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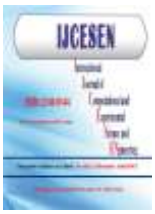

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Research Article

Clinical Safety During Intrahospital Transport of Unstable Emergency Patients for Diagnostic Imaging: Interdisciplinary Roles of Nurses, Radiology Staff, Health Assistants, and Emergency Teams

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Abstract:

Intrahospital transport of unstable emergency patients for diagnostic imaging presents numerous challenges that necessitate a coordinated interdisciplinary approach to ensure clinical safety. In this complex scenario, nurses play a pivotal role in assessing the patient's stability, communicating critical information about the patient's condition, and preparing them for transport. They are responsible for monitoring vital signs and managing any immediate interventions required during movement. Radiology staff are equally crucial, as they must be prepared to accommodate the patient's specific imaging needs while ensuring the appropriate protocols are followed. Collaboration with health assistants further supports this process, ensuring that all necessary equipment and supplies are available and that the transport pathway is clear and safe. This seamless teamwork is essential for mitigating the risks associated with patient transport, as any delay or oversight can have severe consequences for unstable patients. Moreover, emergency teams serve as the backbone of this interdisciplinary effort, providing specialized care and rapid response capabilities throughout the transport process. Their expertise is indispensable in making real-time decisions about the patient's needs, which may change suddenly during transit. Communication among all team members—nurses, radiology staff, health assistants, and emergency personnel—is critical, fostering a shared understanding of each patient's unique needs and circumstances. Regular interdisciplinary training and simulation exercises can enhance this coordination, ensuring that all parties are prepared for the complexities of intrahospital transport. Ultimately, by recognizing and respecting the distinct roles of each discipline, healthcare providers can enhance clinical safety and improve outcomes for unstable emergency patients undergoing diagnostic imaging.

1. Introduction

The modern Intensive Care Unit (ICU) is designed as a sanctuary of stability—a controlled environment where continuous monitoring, life-support systems, and specialized expertise converge to manage the most critically ill patients [1]. However, the very nature of acute care often necessitates a paradoxical disruption of this stability: the intrahospital transport (IHT) of unstable patients to advanced diagnostic imaging suites, such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI), or interventional radiology [2]. While these diagnostic modalities are indispensable for guiding life-saving interventions—identifying intracranial hemorrhages, pulmonary embolisms, or aortic dissections—the journey from the ICU to the radiology department and back represents a period of extreme vulnerability [3]. This process transitions the patient from a resource-rich environment to a mobile, resource-limited setting, exposing them to a cascade of potential physiological and technical hazards [4].

The inherent risks of IHT for critically ill patients have been well-documented over decades of critical care literature, yet it remains an unavoidable component of comprehensive emergency management [5]. The incidence of adverse events during these transports is alarmingly high, with some studies suggesting that physiological deterioration or equipment-related incidents occur in a significant majority of cases [6]. These events are not merely statistical anomalies; they encompass a spectrum of life-threatening complications including severe hypotension or hypertension, oxygen desaturation, cardiac arrhythmias, accidental extubation, dislodgement of central venous catheters, and even cardiac arrest [7]. The meta-analysis by Murata et al. highlights the heterogeneity in defining these events, but the consensus is clear: the patient's safety margin is considerably reduced once they leave the secure perimeter of the ICU [8]. Risk factors are multifaceted, ranging from patient-specific conditions such as high severity of illness scores, the requirement for vasopressor support, and mechanical ventilation with high Positive End-Expiratory Pressure (PEEP), to logistical variables like transport duration and the destination itself, with MRI carrying a notably higher risk profile [1].

The physical environment of transport compounds these clinical risks. The process of moving a patient, often weighing hundreds of pounds including the bed and equipment, presents significant ergonomic challenges for staff and physiological challenges for the patient [3]. Sudden movements can precipitate profound hemodynamic shifts in a patient with a denervated autonomic nervous system due to sedation or illness [4]. Furthermore, the transport corridor is an uncontrolled space; cramped elevators, narrow doorways, and cluttered hallways can impede rapid response and distract the clinical team from patient observation [2]. The very act of maneuvering the bed can consume the attention of a team member,

leaving the patient monitored but potentially unattended for crucial seconds [6]. In this context, the patient is not merely being moved; they are being subjected to a physiological stress test for which they are poorly equipped [7].

