PERINATAL JOURNAL

Original Article

Perinatal Journal 2026; 34(2):515-527

https://doi.org/10.57239/prn.26.03420050

Intra-Hospital transportation and critical ill patient's outcomes: Correlational study

Asmaa Mohammed Abdelghafour[1]*, Mona Aly Mohammed[2], Ghada Shalaby Khalaf[3]

[1]Assistant Lecturer in Critical Care and Emergency Nursing Department Faculty of Nursing, Aswan University, Aswan
[2]Professor of Critical Care and emergency Nursing, Faculty of Nursing, Assiut University, Assiut
[3]Professor of Critical Care and emergency Nursing, Faculty of Nursing, Assiut University, Assiut

Abstract

Intra Hospital Transport (IHT) of critically ill patients is often needed for diagnostic or therapeutic purposes that cannot be done in The Intensive Care Unit (ICU). Patients are more likely to experience complications or unfavorable outcomes during transportation. to analyze the relationship of intra hospital transport with critical ill patient's outcomes in an intensive care unit. observational prospective exploratory descriptive research design. This study was carried in intensive care units at Qena university hospital. A convenience sampling of 100 patients. Five tools were utilized to collect data of the study, Patient assessment tool. Hemodynamic monitoring assessment tool. Medication assessment tool. Equipment preparation and Transport team assessment tool. Complications assessment tool. The overall occurrence of adverse events was 79%. Hemodynamic instability and respiratory deterioration were the most frequent adverse events that occurred during the transport process. This study presented that the occurrence of adverse events during transport of critically ill patients was high and adversely affect the patient's outcomes. The study needs be replicated with a significant sample of patients to ensure the results may be generalized. Protocols and guidelines for patient transfers should be widely implemented across all healthcare facilities to avoid difficulties arising during intrahospital transport.

Keywords: Correlational study, Critically ill patients, Intrahospital transport, Outcomes

Introduction

During transportation, Critically Ill Patients (CIPs) are more likely to experience morbidity and death. With careful planning, the use of properly qualified individuals, and the selection and availability of appropriate equipment, risks can be reduced and results can be enhanced. Vital function monitoring and maintenance do not stop while a patient is being transported. Additionally, the equipment and accompanying staff are chosen based on their training to meet the patient's expected or continuing acute care demands. (Ackley et al 2020).

Both within and outside of the Intensive Care Unit (ICU), it is crucial to continuously assess the CIPs. This should be done by a qualified physician using a systematic ABCDE that takes into account the patient's airway, breathing, circulation, disability, and exposure format. This framework makes it easier to prioritize fixing life-threatening issues and gives professionals a common method. (Zangrillo et al, 2020).

The safety of patients is crucial at every stage of the care continuum, from acute, long-term, and palliative care to primary, community, and home care. According to estimates, unsafe care causes 64 million disability-adjusted life years to be lost annually worldwide. Accordingly, adverse event-related patient damage is most likely in the top 10 global causes of mortality and disability (World Health Organization, 2021).

When CIPs are transported within a hospital, issues typically affect the body's systems, including the circulatory and respiratory systems, and in severe cases, they can be fatal. Transportation equipment can cause complications. Patient and illness severity, equipment and device malfunctions, staff communication during preparation and transport, patient monitoring during transport, and inadequate documentation of intra-hospital transport procedures are all complex risk factors for these complications. (Alizadeh et al, 2021).

In this context, the cardiovascular system issues that CIPs encounter during IHT include pulmonary edema, tachycardia, arrhythmia, cardiac arrest, and changes in blood pressure, typically hypotension.

Correspondence: Asmaa Mohammed Abdelghafour, Assistant lecturer in Critical Care and Emergency Nursing Department Faculty of Nursing, Aswan University, Aswan., **e-mail:** soma201581@yahoo.com, **Received:** February 22, 2025 **Accepted:** April 14, 2026

Changes in respiratory frequency, pneumonia, aspiration, airway blockage, unintentional endotracheal tube displacement or movement, respiratory arrest, O2 reduction, and blood gas alteration are among the respiratory system complications. (Alizadeh et al, 2021 & Association of perioperative Registered Nurses (AORN) Anonymous, 2022).

A competent and experienced team can significantly improve the safety of Intrahospital Transport (IHT) for critically ill patients by carefully planning ahead, ensuring effective communication, providing essential equipment, and accurately assessing patients' medical conditions. Nurses, as central figures in the transport team, are involved throughout every phase of the process. Their clinical expertise and close, continuous presence with the patient enable them to recognize potential life-threatening complications that may arise during transport. The critical care nurse plays a key role in enhancing patient safety by promptly identifying and responding to adverse events, preparing patients adequately, adjusting sedation appropriately, ensuring equipment is suitable and functioning, and consistently monitoring both the patient and equipment during the entire transfer. (Maddry et al, 2017).

Intrahospital transportation is a continual process of treatment and monitoring in addition to being a simple transport technique. Proper monitoring, effective equipment, and highly qualified and experienced professionals are necessary for intrahospital transportation. Finding the associated risk factors is therefore essential to preserving a high standard of patient safety and creating future-use guidelines. (Mostafa, et al. 2024).

Significance of the study

A study conducted by Murata et al. (2022), revealed that critical patient transport is risky; adverse outcomes were linked to between 6% and 70% of all IHT, and 8% of instances requiring medical therapy were found to involve changes in vital signs, unintentional extubation, or cardiac arrest. Additionally, according to the Australian Incident Monitoring Study in Intensive Care, 31% of transport accidents had major bad consequences, with 2% of those reports involving patient deaths. (Williams et al., 2020). In Qena University hospital, relationship between intrahospital transport and patient's outcomes had not been previously systematically evaluated.

