Positioning in Diagnostic Imaging: The Collaborative Roles of Radiology Technicians and Nursing Staff

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Article Info:

DOI: 10.22399/ijcesen.4486
Received : 02 June 2024
Accepted : 30 June 2024

Keywords

Patient preparation,
positioning,
diagnostic imaging,
radiology technicians,
nursing staff,
collaboration

Abstract:

Patient preparation and positioning in diagnostic imaging are critical components that directly impact the quality of imaging outcomes and patient safety. Radiology technicians and nursing staff play integral roles in this process, working collaboratively to ensure that patients are adequately prepared for various imaging procedures. This preparation involves not only informing patients about the procedure, but also assessing their medical history, explaining necessary protocols, and addressing any concerns or contraindications, such as allergies to contrast media. The interaction between radiology technicians and nursing staff can streamline communication, enhance patient comfort, and ultimately contribute to more accurate diagnoses—an essential outcome in medical imaging. Positioning is another vital aspect where the collaborative efforts of these healthcare professionals shine. Radiology technicians, with their expertise in imaging technologies, skillfully position patients in accordance with specific imaging protocols to achieve optimal results. Meanwhile, nursing staff work to assist patients who may have mobility issues or require special accommodations, ensuring they are positioned safely and comfortably. Furthermore, both teams must remain vigilant about patient monitoring, especially for those under sedation or with critical health conditions, to promptly address any adverse situations. By fostering teamwork and communication, radiology technicians and nursing staff can significantly enhance the diagnostic imaging experience, promoting both patient safety and high-quality imaging outcomes.

1. Introduction

The realm of diagnostic imaging has undergone a revolutionary transformation since the discovery of X-rays by Wilhelm Conrad Röntgen in 1895. From rudimentary radiographic plates to the sophisticated, multi-planar, and functional capabilities of modern modalities such as Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET), and advanced ultrasonography, the ability to visualize internal anatomy and pathology has become indispensable in contemporary medicine [1]. The diagnostic yield, accuracy, and clinical utility of these advanced technologies, however, are profoundly contingent upon factors that extend far beyond the engineering specifications of the machines themselves. Paramount among these factors is the meticulous preparation and precise anatomical positioning of the patient undergoing the examination. This preparatory and positioning phase is not a mere preliminary step but a critical determinant of image quality, diagnostic interpretation, patient safety, and overall procedural efficiency [2]. Suboptimal preparation or positioning can lead to diagnostic errors, necessitate repeat examinations—thereby increasing radiation exposure where applicable, causing patient discomfort, and incurring significant additional costs for healthcare systems [3].

The responsibility for ensuring optimal patient preparation and positioning is a complex, shared endeavor that rests squarely on the shoulders of two key professional groups: radiology technicians, more accurately termed radiographers or radiologic technologists, and nursing staff. This collaboration represents a vital interface between direct patient care and technical expertise. The radiology technologist brings in-depth knowledge of imaging physics, equipment operation, radiographic anatomy, and the technical protocols required to capture diagnostically sound images [4]. The nursing staff, whether unit-based nurses preparing a patient for transport to the imaging department or specialized radiology nurses within the department itself, contributes comprehensive patient assessment skills, expertise in medication administration, mastery of intravenous access, and a holistic focus on patient education, physiological stability, and psychological comfort [5]. The synergy of these skill sets is essential for navigating the diverse requirements of different imaging modalities and the unique needs of individual patients, from pediatric to geriatric, from cooperative to critically ill.

2. Patient Preparation and Positioning

The overarching goals of patient preparation and positioning are unified across imaging modalities: to maximize diagnostic information, minimize artifacts, ensure patient safety and comfort, and standardize procedures for reproducible results. Achieving these goals is rooted in several core principles. Firstly, the principle of *diagnostic optimization* dictates that every action, from dietary restrictions to precise limb alignment, aims to enhance the contrast between normal and abnormal tissues and to provide the clearest possible visualization of the area of interest [6]. Secondly, the principle of *safety* encompasses both the protection of the patient from avoidable harm—such as radiation exposure, adverse reactions to contrast media, or falls from the imaging table—

and the protection of staff from occupational hazards [7]. Thirdly, the principle of *patient-centered care*requires that procedures be adapted, whenever possible, to accommodate a patient's physical limitations, cultural beliefs, anxiety levels, and comprehension capacity, thereby upholding dignity and promoting cooperation [8].