Recognizing these dangers, professional bodies such as the Society of Critical Care Medicine (SCCM) and the American Society of Anesthesiologists (ASA) have established guidelines to standardize and safeguard the transport process [5]. These guidelines universally emphasize a structured approach built upon four fundamental pillars: communication, personnel, equipment, and monitoring [8]. The SCCM guidelines, in particular, advocate for a formalized, institutional plan that addresses pretransport coordination, the composition and qualifications of the transport team, the availability of appropriately charged and functional equipment, and the maintenance of continuous, high-acuity monitoring throughout the journey [1]. The underlying principle is that the standard of care should not be diminished simply because the patient is in transit [3].

However, the successful implementation of these guidelines is not automatic. It hinges on the seamless integration of a diverse group of healthcare professionals, each bringing a unique skill set to the mobile care environment [4]. The transport of an unstable patient is not a simple courier service; it is a dynamic, interdisciplinary operation [2]. The core clinical responsibility typically falls upon the emergency team or ICU nurses and physicians, who possess deep knowledge of the patient's condition and critical care expertise [6]. Yet, they must operate in the unfamiliar terrain of the radiology department, where the environment is optimized for imaging machines, not patient resuscitation [7]. Conversely, the radiology staff—technologists and support personnel—are masters of their diagnostic equipment but may have less frequent exposure to the management of the profoundly unstable patient [8]. Bridging this gap is the often-overlooked role of the health assistant or patient transporter, whose responsibilities for safe handling and equipment management are critical to the physical safety of both the patient and the team [5].

2. The Spectrum of Risk During Intrahospital Transport

Understanding the specific dangers inherent to IHT is the first step in mitigating them. These risks can be broadly categorized into patient-related physiological events and system-related technical or logistical failures [9]. The interplay between these categories often determines the outcome of the transport episode.

Physiological instability during transport is common and frequently multifactorial [10]. Changes in patient position can lead to profound alterations in hemodynamics, particularly in patients who are hypovolemic or have impaired cardiovascular reflexes due to sedation or underlying pathology [11]. The jarring motion of the transport stretcher can stimulate the sympathetic nervous system, potentially exacerbating hypertension or tachycardia in some patients, while causing vasodilation and hypotension in others [12]. For the mechanically ventilated patient, the temporary disconnection from a stationary ventilator to a transport ventilator, or the use of a manual resuscitation bag, can lead to significant changes in tidal volume, respiratory rate, and delivered oxygen concentration [13]. This can result in hypercapnia, hypoxemia, or alveolar derecruitment, increasing the risk of ventilator-associated lung injury [9]. Furthermore, the patient's own agitation or anxiety related to the unfamiliar environment and movement can increase oxygen consumption and cardiac work, further destabilizing their precarious physiological balance [10].

Beyond the patient's physiology, the transport process is fraught with technical risks [14]. Equipment failure is a persistent threat. Transport monitors may have battery failure, portable oxygen tanks may run empty unexpectedly, or infusion pumps may malfunction or become dislodged [15]. The sheer act of moving a patient with multiple intravenous lines, arterial catheters, endotracheal tubes, chest tubes, and urinary catheters creates a high risk for accidental dislodgement or removal [16]. Each piece of tubing and wiring represents a potential tether, and a sudden movement or a turn through a narrow doorway can result in a line being pulled out, with potentially catastrophic consequences [11]. The electromagnetic environment of the radiology suite, particularly the MRI scanner, introduces additional hazards [12]. Ferromagnetic objects can become projectiles, and the strong magnetic field can interfere with the function of standard infusion pumps and monitors, necessitating the use of specialized MRI-safe equipment and rigorous screening protocols [17].