It has been noted that intra-hospital transport is a dangerous practice, particularly for CIPs. Due to the emergency circumstances involving severely ill patients, even the shortest transport can result in potentially fatal complications. Therefore, this study conducted to analyze the relationship of intrahospital transport with critical ill patient's outcomes in an intensive care unit.

Aim of the study

This study aimed to analyze the relationship of intrahospital transport with critical ill patient's outcomes in an intensive care unit.

Research questions

1. What is the relationship of intrahospital transport with critical ill patient's outcomes in an intensive care unit?

Methods

Design

Descriptive correlational research design (Prospective, observational exploratory) was conducted in present study.

Setting

This study was carried out in all ICUs at Qena university hospitals, Qena governorate, Egypt.

Sample

Data collection was conducted over a six-month period (30 December 2024 -30 May 2025). All IHTs for diagnostic and therapeutic purposes of patients who were hospitalized in ICUs and needed transport to a diagnostic unit or the hemodynamic unit were analyzed. In total, 100 patients from the 208 who met the criteria for transfer to the ICU were analyzed in this study. The sampling technique applied was convenience sampling. The inclusion criteria included critical patients aged older than 18 years and eligible to be transferred from to ICU. The exclusion criteria were died patients and those referred to other hospitals before being transferred.

Data collection tools

Tool 1: Patient assessment sheet

This tool was developed by the researcher after reviewing literature to assess the patients before, during, and after intrahospital transport.

This tool consists of two-part:

Part 1. Demographic variables include initials of patients' code, age and sex

Part 2. Clinical data include admission diagnosis, prognostic scores, presence of comorbidities, ICU & hospital stay, transport duration, APACHE score and SOFA score.

Tool 2: Hemodynamic monitoring assessment sheet:

This tool was developed by the researcher after reviewing literature (Huygh, et al. 2016) (Kuhn &Werdan. 2001) to assess hemodynamic status of the patient before, during and after intrahospital transport that include (Blood pressure, heart rate, respiratory rate, body temperature, oxygen saturation, etc.)

Tool 3: Medication assessment tool

This tool was developed by the researcher after reviewing literature (Putra et al .2022) to assess medication use during intrahospital transport. Medications were categorizing into four groups: no-medication, vasoactive, sedative, and both vasoactive and sedative.

Tool 4: Equipment preparation and Transport team assessment tool

This tool was developed by the researcher after reviewing literature (Putra et al .2022) (Parveez et al. 2022) to assess the preparedness of the equipment and the number and specialty of the team involved in intrahospital transport.

Tool 5: Adverse events assessment tool

This tool was developed by the researcher after reviewing literature (Younis et al. 2022) (Gimenez et al. 2017) to assess the incidence, type and risk factors of adverse events.

Data collection

The data were collected by a qualified researcher assisted by two nurses as evaluators, working in three shifts per day. The research instrument was an observation sheet. Critical patients were observed before, during, and after transport from the ICU. Prior to being used in this study, the observation sheet was evaluated for content validity through expert judgment by five health professionals. The item-Content Validity Index (I-CVI) value was (81%) for tool 5 , (75%) for tool 4 & (71%) for tool 3, meaning it was feasible for use. This observation sheet was tested on two evaluators who were assessed for three observations with a good Kappa value, (almost perfect agreement).

The observation sheet was, therefore, determined to be reliable for use. The observation sheet contained seven items: two items to measure patient factors (patient condition and medication while in the ICU), two items to measure transfer attendant factors (monitoring and equipment preparation) and one item to measure organizational factors (transfer timing) , an additional item was used to quantify incidents during the transfer process.

The patients' condition was measured with the National Early Warning Score (NEWS). NEWS measurements are taken when a decision is made to move the patient from or to the ICU. The results of NEWS were grouped into three categories: low (NEWS score 0–4), moderate (NEWS score 5–6) and high (NEWS score ≥ 7) (Royal College of Physicians, 2017). Medications are categorized into four groups: no-medication, vasoactive, sedative, and both vasoactive and sedative. (Kulshrestha & Singh, 2016). The equipment preparations were categorized as either uncompleted or completed. Completed equipment is considered to be equipment that is suitable for the patients' clinical needs and transfer levels. Adverse events during patient transfers were grouped into categories, "yes" or "no". "Yes" was selected if at least one adverse event parameter was present in the patient. The hemodynamics measurement was carried out before and after the patient transfers to determine the data gaps. Which include (blood pressure, heart rate, respiratory rate, body temperature, oxygen saturation). Observations for adverse events commenced after the patient left the ICU and continued until the patient was handed over to the ordered area. The parameters of adverse events during the transfers were based on the model developed by Jones et al. (2016).

Data analysis

The data were processed using SPSS version 25. The descriptive data are presented in frequency and percentage. The bivariate test used Chi-square, while the Multivariate test used Pearson correlation coefficient, one-way ANOVA& paired T test.

Results

Table 1: Frequency distribution of studied patients for demographic and clinical Characteristics:

		Frequency	Percent
Age (Mean & SD)	**37.49±15.93**		
Gender	Male	57	57
	Female	43	43
Diagnosis	Post-operative (surgical patients)	19	19
	renal disease	15	15
	Cardiovascular diseases	12	12
	Neurological diseases	15	15
	Lung diseases	12	12
	trauma patients	13	13
	gastrointestinal disease	14	14
Indication of transport	Diagnostic	57	57
	Interventional	43	43

Chi-square test, significance <0.05

Table 1): Demographic and clinical characteristics

The mean age of the patients is 37.49 years, with a standard deviation of 15.93. The sample comprises 57 (57%) males and 43 (43%) females. The most common diagnoses among the patients are post-operative (surgical patients) (19%), renal and neurological diseases (15%) and gastrointestinal diseases (14%). Cardiovascular diseases, lung diseases, and trauma patients are also represented in the sample, albeit to a lesser extent. Most patients (57%) were transported for diagnostic purposes, while 43% were transported for interventional procedures.