A critical conceptual framework in this domain is the understanding of *imaging artifacts*. Artifacts are features in an image that do not correspond to the actual anatomical structures being examined. They can be caused by patient motion, metallic objects, improper positioning, or technical factors. Patient preparation and positioning are primary strategies for artifact prevention. For instance, motion artifacts from breathing or fidgeting can blur an image, while metallic objects like jewelry or clothing zippers can cause streaking or signal void [9]. Effective communication and preparation aim to mitigate these issues at the source. Furthermore, the concept of *standardized protocols* is vital. Each imaging examination follows a specific technical protocol dictating parameters like slice thickness, radiation dose, or magnetic field sequences. Consistent, correct patient positioning is the human factor that allows these technical protocols to execute as designed, ensuring that images are comparable over time for the same patient and across different patients for clinical studies [10].

3. The Role of the Radiology Technologist:

The radiology technologist is the professional directly responsible for operating the imaging equipment and executing the examination protocol. Their role in patient preparation and positioning is hands-on, technically focused, and integral to image creation. It begins the moment the patient enters the imaging suite.

Initial Patient Assessment and Verification. The technologist's first responsibility is to positively identify the patient using at least two identifiers and to verify the examination order, ensuring the correct procedure is performed on the correct patient for the correct clinical indication [11]. This is a critical safety step. The technologist then conducts a focused interaction, often building upon information gathered by nursing staff. They review the patient's clinical history relevant to the scan, reconfirm preparation steps (e.g., NPO status, bowel preparation), and perform a targeted screening for specific contraindications related to their modality. For MRI, this involves an exhaustive screening for ferromagnetic implants, devices, or potential metallic foreign bodies [12]. For CT and procedures involving iodinated contrast, they screen for renal function history and allergies, though contrast administration often involves nursing collaboration [13]. This dialogue also allows the technologist to assess the patient's ability to understand and follow instructions, their level of anxiety, and any physical pain or limitations that might affect positioning.

Modality-Specific Preparation and Communication. Prior to positioning, the technologist provides clear, concise instructions tailored to the examination. For a chest X-ray, this involves coaching on the deep inspiration maneuver ("Take a deep breath in and hold it!") to lower the diaphragms and fully inflate the lungs [14]. For CT of the abdomen, instructions may include breath-holds at specific times to avoid motion artifacts during critical phases of contrast enhancement. For MRI, the technologist must prepare the patient for the confined space of the bore, the loud knocking noises, and the absolute necessity of remaining perfectly still, sometimes for extended periods [15]. This communication is not a one-time event but an ongoing process throughout the examination. The technologist uses the intercom system in CT and MRI to guide the patient through sequences, offering reassurance and updates on the remaining time.

Precision Positioning: The Technical Art. Positioning is the technologist's core technical skill. It involves using anatomical landmarks to align the patient's body part with the central axis of the X-ray beam, the isocenter of the CT gantry, or the magnetic field of the MRI scanner. For radiography, this involves manual handling and the use of sponges, sandbags, and positioning aids to achieve standard views like posteroanterior (PA) chest, lateral skull, or oblique lumbar spine [16]. In CT and MRI, positioning is facilitated by laser alignment lights and movable table tops. The technologist must symmetrically position the patient, often using specialized coils in MRI placed directly over the anatomy of interest to optimize signal reception [17]. For musculoskeletal ultrasound, the technologist positions both the patient's limb and the transducer probe dynamically, often asking the patient to move to stress certain tendons or ligaments. Correct positioning ensures the area of interest is fully included in the imaging field, minimizes distortion, and allows for the use of standardized exposure factors or scan protocols. The technologist is also responsible for applying shielding, such as lead aprons or gonadal shields, to radiation-sensitive areas outside the primary field of view, adhering to the ALARA (As Low As Reasonably Achievable) principle [18].

