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Enhancing Patient Safety during Intra-Hospital Transport: A Critical Analysis of Adherence to Intra-Hospital Transport Protocol among Healthcare Personnel of ICU in a Tertiary Care Hospital

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Abstract: ***Background: Intra-hospital transport of critically ill patients is complex and carries potential risks. Despite its importance, adherence to protocols within ICUs is often unclear. Aim: This study investigated adherence to an intra-hospital transport protocol and associated adverse events in a tertiary care ICU. Methods: Observation of 72 transport events across MICU, SICU, and RICU. A checklist assessed adherence before, during, and after transport. Results: 68.1% transport was originated from MICU for diagnostics procedure. An intra-hospital transport team of four usually managed the process. Pre-transport checklist compliance was moderate (66.6% and 75% for backup cylinder and ventilator checks, respectively), while perfect adherence was observed during and after transport. Cardiovascular adverse events (tachycardia, hypertension, hypotension) were common, but less frequent than agitation compared to previous studies. Discussion: Adherence to the protocol, particularly during and after transport, was high. Yet, pre-transport compliance needs improvement. The study underlines the importance of protocols and suggests further research on pre-transport checks and adverse events. Conclusion: Protocol adherence during ICU transport is vital for patient safety. Future research should address pre-transport compliance and broaden the scope of adverse events for comprehensive risk management.***

Keywords: ICU patient transport, protocol adherence, adverse events, critical care safety, multidisciplinary team

1. Introduction

The critical care landscape demands a comprehensive approach to patient management, often involving intricate diagnostic or interventional procedures for those admitted to the Intensive Care Unit (ICU). The subsequent requirement for intra-hospital transport, either within the facility or to external locations, introduces a complex dynamic. Intra-hospital transport encompasses the movement of patients within the hospital premises for diagnostic or therapeutic purposes, or their transfer to specialized units within the medical facility.[1]

The complexity of this activity necessitates meticulous attention to ensure the preservation of the clinical conditions of patients during transport. Contrary to ideal practice, observations indicate that the transportation of hospitalized patients is frequently conducted automatically, lacking prior planning among the involved team members. This deficiency in planning and preparation, encompassing team coordination, materials, and equipment, heightens the vulnerability to adverse events that may compromise the safety of the patient during transport.[2]

Transporting patients within the ICU setting requires a judicious evaluation of potential benefits and risks. Numerous studies underscore the transformative impact of transporting critically ill patients, often resulting in alterations to the treatment plans for a substantial proportion of cases. Specifically, diagnostic procedures for trauma, vascular, and abdominal surgery patients have been found to prompt changes in management for 40% of transported patients.[2]

Patient safety, defined as the reduction of preventable risks and damage during healthcare processes, emerges as a paramount concern in the context of intra-hospital transport. The significance of patient monitoring during transport is underscored, emphasizing the critical role of appropriate equipment and supplies in enhancing transport safety. The escalating apprehension surrounding errors and adverse events during intra-hospital transport underscores healthcare environments as potential sources of harm to patients.[3]

Acknowledging the need for specific knowledge regarding the risks associated with intra-hospital transport, this research aims to contribute to improved safety and enhanced pre-transport planning. Notably, the lack of mandatory regulations for patient transport in Indian ICUs highlights a gap in current practices. However, the implementation of checklists or protocols within ICUs is recognized as an effective strategy to mitigate complications during transport and ensure patient safety. This study aims to evaluate the adherence to intra-hospital transport protocol among healthcare personnel of ICU in a tertiary care hospital.

2. Methods

A cross-sectional descriptive research approach was employed to evaluate the adherence to intra-hospital transport protocols among healthcare personnel within the Intensive Care Unit (ICU) of a tertiary care center with 1350 beds, housing 59 bedded Medical Intensive Care Units (MICU), Surgical Intensive Care Units (SICU), and Respiratory Intensive Care Units (RICU). The event sampling technique was employed for data collection.

Permission and Protocol Development:
Administrative authorization and approval from the Institutional Ethics Committee (IEC) were secured prior to initiating the study. The investigator drafted an intra-hospital transport protocol by synthesizing available guidelines from the literature review. This protocol underwent thorough discussions with department heads and the nursing team. Upon approval from the head of the ICUs, the protocol was disseminated to all healthcare personnel within the ICU and prominently displayed in relevant areas.