Table 2): Frequency of patients' related events during intra-hospital transportation

Patient related events	Frequency	Percent
Cardiac arrest	4	4
Change in blood pressure usually Hypotension	26	26
Tachycardia	30	30
Bradycardia	11	11
Arrhythmia	5	5
Abnormal respiratory rate	16	16
Aspiration	17	17
Respiratory arrest	12	12
Desaturation	29	29
Pain	14	14
Nausea or vomiting	9	9
Agitation	10	10

Chi-square test, significance <0.05

Table 2): shows frequency of patients- related events during intra-hospital transport: Cardiac Arrest: This adverse events occurred in 4% of cases, indicating a severe cardiac complication. Change in Blood Pressure (Usually Hypotension): Hypotension, or low blood pressure, occurred in 26 % of cases, indicating potential hemodynamic instability. Tachycardia: Tachycardia, an elevated heart rate, occurred in 30% of cases, which can indicate various physiological or pathological conditions. Bradycardia: Bradycardia, a slow heart rate, occurred in 11% of cases, indicating potential cardiac conduction abnormalities. Arrhythmia: Approximately 5% of cases involved arrhythmias, indicating disturbances in the heart's rhythm. Abnormal Respiratory Rate: Respiratory rate abnormalities occurred in 16% of cases, indicating potential respiratory dysfunction. Aspiration: Aspiration, inhalation of foreign material into the airways, occurred in 15 % of cases, indicating a risk of pulmonary complications. Respiratory Arrest: Respiratory arrest occurred in 12% of cases, indicating a critical respiratory compromise. Desaturation: Oxygen desaturation occurred in 29% of cases, indicating inadequate oxygenation. Pain: Pain was reported in 14 % of cases, indicating patient discomfort or distress. Nausea or Vomiting: Nausea or vomiting occurred in 9% of cases, indicating potential gastrointestinal disturbances. Agitation: Agitation was reported in 10% of cases, indicating potential psychological distress or neurological dysfunction.

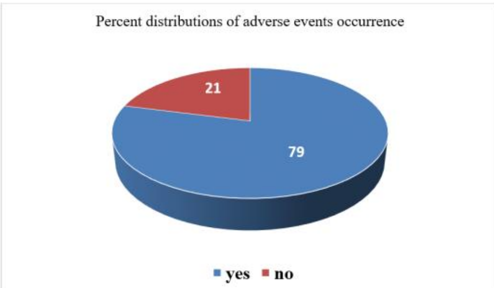

Figure 1: Percent distributions of adverse events occurrence

Figure 1): shows that the percent distributions of adverse events occurrence in the study sample was 79%.

Table 3:

Age: The mean age of participants who experienced adverse events (37.35 ± 16.16 years) was comparable to those who did not (38 ± 15.43 years), with a non-significant P-value of >0.05. Hospital stay: There was no significant difference in the mean number of hospital stay days between participants who experienced adverse events (8.25±4.07) and those who did not (9.33±4.50), with a P-value of 0.29. Days of ICU stay: There was no significant difference in the mean number of ICU stay days between participants who experienced adverse events (6.67 ± 4.10) and those who did not (8.05 ± 4.90), with a P-value of 0.19. Transportation Duration: Participants who experienced adverse events had a significantly shorter transportation duration (25.46 ± 10.89 minutes) compared to those who did not experience adverse events (31.09 ± 11.64 minutes), with a significant P-value of 0.04. APACHE Score: The mean APACHE score before intrahospital transportation was higher among participants who experienced adverse events (20.06 ± 9.96) compared to those who did not (16.80 ± 7.58), but the difference was not statistically significant (P = 0.16). SOFA Score: There was no significant difference in the mean SOFA score before intrahospital transportation between participants who experienced adverse events (10.06 ± 4.28) and those who did not (10.90 ± 4.41), with a P-value of 0.42.

Table 3. Correlation between Adverse event occurrence during transport and various risk factors

Various risk factors	**Adverse events occurrence**		**P value**	**T. test ***
	Yes (79)	**No (21)**		
Age	37.35±16.16	38±15.43	0.87	-0.164
Hospital stay	8.25±4.07	9.33±4.50	0.29	-1.05
Day of ICU stay	6.67 ± 4.10	8.05± 4.90	0.19	-1.310
Transportation duration	25.46±10.89	31.09±11.64	0.04*	-2.074
APACHE before intrahospital transportation	20.06±9.96	16.80±7.58	0.16	1.392
SOFA score before intrahospital transportation	10.06±4.28	10.90±4.41	0.42	-.795

* Independent T test

Table 4. Correlation between Adverse event occurrence during transport and other various risk factors

Other various risk factors		**Adverse events occurrence**		P value	X2 *
		Yes (79)	No (21)		
Gender	Male	47(59.5%)	10(47.6%)	0.329	0.954
	Female	32 (40.5%)	11 (52.4%)		
Diagnosis	Post-operative (surgical patients	15 (19.0%)	4 (19.0%)	0.78	3.16
	Renal diseases	13 (16.5%)	2 (9.5%)		
	Cardiovascular disease	10 (12.7%)	2 (9.5%)		
	Neurological disease	11 (13.9%)	4 (19.0%)		
	Lung disease	10 (12.7%)	2 (9.5%)		
	Gastrointestinal disease	9 (11.4%)	5 (23.8%)		
	Trauma	11 (13.9%)	2 (9.5%)		