Finally, communication breakdowns constitute a significant, yet often underappreciated, risk category [18]. The transfer of the patient from the ICU team to the radiology team is a high-risk moment for information loss [19]. If the radiology staff is not fully briefed on the patient's condition, specific vulnerabilities (e.g., a difficult airway, a need for strict aspiration precautions), and the goals

of the imaging study, they cannot effectively contribute to the patient's safety during the scan [20]. Similarly, if a problem arises during the scan, a lack of clear, pre-established communication pathways between the radiology control room and the ICU team at the bedside can delay a critical intervention [14]. These systemic failures often prove to be the root cause of adverse events, underscoring the need for a robust, interdisciplinary communication protocol [15].

3. The Pivotal Role of the Emergency Team and ICU Nurses

At the heart of any safe transport is the clinical expertise of the emergency team or ICU nurses accompanying the patient [21]. These individuals are the patient's primary advocates and the clinical decision-makers during the journey [16]. Their responsibilities begin long before the patient is moved and extend until the patient is safely returned to the ICU or transferred to another responsible clinical team [17].

The pre-transport phase is arguably the most critical for nursing intervention [22]. It involves a meticulous assessment of the patient's stability and readiness for transport [18]. The nurse must evaluate the patient's hemodynamic status, respiratory function, and neurological state to determine if the potential benefit of the diagnostic study outweighs the undeniable risks of the transport [19]. This assessment informs the planning of necessary interventions, such as adjusting vasopressor infusions, suctioning the airway, or administering additional sedation or analgesia specifically for the journey [20]. The nurse is also responsible for ensuring that all necessary equipment is assembled, checked for functionality, and has adequate battery life and oxygen supply [23]. This includes verifying the transport monitor, defibrillator, oxygen tank, suction source, and all emergency medications are immediately accessible [21]. A comprehensive pre-transport checklist, a tool strongly advocated for in safety guidelines, is often led and completed by the bedside nurse to ensure no critical step is overlooked [24].

During the transport itself, the nurse's role is one of continuous, vigilant monitoring and intervention [22]. Positioned at the patient's head, ideally, the nurse has an unobstructed view of the patient's face, the endotracheal tube, and the monitor screen [25]. They are tasked with observing for subtle signs of deterioration—a slight change in level of consciousness, a dip in oxygen saturation, an irregularity in the cardiac rhythm—and interpreting these findings in the context of the patient's baseline condition [23]. The nurse must be prepared to intervene immediately, whether that means manually ventilating the patient, administering a bolus of fluid or medication, or repositioning the patient to improve oxygenation [26]. This requires not only technical skill but also the ability to function effectively in a constrained and distracting environment, often with limited support [24]. The nurse functions as the mobile ICU, providing a seamless extension of critical care throughout the transport corridor [27].

Upon arrival in the radiology suite, the nurse's role transitions to one of coordination and handoff communication [25]. They are responsible for a clear, structured handoff to the radiology team, using tools like the SBAR (Situation, Background, Assessment, Recommendation) format to succinctly convey the patient's history, current status, and specific needs during the procedure [28]. The nurse remains with the patient throughout the imaging study unless radiation exposure is a concern, in which case they must be positioned to maintain visual and verbal contact, ready to re-enter immediately if needed [26]. After the scan, the nurse leads the process of re-stabilizing the patient, reconnecting any disconnected lines, and preparing for the return journey, repeating the same level of vigilance in reverse [27].

4. The Critical Contribution of Radiology Staff

The radiology department is the destination, and its staff are the expert guides in this foreign land. The role of the radiologist and, most critically, the radiology technologist is indispensable for the safe and efficient completion of the diagnostic study [29]. Their expertise lies in navigating the technical and environmental demands of the imaging equipment while ensuring patient safety and optimizing image quality [30].

The primary responsibility of the radiology technologist is to prepare the imaging environment for the arrival of the unstable patient [28]. This involves ensuring that the scanner is available and ready, and that any necessary contrast media is prepared and labeled [9]. Crucially, for MRI, this includes performing an additional, rigorous safety screening of the patient and all accompanying equipment to prevent ferromagnetic projectiles and equipment malfunction [10]. The technologist must work in close coordination with the transport team to facilitate a smooth and safe transfer of the patient from the transport stretcher to the imaging table [11]. This patient handling requires a high degree of coordination to prevent line dislodgement and maintain spinal precautions if indicated [12]. The technologist's knowledge of safe lifting and patient

positioning techniques is paramount in preventing injury to both the patient and the staff [13].