Protocol Selection and Image Quality Verification. Based on the patient's size, clinical

indication, and sometimes in consultation with the radiologist, the technologist may select or modify technical parameters within protocol guidelines. Following the acquisition of images, a crucial part of their role is to verify image quality before the patient leaves the department. This includes checking for adequate coverage, absence of significant artifacts, and appropriate contrast and density. If images are non-diagnostic due to motion, poor preparation, or positioning error, the technologist must problem-solve, which may involve repositioning the patient and repeating the scan, a decision made judiciously, especially in modalities involving radiation [19].

4. The Role of Nursing Staff:

Comprehensive Pre-Procedural Assessment and Preparation. Days or hours before an imaging study, the nursing role begins with thorough patient education. Nurses explain the purpose of the test, what the patient can expect, and the rationale behind preparation instructions such as fasting (NPO), bowel cleansing, or medication adjustments (e.g., holding metformin prior to iodinated contrast CT) [20]. They assess the patient's baseline vital signs, renal function (via serum creatinine and estimated Glomerular Filtration Rate (eGFR)), allergy history, and current medication list. This assessment is crucial for identifying patients at risk for adverse events, particularly contrast-induced nephropathy or allergic-like reactions to contrast media [21]. Nurses ensure that laboratory results are available and reviewed. They also assess for claustrophobia or extreme anxiety regarding MRI, facilitating pre-medication orders if necessary. For patients with intravenous access devices, nurses ensure patency or establish new peripheral intravenous (IV) access suitable for the high flow rates often required in contrast-enhanced CT [22].

Management of Pharmacological Agents. A primary domain of nursing expertise is the administration and monitoring of medications related to imaging. This includes: 1) **Contrast Media:**Nurses administer intravenous iodinated (CT) or gadolinium-based (MRI) contrast agents, monitoring for immediate adverse reactions ranging from mild nausea or urticaria to severe, life-threatening anaphylactoid responses [23]. They are trained in emergency response and have resuscitation equipment immediately available. 2) **Sedation and Analgesia:** For patients unable to tolerate a procedure due to pain, anxiety, claustrophobia, or an inability to follow commands (e.g., pediatric patients, adults with dementia), nurses administer and monitor conscious sedation (e.g., midazolam, fentanyl) under established protocols or in collaboration with anesthesiologists for deeper sedation [24]. They manage the patient's airway, oxygenation, and hemodynamic status throughout. 3) **Pre-Medication:** For patients with a history of mild-to-moderate contrast allergy, nurses administer pre-medication regimens, typically involving corticosteroids and antihistamines, as per institutional protocol [25].

In-Procedure Patient Care and Monitoring. During the imaging procedure, especially those that are lengthy or involve sedation or contrast, the nurse's role is continuous monitoring. In MRI, where the patient is isolated, nurses monitor via video and two-way audio, assessing for signs of panic, discomfort, or physiological distress [26]. For critically ill patients transferred from intensive care units, nurses are responsible for managing and monitoring vital signs, ventilator settings, intravenous infusions of vasoactive drugs, and other life-support equipment within the often-challenging environment of the imaging suite [27]. They act as the constant advocate for the patient, communicating any concerns to the technologist and radiologist.

Post-Procedural Care and Discharge Education. Following the examination, nursing care continues. They monitor patients for delayed adverse reactions to contrast media or sedation, particularly ensuring stable vital signs and adequate recovery from sedation before discharge [28]. They manage the removal of IV access and provide post-procedural instructions, such as encouraging oral hydration after intravenous contrast to facilitate renal excretion. For outpatient procedures, they provide clear discharge criteria and instructions on who to contact if complications arise later.

5. Modality-Specific Collaborative Workflows in Patient Preparation and Positioning

Radiography (X-ray) and Fluoroscopy. For standard radiography, the technologist typically manages the entire process, from patient interview to positioning and image capture. Nursing involvement is usually minimal unless the patient is an inpatient with specific medical needs. However, in **fluoroscopic procedures**—such as barium studies, intravenous urograms (IVUs), or hysterosalpingograms—the collaboration intensifies. Nurses are frequently involved in administering bowel preparation medications beforehand. During a barium enema, a nurse may assist the patient on and off the table and with post-procedure cleanup. For IVUs, nurses often establish IV access and administer the iodinated contrast agent under the technologist's or radiologist's direction, while the technologist focuses on

positioning and timing the radiographic captures [29]. Patient positioning in fluoroscopy is dynamic, with the technologist maneuvering the equipment and often tilting the table while instructing the patient to roll into different positions to coat the GI tract with contrast.