Number of invasive devices	Two	21 (26.6%)	6 (28.6%)	0.80	1.60
	Three	23 (29.1%)	4 (19.0%)		
	Four	18 (22.8%)	6 (28.6%)		
	Five	15 (19.0%)	5 (23.8%)		
	More than five	2 (2.5%)	0(0.0%)		
Equipment preparation	Complete	45(57%)	16(76.2%)	0.108	2.57
	Incomplete	34(43%)	5(23.8%)		
Comorbidities	one disease	29(36.7%)	5(23.8%)	0.45	1.59
	More than one disease	24(30.4%)	9(42.9%)		
	None	26(32.9%)	7(33.3%)		
Timing of transportation	Morning	51 (64.6%)	16 (76.2%)	0.59	1.02
	Afternoon	23 (29.1%)	4 (19.0%)		
	Night	5 (6.3%)	1 (4.8%)		
Team specialty	Nursing	12 (15.2%)	3 (14.3%)	0.39	0.40
	Nursing & doctors	21 (26.6%)	7 (33.3%)		
	nursing, doctors, and workers(assistant)	14 (22.8%)	8 (19.0%)		
	Nursing & worker	28 (35.4%)	7 (33.3%)		
Medication assessment	No-medication	10(12.7%)	6(28.6%)	0.36	3.15
	Vasoactive	20(25.3%)	4(19 %)		
	Sedative	22(27.8%)	5(23.8%)		
	Both vasoactive and sedative	27(34.2.%)	6(28.6%)		

Chi-square test, significance <0.05

Table 4) shows that there was no difference in adverse events between male (59.5%) and female (40.5%). The patient's main diagnosis (surgical = 19%; renal disease = 16.5%; cardiovascular disease = 12.7%; neurological disease = 13.9%, lung disease = 12.7%; gastrointestinal diseases = 11.4% and trauma =13.9%) P value 0.78were not found to be significant. The majority of patients with adverse events had three invasive devices (29.1%) P value 0.80 was found to be not significant. Also, among cases where equipment preparation was complete, adverse events occurrence was reported in 57.5% of cases,

compared to 76.2 % where adverse events were not reported. Conversely, when equipment preparation was incomplete, adverse events occurred in 42.5% of cases, compared to 23.8% where adverse events were not reported. There was no significant difference in the timing of transportation between participants who experienced adverse events and those who did not experienced with the P value 1.02 and the majority of patients with adverse events transferred during morning shift 64.6%. Regarding the team specialty, the majority of patients with adverse events transferred by nursing and worker shift 35.4%. Participants who experienced one comorbid disease had adverse events occurrence in 36.7% of cases, compared to 23.8% where adverse events were not reported (P >0.05). Participants receiving both vasoactive and sedative medications had adverse events occurrence in 34.2. % of cases, compared to 28.6% where adverse events were not reported (P >0.05).

Table 5. Shows the mean and SD of physiological parameters of patients before, during, and after intra-hospital transportation

	Adverse Event Occurrence		
	Yes	**No**	**P value**
Mean Blood pressure before intrahospital transportation	83.29±22.64	87.14±21.88	0.48
Mean Blood pressure during intrahospital transportation	81.59±23.89	87.38±23.00	0.32
Mean Blood pressure after intrahospital transportation	81.51±23.02	87.61±23.27	0.28
Mean heart rate before intrahospital transportation	86.31±20.09	83.42±17.22	0.54

Mean heart rate during intrahospital transportation	85.73±20.86	83.66±18.49	0.68
Mean heart rate after intrahospital transportation	86.05±20.73	83.57±20.87	0.62
Mean respiratory rate before intrahospital transportation	23.62±8.95	21.57±9.78	0.36
Mean respiratory rate during intrahospital transportation	23.60±8.79	21.95±9.75	0.45
Mean respiratory rate after intrahospital transportation	23.97±9.09	21.90±9.61	0.36
Mean temperature before intrahospital transportation	37.29±1.29	37±1.00	0.34
Mean temperature during intrahospital transportation	37.58±3.17	37.04±0.94	0.45
Mean temperature after intrahospital transportation	37.71±4.27	37.16±0.97	0.56
Mean oxygen saturation before intrahospital transportation	92.82±7.63	91.76±6.89	0.56
Mean oxygen saturation during intrahospital transportation	91.83±7.83	91±6.70	0.65
Mean oxygen saturation after intrahospital transportation	92.98±7.55	92.04±6.96	0.60

Table 5) shows Physiological Parameters of studied patients: Mean Blood Pressure: There were no significant differences in mean blood pressure before (P = 0.48), during (P = 0.32), or after (P = 0.28) intrahospital transportation between participants who experienced adverse events and those who did not. Heart Rate: Similarly, there were no significant differences in heart rate before (P = 0.54), during (P = 0.68), or after (P = 0.62) intrahospital transportation between participants with and without adverse events. Respiratory Rate: No significant differences were observed in respiratory rate before (P = 0.36), during (P = 0.45), or after (P = 0.36) intrahospital transportation between participants with and without adverse events. Temperature: Likewise, there were no significant differences in temperature before (P = 0.34), during (P = 0.45), or after (P = 0.56) intrahospital transportation between participants with and without adverse events. Oxygen Saturation: No significant differences were observed in oxygen saturation before (P = 0.56), during (P = 0.65), or after (P = 0.60) intrahospital transportation between participants with and without adverse events.