During the imaging procedure, the radiology staff contributes to patient monitoring, albeit from a different vantage point [14]. The technologist in the control room monitors the patient through a window and via cameras, observing for gross movements that could degrade image quality and for any signs of acute distress, such as increased agitation or apparent respiratory difficulty [15]. They are the eyes and ears outside the scan room and serve as the first line of communication if a problem is observed [16]. If a patient deteriorates during the scan, the technologist is responsible for halting the procedure immediately and alerting the accompanying clinical team [17]. In the case of CT, where radiation exposure is a concern, the technologist plays a key role in minimizing exposure to both the patient and the staff, ensuring that all non-essential personnel are safely behind the lead barrier during the scan [18].

The radiologist also has a critical role, particularly in interpreting emergent findings in real-time [19]. For unstable patients, the question is often binary—is there a surgical lesion or not?—and the answer is needed immediately. The radiologist must be prepared to provide a preliminary, on-call interpretation to the transport team to guide the next steps in management, whether that be a direct transfer to the operating room or a return to the ICU [20]. This rapid communication loop completes the diagnostic purpose of the transport, ensuring that the risk taken by moving the patient yields a timely and actionable clinical result [21].

5. The Integral Support of Health Assistants

Often the unsung heroes of the transport team, health assistants (also known as patient care technicians or transporters) provide the logistical and ergonomic backbone that enables a safe and smooth journey [22]. Their role, while less clinically focused than the nurse's, is no less essential to the overall safety equation. They are the experts in the physical act of transport, managing the complex machinery of the hospital bed and navigating the spatial challenges of the hospital environment [23].

The health assistant's primary contribution lies in the safe handling of the patient and equipment [24]. They are typically responsible for maneuvering the heavy hospital bed, steering it through hallways, around corners, and into and out of elevators [25]. This task, while seemingly straightforward, requires significant skill and spatial awareness. A sudden jolt or a poorly navigated turn can have direct physiological consequences for the patient [26]. Furthermore, the assistant is responsible for managing the tangle of cables and tubing that connect the patient to their life-support equipment, ensuring that lines are not snagged, pulled, or disconnected during movement [27]. They serve as a second pair of hands, working in tandem with the nurse to keep the patient's environment organized and safe. In the event of an emergency, the health assistant can be invaluable, fetching additional equipment, calling for help, or assisting with basic life support measures under the direction of the nurse [28].

Beyond the immediate patient interaction, health assistants often play a role in equipment logistics [29]. They may be responsible for checking the oxygen levels in portable tanks before departure, ensuring the transport monitor is charged, and gathering the necessary pumps and poles [30]. Their familiarity with the hospital's layout is also a key safety asset, as they can identify the most efficient and smoothest route to the destination, avoiding construction areas, crowded public spaces, or malfunctioning elevators that could delay transport and prolong patient exposure to risk [9]. A skilled health assistant effectively serves as a pilot, navigating the patient and the clinical team safely through the complex terrain of the hospital, allowing the nurses and physicians to focus their full attention on the patient's clinical status [10].

6. Synergy and Communication: The Interdisciplinary Imperative

The individual roles of nurses, physicians, radiologists, technologists, and health assistants, while distinct, are interdependent. The safety of the patient during IHT is not the sum of individual efforts but the product of their seamless integration [11]. This synergy is achieved through effective communication, mutual respect, and a shared mental model of the goals and potential pitfalls of the transport [12].

Effective interdisciplinary communication must be structured and intentional. The use of standardized communication tools, such as the SBAR handoff, is crucial during the transfer of responsibility between the ICU and radiology teams [13]. A pre-transport huddle, involving all members of the transport team, can be highly effective in establishing a shared plan [14]. In this brief meeting, the nurse can outline the patient's status and specific concerns, the health assistant can identify the planned route, and the radiology technologist can confirm the room is ready and highlight any department-specific safety requirements [15]. This brief, focused conversation ensures that everyone is informed and prepared, reducing the risk of

misunderstandings during the transport itself [16]. Furthermore, it establishes clear lines of authority for the journey, typically designating the ICU nurse or physician as the team leader in charge of all clinical decisions [17].