Computed Tomography (CT). CT preparation is a prime example of seamless collaboration. **Pre-scan:** Nurses conduct the primary assessment for renal risk and allergy history, obtain IV access, and administer pre-medications if needed. The technologist verifies this information, screens for pregnancy, and explains the breath-hold instructions. **During the scan:** The technologist positions the patient on the table, uses laser lights for alignment, and operates the scanner from the control room. For routine non-contrast scans, the technologist may perform the entire procedure. For **contrast-enhanced studies**, the nurse typically administers the contrast medium via a power injector, either from within the scanner room or remotely, while the technologist triggers the scan at the correct contrast phase (e.g., arterial, venous, delayed) [30]. Communication is key to timing. The technologist must inform the nurse when to start the injection, and the nurse must communicate any issues, such as IV infiltration or patient reaction, immediately. Positioning for CT is generally supine, but specialized protocols may require prone positioning (e.g., for CT colonography) or arms placed above the head for chest/abdominal scans to reduce artifact, which the technologist directs and assists with.

Magnetic Resonance Imaging (MRI). MRI presents unique challenges due to the powerful magnetic field. The **screening process** is a shared but distinct responsibility. Nurses often contribute to the initial medical history gathering, but the technologist performs the definitive, detailed screening for metallic objects and implants, using checklists and, if necessary, ferromagnetic detectors [31]. Both professionals reinforce safety instructions regarding the removal of all metallic objects. **For anxious or pediatric patients**, nurses lead the sedation process. They administer sedation, monitor the patient's physiological parameters using MRI-compatible equipment, and oversee recovery. The technologist positions the patient, often with the nurse's assistance when the patient is sedated, selects the appropriate radiofrequency coils, and places hearing protection. During the scan, both monitor the patient: the technologist for motion via the images, and the nurse for physiological stability via monitors. For MRI studies requiring contrast, the nurse administers the gadolinium-based agent, often during a pause in the sequences, at the technologist's direction.

Ultrasonography. Ultrasound is a highly operator-dependent modality where the technologist (sonographer) has an exceptionally interactive role. Preparation is often modality-specific (e.g., full bladder for pelvic ultrasound, fasting for gallbladder ultrasound). Nursing involvement is generally limited to ensuring this preparation is done for inpatients. The sonographer positions the patient (supine, decubitus, etc.) and then dynamically positions the transducer probe throughout the examination. They may ask the patient to change positions in real-time (e.g., erect positioning to assess for gallbladder polyps, left lateral decubitus for better pancreatic visualization) [32]. For procedures like ultrasound-guided biopsies or drainages, a nurse assists with sterile technique, hands equipment to the radiologist, and provides patient monitoring and post-procedural care.

Nuclear Medicine and Molecular Imaging. Preparations for studies like bone scans, PET-CT, or cardiac stress tests are highly specific and prolonged. Nurses play a central role in administering radioactive tracers (radiopharmaceuticals) via injection, inhalation, or ingestion, following strict radiation safety protocols [33]. They monitor patients during uptake periods, which can last from minutes to hours. The technologist's role focuses on patient positioning on the gamma camera or PET scanner, which often requires long acquisition times (20-30 minutes per bed position for PET). They must position the patient comfortably to minimize motion and may use immobilization devices. For PET-CT, the fusion of metabolic and anatomical data requires precise co-registration, making consistent positioning between the CT and PET portions critical—a responsibility of the technologist [34].

6. Special Patient Populations and Challenging Scenarios

Standard protocols must be adapted to meet the needs of diverse patient groups, demanding advanced skills and flexibility from both technologists and nurses.