Table 6. Shows arterial blood gases parameters before and after intra-hospital transportation

	Adverse Event Occurrence		
	Yes	No	P value
Mean PH before intrahospital transportation	7.39±0.08	7.39±0.08	0.71
Mean PH after intrahospital transportation	7.40±0.07	7.4019±0.07	0.93
Mean Pao2 before intrahospital transportation	74.78±13.67	74.33±15.15	0.89
Mean Pao2 after intrahospital transportation	75.06±13.78	73.90±15.26	0.73
Mean Paco2 before intrahospital transportation	43.54±9.90	40.90±6.17	0.24
Mean Paco2 after intrahospital transportation	44.74±8.61	41.47±5.92	0.10
Mean Hco3 before intrahospital transportation	24.22±3.58	25.09±3.20	0.31
Mean Hco3 after intrahospital transportation	24.46±3.33	25.61±3.32	0.16

Arterial blood gases Parameters

pH: There were no significant differences in pH before (P = 0.71) or after (P = 0.93) intrahospital transportation between participants with and without adverse events.PaO2: Similarly, there were no significant differences in PaO2 levels before (P = 0.89) or after (P = 0.73) intrahospital transportation between participants with and without adverse events.PaCO2: No significant differences were observed in PaCO2 levels before (P = 0.24) or after (P = 0.10) intrahospital transportation between participants with and without adverse events. HCO3: There were no significant differences in HCO3 levels before (P = 0.31) or after (P = 0.16) intrahospital transportation between participants with and without adverse events.

Discussion

The current study utilized a sample of 100 adult patients who were transported from the ICU to another department within the center for diagnostic or therapeutic purposes and then returned to the ICU, Concerning the gender of the studied patients, the result of the present study showed that majority of them are males. This finding agreed with study by Hanifi et al., (2021) who conducted a study about "Complications and Related Factors during the Intrahospital Transport of Critically Ill Patients" and reported that most of the studied patients were males.

Regarding the diagnosis of patient our study showed that majority of patients were considered post-operative (surgical) this finding is synchronized with the study of (Eiding et al. 2022) who demonstrated that (55%) were considered surgical and (45%) were considered medical admissions.

Our study showed that most patients were transported for diagnostic purposes. This finding agreed with the study of (Zirpe et al. 2023) who presented that The commonest (71.3%) indication for transport was imaging for diagnostic purposes. these findings were disagreed with Ismail et al. (2020), who showed that most of the studied patients were transported to radiology department, especially CT scan.

The prevalence of adverse events during intra-hospital transport of critically ill patients is high in a number of countries (Brunsveld- Reinders et al., 2015; Parmentier- Decrucq et al., 2013). The current result showed that the most common adverse events occurred during intrahospital transport are hemodynamic instability including hypotension and tachycardia followed by desaturation then aspiration indicating a risk of pulmonary complications finally abnormal respiratory rate which can indicate respiratory dysfunction. these findings were synchronized with a study conducted by Mohamad et al (2021), reported that deterioration of respiratory and hemodynamic state were the most frequent adverse events that occurred during the transit process. Additionally, Ismail et al. (2020) shown that critically ill patients undergoing an intra-hospital transfer experience hypotension and desaturation. Furthermore, during IHT of critically ill patients, Sinara et al. (2020) found that the most frequent physiological changes included elevated heart rate, elevated intracranial pressure, blood pressure changes, cardiac arrhythmias, heart attacks, respiratory distress, cardiac arrest, agitation, decreased oxygen saturation, and a few other blood disorders. Between 1.1% and 1.5% of critically ill sick patients experienced cardiac arrest during hospital transfers. (Min et al., 2019; Salt et al., 2020). while in our study, cardiac Arrest occurred in 4% of cases. In addition, study conducted by (Zirpe et al. 2023) revealed that Two patients suffered cardiac arrests during transport. Our study also agreed with the study of (Murata et al. 2022) who showed that: Frequently reported adverse events related to physical condition were desaturation, hypotension, hypertension, arrythmia including cardiac arrest and agitation.

Clinical results are negatively impacted by intrahospital movement, which is associated with a high rate of complications and adverse events. (Pedreira et al. 2014) and (Blakeman et al. 2013). Studies differ in terms of the frequency and seriousness of problems. Differences in how adverse events are defined can account for these disparities. We found that up to 79% of transferred patients had difficulties, which is a high proportion of both clinical and non-clinical issues at levels comparable to those documented in most studies. (Jia et al,2016, Almeida et al,2012). Also, a study conducted by (Murata et al. (2022), revealed that the transport of critical patients is hazardous, where between 6%-70% of all IHT was associated with adverse events, changes in vital signs, accidental extubation, and cardiopulmonary arrest have been reported to occur in 8% of cases which needed medical therapy. It also in contrast to other study was conducted by Veiga et al,2019 who reported low rate of adverse events.

In regard to hospital stay, the increase in the mean length of hospital stay following the occurrence of an adverse event has already been described in the literature (Classen et al. 1997 & Forster. Et al. 2007). Longer periods of hospitalization may be required as a result of complications resulting from adverse events (Thomas et al. 1997). Our study is contradicted with the previous studies.

Our study suggests that shorter transportation durations are associated with a higher occurrence of adverse events. it is supported by the study of (Mohammed A G et al. 2023) who said that even the shortest transportation may lead to life-threatening adverse events due to the crisis situation of critically ill patients. This result is contradicted with the findings of Ismail et al. (2020), which demonstrated that a lengthy distance between hospital sites significantly increases the likelihood of transportation-related adverse events (Ismail et al., 2020).

A higher risk of physiologic deterioration was associated with disease severity as measured by APACHE II scores [Lahner et al., 2007]. The current study found that patients with an APACHE II score of ≥20 had a significantly increased incidence of adverse events, but that the APACHE II score on the day of IHT was not an independent influencing factor for adverse events during IHT. The study of (Zirpe, et al. 2023) demonstrated that: It is likely that patients with high APACHE II scores may need high doses of vasoactive agents, making them vulnerable to a higher incidence of AEs.