Observational Checklist:
To evaluate adherence before, during, and after each intra-hospital transport, an observational checklist aligned with the protocol was prepared by the investigator. This checklist served as a comprehensive tool for systematic assessment. (Figure 1)

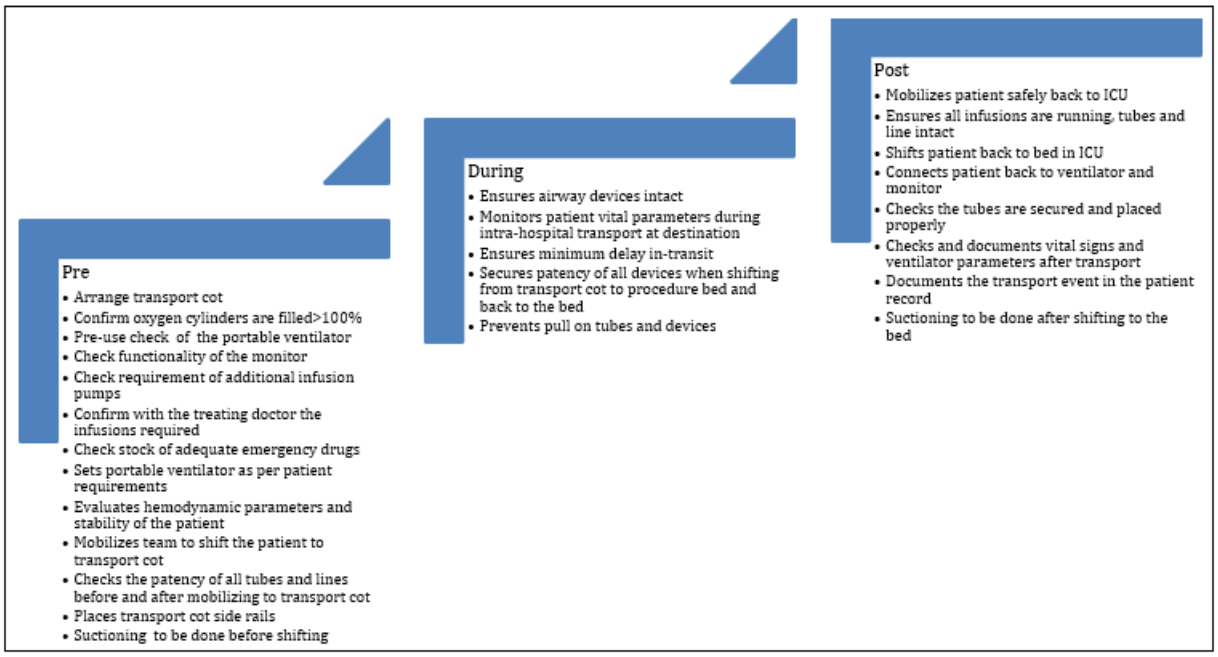

Figure 1: Transport Checklist

Event Identification:
The study focused on events in a 39-bed MICU, a 10-bed SICU, and a 10-bed RICU. All patients who required transport were included in the study. Any adverse events before, during and after transport were noted.

Observation Process:
The investigator observed the entire transport event, commencing from the preparation phase until the patient was reconnected to the ventilator, monitor, and infusion pumps. Additionally, healthcare personnel were observed assessing the hemodynamic stability of the patient post-transport.

This methodological approach ensured a comprehensive evaluation of intra-hospital transport adherence within the designated ICUs. The study adhered to ethical guidelines and obtained necessary approvals, while the observational checklist and protocol were designed to facilitate systematic data collection and analysis.

3. Results

1) Baseline Variables:

Among 72 intra-hospital transport events, 68.1% originated from the MICU, and 81.9% were transported for CT scans. The intra-hospital transport team, comprising four members, was involved in 84.7% of events. The majority of events (73.6%) took more than 30 minutes to one hour for the entire transport process. Intubated patients constituted 75% of the total subjects, requiring the use of a portable ventilator during transport. (Table 1)