The culture of the interaction is as important as its structure [18]. A hierarchical environment where some team members feel intimidated or unheard is a direct threat to safety. A health assistant who notices a snagged line must feel empowered to speak up immediately, without fear of being dismissed [19]. A radiology technologist who observes a change in the patient's condition on the monitor must be confident that their observation will be taken seriously by the clinical team [20]. Fostering a culture of psychological safety, where every member's input is valued as a critical component of the team's collective vigilance, is essential [21]. This collaborative approach transforms a group of individuals into a high-functioning, interdisciplinary team, capable of anticipating and responding to challenges effectively [22].

7. Checklists, Protocols, and System-Level Safeguards

While individual and team competencies are vital, they must be supported by robust system-level safeguards [23]. The most powerful of these are the structured protocols and checklists designed to standardize the transport process and minimize the risk of human error [24]. These tools serve as cognitive aids, ensuring that critical steps are not forgotten, especially in the chaotic and stressful context of an emergency transport [25].

A comprehensive intrahospital transport protocol should be a formal, institutional policy that outlines the minimum standards for patient transport [26]. This protocol should define, based on patient acuity, the required composition of the transport team (e.g., ICU nurse alone vs. nurse plus respiratory therapist or physician), the necessary monitoring equipment, and the process for obtaining informed consent for transport if applicable [27]. It should also mandate a pre-transport checklist to be completed by the team before departure [28]. This checklist, often a physical document or an electronic form, prompts the team to verify the patient's stability, the functionality of all equipment, the adequacy of oxygen and battery supplies, and the availability of emergency medications [29]. Studies have consistently shown that the implementation of such checklists is associated with a significant reduction in the incidence of adverse events during IHT [30].

Beyond the checklist, system-level safeguards include the strategic placement of necessary equipment [11]. Ensuring that transport monitors are always docked and charging, that oxygen tanks are centrally stocked and checked, and that emergency airways are readily available in designated transport areas reduces the likelihood of equipment-related failures [12]. Furthermore, regular, interdisciplinary simulation-based training can be a powerful tool for improving team performance and identifying latent safety threats in the transport process [13]. By practicing high-risk transports in a simulated environment, teams can refine their communication, test their protocols, and build the muscle memory needed to respond effectively to real-life emergencies [14]. These institutional commitments to standardization and training transform the transport process from a hazardous endeavor into a controlled, reliable clinical procedure.

8. Conclusion

The intrahospital transport of unstable emergency patients for diagnostic imaging represents a nexus of high risk and high benefit. It is a necessary procedure that places the most vulnerable patients in a precarious position, demanding the highest level of coordinated care. The responsibility for navigating this journey safely does not rest on a single individual or profession. Instead, it is a shared endeavor that requires the seamless integration of the emergency team's clinical acumen, the radiology staff's technical expertise, and the health assistant's logistical skill. The ICU nurse serves as the constant, vigilant guardian of the patient's physiology. The radiology technologist acts as the expert guide in a technologically demanding and potentially hazardous environment. The health assistant provides the essential physical support and spatial navigation that allows the clinical team to focus on the patient.

Ultimately, the safety of the patient is a product of synergy. It is achieved through structured communication, a shared mental model of the plan, and a culture of mutual respect where every voice is valued. This human collaboration must be reinforced by robust system-level safeguards, including standardized protocols, rigorous pre-transport checklists, and ongoing interdisciplinary training. By embracing this comprehensive, interdisciplinary approach—where nurses, radiologists, technologists, health assistants, and emergency physicians function not as separate entities but as a single, cohesive mobile intensive care unit—hospitals can fulfill their primary obligation: to ensure that the pursuit of a diagnostic

image never comes at the cost of the patient's safety. The goal is to extend the sanctuary of the ICU into the radiology suite and all the corridors in between, transforming a perilous journey into a safe and routine extension of critical care.

Author Statements:

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