The Simplified Acute Physiology Score II and Sequential Organ Failure Assessment score have not been reported to predict adverse events during transport in our study, this may be due to the limited number of our study sample. This was compatible to other studies [Parmentier- Decrucq et al,2013, Strauch et al,2015]. Our study mismatched with the study of (Gimenez et al. 2017) who revealed that The mean SOFA score was higher among the group of patients transported with the occurrence of adverse events than those transported without the occurrence of adverse events.

Regarding to the number of invasive devices, Our results do not demonstrate a correlation between the occurrence of adverse events and the number of invasive devices and there was no significant difference in the number of invasive devices between participants who experienced adverse events and those who did not , with a P-value of 0.80. Our study supported by the study of (Gimenez et al. 2017).

During intra-hospital transfers, proper equipment preparation improves patient safety and security (Swickard et al., 2018). Equipment is a crucial component that needs to be ready before the patient is transferred. Tool preparation entails having easy-to-use equipment, an operational alarm, enough air, and a long enough battery life (Hunt, 2018). To continue operating effectively, preparations need to be completed accurately, safely, and steadily (Droogh et al., 2015). The study's findings showed that adverse events during the transfer of critically sick patients from or to the intensive care unit were caused by the preparation of the equipment. These findings agreed with earlier research that claims equipment shortages are the primary cause of intrahospital transport difficulties (Chaichotjinda et al., 2020). Also, this finding is in the same line with a study by Murata et al., (2022) who conducted a study about " Complications during intrahospital transport of critically ill patients" and showed that malfunctioning and unavailable equipment were risk factors for IHT of critically ill patients.

Based on supportive clinical and laboratory variables, comorbidities are taken into account when a patient is admitted to the critical care unit. Comorbid conditions that enhance the risk of problems during IHT in critically ill patients include diabetes mellitus, chronic heart failure, and chronic vascular disease (Nonami et al., 2022). This study was agreed with our study which revealed that majority of patients with one comorbid disease had a higher risk of adverse event occurrence.

Regarding the timing of transportation, Intrahospital transport requires both physical and human resources, therefore one may expect that transport undertaken during the night shifts or on the weekends have a higher incidence of AEs. This may be due to added apprehension and stress in staff, and limited experience of personnel (Zirpe et al 2023). Our study showed that There was no significant difference in the timing of transportation between participants who experienced adverse events and those who did not experienced and the majority of patients with adverse events transferred during morning shift. Our study matched with the study of (Parveez et al. 2020) who demonstrated that there was no difference in AEs in different shifts. in a single-center Indian study, also did not find any difference in AEs during transports on weekends vs weekdays (70% vs 64.3%, p = 0.616) or day shifts vs night shifts. In a study conducted by (Zirpe et al 2023). Revealed that, of the 205 (19.2%) transports undertaken during night shifts, the incidence of AEs was low (n = 18). This may be a result of staff being extra vigilant, as they knew about the study.

Patients in critical condition should be checked at least once every hour, and more frequently if they are receiving sedative and vasoactive medications (Jones et al., 2016). In our study, the use of vasoactive drugs and sedatives were not related to adverse events. This contradicts the result of the study by Veiga et al,2019.

Regarding physiological parameters, our study showed that there were no significant differences in blood pressure, heart rate, respiratory rate, temperature & oxygen saturation before, during and after intrahospital transportation between participants with and without adverse events. In another study conducted by (Delacrétaz et al . 2022) demonstrated that Transport was not associated with significant changes in heart rate and SpO2. In comparison with values measured before transport, FiO2 decreased during and after transport, leading to an increase in SpO2/ FiO2 ratio during and after transport. Patient heart rate before, during, and after transport, and SpO2 before transport were not different between uncomplicated and complicated transports. In contrast, SpO2 during and after transport was lower in complicated transports, and FiO2 before, during, and after transport was higher in complicated transports. This resulted in a lower SpO2/FiO2 ratio before, during, and after transport in complicated transports. Also, Parveez et al, 2020 said that Physiological changes such as in Heart Rate (HR), blood pressure (BP), respiratory rate (RR), and oxygen saturation (SpO2) are commonly observed during transport in up to 10%–68% of patients.

Regarding arterial blood gases parameters, our study presented that there were no significant differences in pH, Pao_2, $PaCo_2$ & Hco_3 before or after intrahospital transportation between participants with and without adverse events. (Zuchelo and Chiavone. 2009) explored alterations of arterial pH (a change in arterial pH was defined as pH change >0.07 during transport) in 58 IHT patients and found that 17% of patients met this criterion, 8 patients had increased pH while 2 had decreased pH values. After examining PaCO2 values, it was discovered that four patients had decreased PaCO2, while one had increased PaCO2. These data suggest that IHT may result in non-trivial changes in pH and PaCO2 with the associated potential for alterations in patient physiology. Our study mismatched with the study of (Jia et al. 2016) who revealed that The incidence of arterial blood gas analysis–related P-AEs was unexpectedly high (46.9 % of IHTs).

Strengths & limitations

There are strengths and limitations to be considered in the present study. The strength of the study is the methodological and data collection rigor through direct observation and the fact that this study evaluated the impact of the occurrence of adverse events on the patient's prognosis. A key limitation is that it was conducted in a single center, which may reflect only local practices and thereby restrict the external validity of the findings. Furthermore, the relatively small sample size may have limited the ability to detect subtle differences between groups.

Conclusion

The present study highlights that Intrahospital Transport (IHT) of critically ill patients is a complex and high-risk process associated with a considerable incidence of adverse events, most commonly hemodynamic instability, desaturation, and respiratory complications. Factors such as patient characteristics, disease severity, comorbidities, and equipment preparedness were found to influence the occurrence of complications, while timing of transfer and number of invasive devices were not significant predictors. Although our results are in line with several previous studies, some discrepancies with the literature may be explained by differences in study design, patient populations, and institutional practices. Overall, these findings reinforce the need for standardized protocols, adequate preparation, and vigilant monitoring during IHT to minimize risks and improve patient safety.