Table 1: Baseline Characteristics, n=72

S No.	Characteristics	Frequency	Percentage (%)
1	**Transport origin**		
	MICU	**49**	**68.1**
	SICU	17	23.6
	RICU	6	8.3
2	**Transport destination**		
	CT	**59**	**81.9**
	MRI	12	16.7
	ENDOSCOPY	6	1.4
3	**Number of members in the transport team**		
	1-4	**61**	**84.7**
	>4 members	11	15.3
4	**Time taken for the entire transport**		
	10-30 minutes	5	6.9
	31-60 minutes	**53**	**73.6**
	>1 hour	14	15.3
5	Intubated	**54**	**75**
	Non-intubated	18	25

2) Adherence to Intra-Hospital Transport Protocol (Before, During, and After):

Before Transport:

It was noted only 66.6% of the times checking of the filled backup cylinder was done. Pre-use checks of the portable ventilator were performed in 75% of cases. (Table 2)

Table 2: Check list Before Transport, n=72

Items	Adherence Frequency (n)	Percentage
Arrange transport cot	72	100%
Confirm oxygen cylinders are filled>100%	72	100%
Check the filled backup cylinder	48	66.60%
Pre-use check of the portable ventilator	54	75%
Check functionality of the monitor	72	100%
Check requirement of additional infusion pumps	72	100%
Confirm with the treating doctor the infusions required	72	100%
Check stock of adequate emergency drugs	72	100%
Sets portable ventilator as per patient requirements	72	100%
Evaluates hemodynamic parameters and stability of the patient	72	100%
Mobilizes team to shift the patient to transport cot	72	100%
Checks the patency of all tubes and lines before and after mobilizing to transport cot	72	100%
Places transport cot side rails	72	100%
Suctioning to be done before shifting	72	100%

During Transport:

100% adherence to the intra-hospital transport protocol was observed. Continuous monitoring of vital parameters (ECG, BP, oxygen saturation, and respiratory rate) using a portable cardiac monitor. (Table 3)

Table 3: Check list During Transport, n=72

Items	Frequency	Percentage (%)
Ensures airway devices intact	72	100%
Monitors patient vital parameters during intra-hospital transport at destination	72	100%
Ensures minimum delay in-transit	72	100%
Secures patency of all devices when shifting from transport cot to procedure bed and back to the bed	72	100%
Prevents pull on tubes and devices	72	100%

After Transport:

Complete adherence to the post-intra-hospital transport protocol, including safe mobilization to the ICU cot, reconnection to the cardiac monitor, securing infusions, and verifying the placement of vascular access and tubes was noted. (Table 4)

Table 4: Check list After Transport, n=72

Items	Frequency	Percentage (%)
Mobilizes patient safely back to ICU	72	100%
Ensures all infusions are running, tubes and line intact	72	100%
Shifts patient back to bed in ICU	72	100%
Connects patient back to ventilator and monitor	72	100%
Checks the tubes are secured and placed properly	72	100%
Checks and documents vital signs and ventilator parameters after transport	72	100%
Documents the transport event in the patient record	72	100%
Suctioning to be done after shifting to the bed	62 (54- intubated 8-non intubated)	86.1% (75% 11.1%)

3) Adverse Events Related to Transportation:

Cardiovascular system-related adverse events: tachycardia (59.7%), increased blood pressure (31.9%), and decreased blood pressure (26.3%).

Central nervous system-related adverse events: agitation and restlessness observed in 2.7% of cases. (Figure 2)

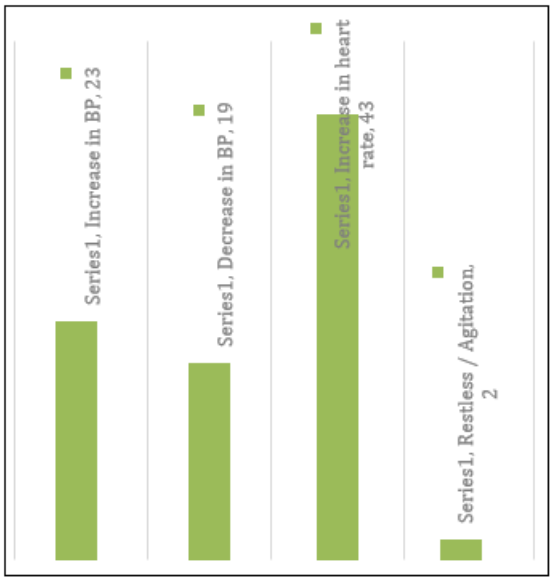

Figure 2: Adverse events during Transport
BP- Blood Pressure

4. Discussion

The study's findings revealed that a majority of intra-hospital transport events (68.1%) originated from the Medical Intensive Care Unit (MICU), with 81.9% of subjects being transported for diagnostic purposes, particularly for CT scans. This trend aligns with similar studies conducted at Westmead Hospital and Harbin Medical University, where computed tomography was identified as the most common reason for intra-hospital transport (86.2%).[5]