Pediatric Patients. Imaging children requires age-appropriate communication, distraction techniques, and often immobilization or sedation. Technologists use specialized pediatric protocols to minimize radiation dose [35]. Positioning aids like foam pads, Velcro straps, and sandbags are used gently but effectively to prevent motion. For neonates and infants in the NICU, nursing staff are essential in managing the transport of critically ill babies and their life-support equipment to the imaging department. They assist the technologist in

safely transferring the infant to the imaging plate or CT table while maintaining thermoregulation and monitoring.

Geriatric Patients and Patients with Mobility Limitations. Older adults or patients with arthritis, Parkinson's disease, or recent surgery present challenges with pain, stiffness, and an inability to assume certain positions. Technologists must use pillows and padding for support and comfort, avoiding positions that could cause injury. Nurses assist with safe patient transfer using lifts or slide boards and administer prescribed analgesia prior to the procedure if needed [36]. Clear, patient instructions and patience are vital.

Critically Ill and Trauma Patients. In the emergency setting, speed and safety are paramount. The "ABCDE" (Airway, Breathing, Circulation, Disability, Exposure) approach is maintained. Nursing and technologist roles merge in a rapid, efficient workflow. Nurses manage IV lines, monitors, and ventilator settings. Technologists perform imaging with minimal movement of the patient, often utilizing trauma positioning protocols (e.g., cross-table lateral cervical spine view) and placing imaging plates underneath the patient without moving them [37]. Communication is terse and focused on immediate needs.

Patients with Cognitive Impairment or Severe Anxiety. For patients with dementia, severe claustrophobia, or psychiatric conditions, cooperation can be extremely limited. Nurses are pivotal in assessing the need for and managing sedation. Technologists must work quickly and efficiently once the patient is sedated or find creative ways to gain cooperation. Sometimes, imaging with a family member present in the room (appropriately shielded for X-ray/CT) can provide calming support [38].

Bariatric Patients. Physical accommodation is the primary challenge. Technologists must know the weight and bore diameter limits of their equipment. Special wide-bore CT and MRI scanners are increasingly common. Positioning aids like larger padding and reinforced tables are used. Both staff members must practice safe patient handling techniques to prevent musculoskeletal injuries to themselves and the patient [39].

7. Quality Assurance, Safety, and Interprofessional Communication

The foundation of effective patient preparation and positioning is a robust culture of safety and clear communication. **Time-outs or procedural pauses** are conducted immediately before initiating a procedure, especially invasive ones or those involving contrast. The entire team (technologist, nurse, radiologist) verbally confirms patient identity, procedure site, and that all necessary preparations and safety checks are complete [40].

Documentation is a shared responsibility. Nurses document patient assessments, medications administered, IV site status, and patient tolerance. Technologists document technical parameters, positioning notes, radiation dose (for applicable modalities), and any patient factors affecting image quality. **Incident reporting** for near-misses or adverse events (e.g., contrast extravasation, patient fall) is essential for systemic improvement.

Ongoing **education and training** for both professions are crucial. This includes regular updates on new imaging protocols, contrast safety guidelines, sedation policies, and safe patient handling techniques. Interprofessional education sessions, where technologists and nurses train together on scenarios like managing a contrast reaction or positioning a challenging patient, foster mutual understanding and improve team performance [40].

8. Conclusion

Patient preparation and positioning in diagnostic imaging constitute a sophisticated, clinically critical process that significantly influences diagnostic outcomes, operational efficiency, and the overall patient experience. It is a domain where technical precision and compassionate, holistic care converge. The radiology technologist, with deep expertise in imaging science and procedural execution, and the nursing staff, with mastery in patient assessment, physiological management, and therapeutic communication, form an indispensable partnership. Their roles, while distinct in focus, are deeply interdependent. Effective collaboration, grounded in mutual respect, clear communication, and shared goals, transforms a routine diagnostic test into a reliable, safe, and patient-centered episode of care. As imaging technology continues to advance, becoming more complex and integral to personalized medicine, the human expertise embodied by this collaborative team will remain the irreplaceable constant, ensuring that the remarkable power of diagnostic visualization is realized fully and safely for every patient. The ongoing refinement of this teamwork, supported by institutional commitment to quality assurance and interprofessional education, stands as a cornerstone of excellence in modern radiology practice.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.

- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.
- **Author contributions:** The authors declare that they have equal right on this paper.
- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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