Recommendations

Future research should employ multicenter designs with larger samples to enhance generalizability and improve statistical power. In addition, the consistent application of standardized protocols and guidelines for patient transports across healthcare facilities is strongly recommended to minimize complications and ensure safer intrahospital transport.

References

1. Ackley, B. J., Ladwig, G. B., Makic, M. B. F., Kratz, M., & Zanotti, M. (2020). Nursing diagnosis handbook: An evidence-based guide to planning care (12th ed.). Elsevier Health Sciences.
2. Alizadeh Sharafi, R., Ghahramanian, A., Sheikhalipour, Z., Ghafourifard, M., & Ghasempour, M. (2021). Improving the safety and quality of the intra-hospital transport of critically ill patients. Nursing in Critical Care, 26(4), 244–252.
3. Almeida, A. C. G. D., Neves, A. L. D., Souza, C. L. B. D., Garcia, J. H., Lopes, J. D. L., & Barros, A. L. B. L. D. (2012). Intra-hospital transport of critically ill adult patients: Complications related to staff, equipment and physiological factors. Acta Paulista de Enfermagem, 25, 471–476. https://doi.org/10.1590/S0103-21002012000300024
4. Association of perioperative Registered Nurses (AORN). (2022). Adverse event during intra-hospital transport: The official voice of perioperative nursing. AORN Journal, 111(5), 577–579.
5. Blakeman, T., & Branson, R. (2013). Inter- and intra-hospital transport of the critically ill. Respiratory Care, 58(6), 1008–1023. https://doi.org/10.4187/respcare.02404
6. Brunsveld-Reinders, A. H., Arbous, M. S., Kuiper, S. G., & de Jonge, E. (2015). A comprehensive method to develop a checklist to increase safety of intra-hospital transport of critically ill patients. Critical Care, 19(1), 1–10. https://doi.org/10.1186/s13054-015-0938-1
7. Chaichotjinda, K., Chantra, M., & Pandee, U. (2020). Assessment of interhospital transport care for pediatric patients. Clinical and Experimental Pediatrics, 63(5), 184–188. https://doi.org/10.3345/kjp.2019.00024
8. Classen, D. C., Pestotnik, S. L., Evans, R. S., Lloyd, J. F., & Burke, J. P. (1997). Adverse drug events in hospitalized patients: Excess length of stay, extra costs, and attributable mortality. JAMA, 277(4), 301–306.
9. Delacrétaz, R., Fumeaux, C. J. F., Stadelmann, C., Trejo, A. R., Destaillats, A., & Giannoni, E. (2022). Adverse events and associated factors during intrahospital transport of newborn infants. The Journal of Pediatrics, 240, 44–50.
10. 1Droogh, J. M., Smit, M., Absalom, A. R., Ligtenberg, J. J. M., & Zijlstra, J. G. (2015). Transferring the critically ill patient: Are we there yet? Critical Care, 19(1), 1–7. https://doi.org/10.1186/s13054-015-0749-4
11. Eiding, H., Kongsgaard, U. E., Olasveengen, T. M., & Heyerdahl, F. (2022). Interhospital transport of critically ill patients: A prospective observational study of patient and transport characteristics. Acta Anaesthesiologica Scandinavica, 66(2), 248–255.
12. Forster, A. J., Rose, N. G., van Walraven, C., & Stiell, I. (2007). Adverse events following an emergency department visit. BMJ Quality & Safety, 16(1), 17–22.
13. Gimenez, F. M. P., Camargo, W. H. B. D., Gomes, A. C. B., Nihei, T. S., Andrade, M. W. M., Valverde, M. L. D. A., & Grion, C. M. C. (2017). Analysis of complications during intrahospital transport of critically ill patients. Critical Care Research and Practice. https://doi.org/10.1155/2017/6847124
14. Hanifi, N., Ghadimi, M., & Dinmohammadi, M. (2021). Adverse events and related factors during intrahospital transport of critically ill patients : An observational prospective study. Journal of Critical Care Nursing, 14(4), 69–61.
15. Hunt, D. (2018). Transfer of the critically ill adult patient. Surgery (Oxford), 36(4), 166–170. https://doi.org/10.1016/j.mpsur.2018.01.005
16. Huygh, J., Peeters, Y., Bernards, J., & Malbrain, M. L. (2016). Hemodynamic monitoring in the critically ill: An overview of current cardiac output monitoring methods. F1000Research, 16(5), 2855.
17. Ismail, M., Baharuddin, K., Zainal Abidin, Z., Abu Bakar, M., & Sjahid, A. (2020). Study on the incidence of adverse events during intra-hospital transfer of critical care patients from emergency department. Medical Journal of Malaysia, 75(4), 325–330.
18. Jia, L., Wang, H., Gao, Y., Liu, H., & Yu, K. (2016). High incidence of complications during intra-hospital transport of critically ill patients and new related risk factors: A prospective,