The composition of the intra-hospital transport team, with four members in 84.7% of events, mirrored findings from a Swedish ICU study, indicating that 86% of events involved two to four team members.[14] Additionally, a significant proportion of events (73.6%) took more than 30 minutes to one hour for the entire transport process, and 75% of subjects requiring a portable ventilator were intubated. These percentages were consistent with similar studies in Sweden (80%) and another ICU study (71.25%).[6,14]

Before transport, the study identified that 66.6% of events involved checking the filled backup cylinder, while the pre-use check of the portable ventilator was conducted in 75% of events. These figures may be influenced by increased demand for oxygen cylinders during the second wave of the Covid-19 pandemic. During transport, the study demonstrated 100% adherence to the intra-hospital transport protocol, including measures to ensure the integrity of airway devices, prevent endotracheal tube blockage or displacement, and monitor vital parameters continuously.

Post-transport, the study reported 100% adherence to checklist items, such as safe mobilization to the ICU cot, reconnection to the cardiac monitor, securing infusions, and checking for the placement of vascular access and tubes. This comprehensive adherence to post-transport measures is crucial, as related studies have highlighted events related to line disconnection and displacement of IV lines.[3,15]

Regarding adverse events related to transportation, the study identified that the majority were cardiovascular-related, including tachycardia (59.7%), increased blood pressure (31.9%), and decreased blood pressure (26.3%). In comparison, a Brazilian study reported physiological alterations during transport, such as tachycardia (35%), hypotension (50%), hypertension (28.6%), and agitation (30%).[3] Critical events during transport in a related study encompassed various categories, with non-adherence to procedures being linked to increased adverse events.Our study had lower rate of agitation compared to previous study, mainly due to strict sedation protocols followed during transport.

While the study contributes valuable insights into intra-hospital transport practices within the ICU setting, it is important to acknowledge certain limitations that may impact the generalizability and interpretation of the findings.

Firstly, the study was conducted at a single tertiary care center, specifically in the ICU of SJMCH. The results may be influenced by the unique characteristics, practices, and resources of this particular healthcare institution, limiting the external validity of the findings. Replicating the study in diverse healthcare settings could provide a more comprehensive understanding of intra-hospital transport practices.

Secondly, the data collection period coincided with the second wave of the Covid-19 pandemic, which may have influenced certain aspects of the findings, such as adherence

to specific checklist items. The increased demand for oxygen cylinders during this period could have impacted the thoroughness of pre-transport checks. Therefore, the findings may not fully represent practices during non-pandemic times, and caution is warranted in extrapolating the results to different healthcare contexts.

Furthermore, the study relied on observational methods to assess adherence to the intra-hospital transport protocol. While this approach offers valuable real-time insights, it is subject to observer bias and may not capture all relevant contextual factors influencing decision-making and actions during transport. Additionally, the study did not explore the perceptions and experiences of healthcare personnel involved in intra-hospital transport, which could provide valuable qualitative insights into the challenges and facilitators of adherence to protocols.

The study's focus on specific adverse events, such as cardiovascular and central nervous system-related events, may have omitted other potential adverse outcomes during intra-hospital transport. A more comprehensive exploration of a broader range of adverse events and their causes could enhance the study's impact.

Lastly, the study did not incorporate a comparison group or assess the impact of specific interventions on intra-hospital transport practices. A comparative analysis with a control group or an assessment of the effectiveness of specific interventions could offer a more robust understanding of the factors influencing adherence to protocols.

In summary, while the study provides valuable data on intra-hospital transport practices, its generalizability may be limited due to the single-center design, pandemic-related influences, observational methods, and the absence of a comparative analysis. Researchers and practitioners should interpret the findings with these limitations in mind and consider them when applying the results to different healthcare settings.

5. Conclusion

This study underscores the importance of strict adherence to protocols in ensuring patient safety during the transport of critically ill patients within the ICU setting. The findings provide valuable insights into the challenges and successes of intra-hospital transport practices, contributing to the ongoing efforts to enhance the quality and safety of critical care processes.

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