multicenter study in China. Critical Care, 20(1), 1–13. https://doi.org/10.1186/s13054-016-1183-y
19. Jones, H. M., Zychowicz, M. E., Champagne, M., & Thornlow, D. K. (2016). Intrahospital transport of the critically ill adult: A standardized evaluation plan. Dimensions of Critical Care Nursing, 35(3), 133–146. https://doi.org/10.1097/DCC.0000000000000176
20. Kuhn, C., & Werdan, K. (2001). Hemodynamic monitoring. In Surgical Treatment: Evidence-Based and Problem-Oriented. Zuckschwerdt.
21. Kulshrestha, A., & Singh, J. (2016). Inter-hospital and intra hospital patient transfer: Recent concepts. Indian Journal of Anaesthesia, 60(7), 451–457. https://doi.org/10.4103/0019-5049.186012
22. 2Lahner, D., Nikolic, A., Marhofer, P., Koinig, H., Germann, P., Weinstab, C., et al. (2007). Incidence of complications in intrahospital transport of critically ill patients. Wien Klin Wochenschr, 119, 412–416. https://doi.org/10.1007/s00508-007-0813-4
23. Maddry, J., Arana, A., Savell, S., Reeves, L., Perez, C., Mora, A., & Bebarta, V. (2017). Critical care transport team evacuation of medical patients without traumatic injury. Military Medicine, 182(11), 1874–1880.
24. Min, H. J., Kim, H. J., Lee, D. S., Choi, Y. Y., Yoon, M., Lee, D., et al. (2019). Intra-hospital transport of critically ill patients with rapid response team and risk factors for cardiopulmonary arrest: A retrospective cohort study. PLoS ONE, 14(3). https://doi.org/10.1371/journal.pone.0213146
25. Murata, M., Nakagawa, N., Kawasaki, T., Yasuo, S., Yoshida, T., Ando, K., & Okada, Y. (2022). Adverse events during intrahospital transport of critically ill patients: A systematic review and meta-analysis. The American Journal of Emergency Medicine, 52, 13–19.
26. Nonami, S., Kawakami, D., Ito, J., Ouchi, K., Miyoshi, Y., Tatebe, M., Tsuchida, T., Seo, R., & Mima, H. (2022). Incidence of complications associated with the in-hospital transport of critically ill patients. Critical Care Explorations, 4(3), e0657. https://doi.org/10.1097/CCE.0000000000000657
27. Parmentier-Decrucq, E., Poissy, J., Favory, R., Nseir, S., Onimus, T., Guerry, M. J., et al. (2013). Complications during intrahospital transport of critically ill patients: Incidence and risk factors. Annals of Intensive Care, 3(1), 10. https://doi.org/10.1186/2110-5820-3-10
28. Parveez, M. Q., Yaddanapudi, L. N., Saini, V., Kajal, K., & Sharma, A. (2020). Critical events during intrahospital transport of critically ill patients to and from ICU. Turkish Journal of Emergency Medicine, 20(3), 135–141. https://doi.org/10.4103/2452-2473.290067
29. Pedreira, L. C., de Matos Santos, I., Farias, M. A., Sampaio, E. E. S., Barros, C. S. M. A., & Coelho, A. C. C. (2014). Nurses' knowledge of intra-hospital transport of critical patients. Enfermagem UERJ, 22(4), 533–540.
30. Putra, K., Wulandari, I., Suharsono, T., & Hany, A. (2023). Adverse events during intra-hospital transport of critically ill patients : An observational study. Central European Journal of Nursing and Midwifery, 13(3), 699–706. https://doi.org/10.15452/CEJNM.2022.13.0012
31. Royal College of Physicians. (2017). National Early Warning Score (NEWS) 2.
32. Salt, O., Akpinar, M., Sayhan, M. B., Örs, F. B., Durukan, P., Baykan, N., & Kavalci, C. (2020). Intrahospital critical patient transport from the emergency department. Archives of Medical Science, 16(2), 337–344. https://doi.org/10.5114/aoms.2018.79598
33. Sinara, F., Clesnan, M., Rosângela, F., & Fabíola, G. (2020). Going and coming from a surgical center: Assessing risk inpatient transport in a university hospital of Brazil. Bioscience Journal, 36(2), 663–671.
34. Strauch, u., bergmans, d. c., winkens, b., & roekaerts, p. m. (2015). short-term outcomes and mortality after interhospital intensive care transportation. bmj open, 5(4), e006801.
35. Swickard, s., winkelman, c., hustey, f. m., kerr, m., & reimer, a. p. (2018). patient safety events during critical care transport. air medical journal, 37(4), 253–258.

https://doi.org/10.1016/j.amj.2018.02.009
36. Thomas, w. j., guire, k. e., & horvat, g. g. (1997). is patient length of stay related to quality of care? journal of healthcare management, 42(4), 489–507.
37. Veiga, v. c., postalli, n. f., alvarisa, t. k., travassos, p. p., vale, r. t., oliveira, c. z., & rojas, s. s. (2019). Complications during intrahospital transport of critically ill patients in a large hospital. revista brasileira de terapia intensiva, 31(1), 15–20. https://doi.org/10.5935/0103-507x.20190003
38. Williams, p., karuppiah, s., greentree, k., & darvall, j. (2020). a checklist for intrahospital transport of critically ill patients improves compliance with transportation safety guidelines. australian critical care, 33(1), 20–24.
39. World health organization. (2021). global patient safety action plan 2021–2030.
40. Younes, g. a., ali, s., amin, s. m., & al-etyazidy, h. a. (2022). effect of educational program about intra-hospital safety transportation of critically ill patients on nurses' performance and outcomes. tanta scientific nursing journal, 27(4), 231–250.
41. Zangrillo, a., beretta, l., silvani, p., colombo, s., & scandroglio, a. (2020). fast reshaping of icu facilities in milan during covid-19. critical care and resuscitation, 22(2), 91.
42. Zirpe, k. g., tiwari, a. m., kulkarni, a. p., govil, d., dixit, s. b., munjal, m., et al. (2023). adverse events during intrahospital transport of critically ill patients: the i-touch study. indian journal of critical care medicine, 27(9), 635–641. https://doi.org/10.5005/jp-journals-10071-24530
43. zuchelo, l. t., & chiavone, p. a. (2009). intrahospital transport of ventilated patients: cardiorespiratory repercussions. jornal brasileiro de pneumologia, 35(4), 367–374. https://doi.org/10.15 /s1806-37132009000400011