

Pre-referral stabilization and timeliness as predictors of adverse events among adult medical patients referred to a tertiary hospital

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Abstract

Background: In Tanzania, despite of great efforts in improving hospital infrastructures to enhance pre referral communication between referring hospital and receiving hospital and hasten patient transfer still we have gaps in knowing the time interval from decision of referring patient to time the patient arrives at the receiving hospital. Furthermore, the status of appropriateness of pre referral stabilization and its relation to occurrence of adverse events is still unknown.

Objective: To evaluate pre referral stabilization appropriateness and timeliness as adverse events predictors among medical adult patients referred to Muhimbili National Hospital

Methodology: Prospective study conducted among critically ill non traumatic adult patient referred to Muhimbili National Hospital in 3 months period. Participants with NEWS2 Score 5 or more were enrolled using consecutive sampling technique. Validated structured questionnaire was used to assess the level of stabilization done on compromised Airway, breathing, Circulation, Disability of the patient on arrival. Information on demographics, and timeliness were recorded. Predictors of adverse outcome were evaluated using multivariate logistic regression analysis.

Results: Enrolled 351 patients. Primary survey included compromised airway 62(17.7%), breathing 153(43.6%), circulation 164(45.8%), and hypoglycaemia 6(3.9%). Interventions done were 3(13.5%) suctioning among with secretions, airway adjuvant placement 3(6.9%) among with inability to protect airway. Oxygen therapy was given in 71(46.4%) among 153 with hypoxia. Among hypotensive patients, intravenous fluid was given 27(38.6%) and hypoglycaemia correction in 1(16.7%). Time from referral decision to arrival, pre-referral stabilization in breathing and circulation were shown to predict adverse events.

Conclusion: Time from decision to refer patient to time of patient arrival at tertiary hospital, and appropriateness of pre referral stabilization of breathing and circulation were independent predictor of adverse events.

Key words: Pre referral stabilization; Timeliness; Predictors; Adverse events

1. Introduction

Since the inception of Intensive Care Units (ICUs) in the 1950s, the demand for intensive care services has increased significantly, necessitating the transfer of critically ill patients when specialized care is required, especially in the absence of adequate facilities at lower-capacity hospitals(8). While timely transfers can be lifesaving, they pose considerable challenges, including high costs, logistical complexities, and inherent risks. Notably, the transport of

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critically ill patients is often associated with physiological deterioration and the occurrence of adverse events, with evidence suggesting that the incidence of such events correlates with the adequacy of pre-referral stabilization, the duration of transfer, and the expertise of medical personnel involved in transport (9,10).

The decision to refer a patient to another facility is typically predicated on a comprehensive assessment of potential risks and benefits by an experienced clinician. This risk assessment should encompass various factors, including the patient's clinical presentation, specific risks associated with their condition, the level of dependency required, risks inherent to the transfer process, the likelihood of patient deterioration, and the duration and mode of transport(11,12).

Clinical indications for referring critically ill patients include the necessity for specialized investigations or interventions that are unavailable at the referring hospital, as well as ongoing support that exceeds the capabilities of that facility. Non-clinical reasons for transfer may involve the unavailability of critical care services or insufficiently staffed critical care beds at the referring institution(12,13).

This gap in healthcare infrastructure and policy underscores the importance of investigating and understanding the practices surrounding referral and stabilization of critically ill patients within our healthcare system. By identifying deficiencies and areas for improvement, we aim to enhance the quality of care provided and to ultimately improve patient outcomes during the critical transfer process(14).

The key to successful referral of the critically ill patient is pre referral stabilization. Up to 91% of incidents during transport of critically ill patients are preventable. This can be achieved by thorough assessment, resuscitation and stabilization of patients before departure from the referring hospital and in turn this will reduce mortality and morbidity(11,15).

These interventions take time to perform, but time spent undertaking intensive care interventions at the referring hospital does not worsen patient outcome(16). Stabilization of an 'Airway, Breathing, Circulation, Disability (ABCD)' or similar systematic approach to the patient helps to avoid oversight and pre-empt potential pitfalls.

Proper and timely referrals to higher centers along with appropriate stabilization before transfer can improve outcomes in critically ill patients, however poorly organized and hasty transfers can lead to increased- morbidity and mortality(13).

In Tanzania, despite of great efforts in improving hospital infrastructures to enhance pre referral communication between referring hospital and receiving hospital and hasten patient transfer still we have gaps in knowing the time interval from decision of referring patient to time the patient arrives at the receiving hospital. Furthermore, the status of appropriateness of stabilization before transfer and its relation to occurrence of adverse events is still unknown.

The study looked at timeliness, appropriateness of pre referral stabilization and predictors of adverse events among non-traumatic critically ill patients attended at the Emergency Department of Muhimbili National Hospital.

2. Methodology

This was a prospective study conducted at Muhimbili National Hospital Emergency Medicine Department (MNH-ED), Tanzania. The MNH-ED is a full capacity ED and is the entry point to the hospital for most of the patients attending MNH and receives around 200 patients daily with an admission rate of 65%. Acutely ill patients are received at ED, resuscitated and stabilized before being appropriately disposed.

A Pilot study was done using MNH-ED electronic system data and sample size was calculated by using probability-based sample size.

Consecutive sampling technique was used in the period of March to June 2022 whereby all critically ill non trauma adult patient with NEWS2 score of 5 and above received as referrals at the MNH-ED were recruited into the study until sample size of 351 critically ill non trauma patients was reached. Timeliness was recorded as the time of decision to refer to the time of arrival to the MNH-ED.

The assessment pre referral stabilization appropriateness was done by using pre referral stabilization checklist adapted from ACLS manual. Follow up of adverse events until time of disposition from the Emergency Department were documented. Patients who arrived without referral note or without prior phone call were not included into the study.

Ethical clearance and approval to conduct the study was sought from MUHAS/MNH research and publication ethics committee and institution review board (IRB).

Data obtained were entered and analyzed using SPSS version 26. Chi-square test and Multiple Logistic Regression were used to establish significance of association among variables. The level of significance of P value less than 0.05 was considered statistically significant.

3. Results

The flowchart of patients

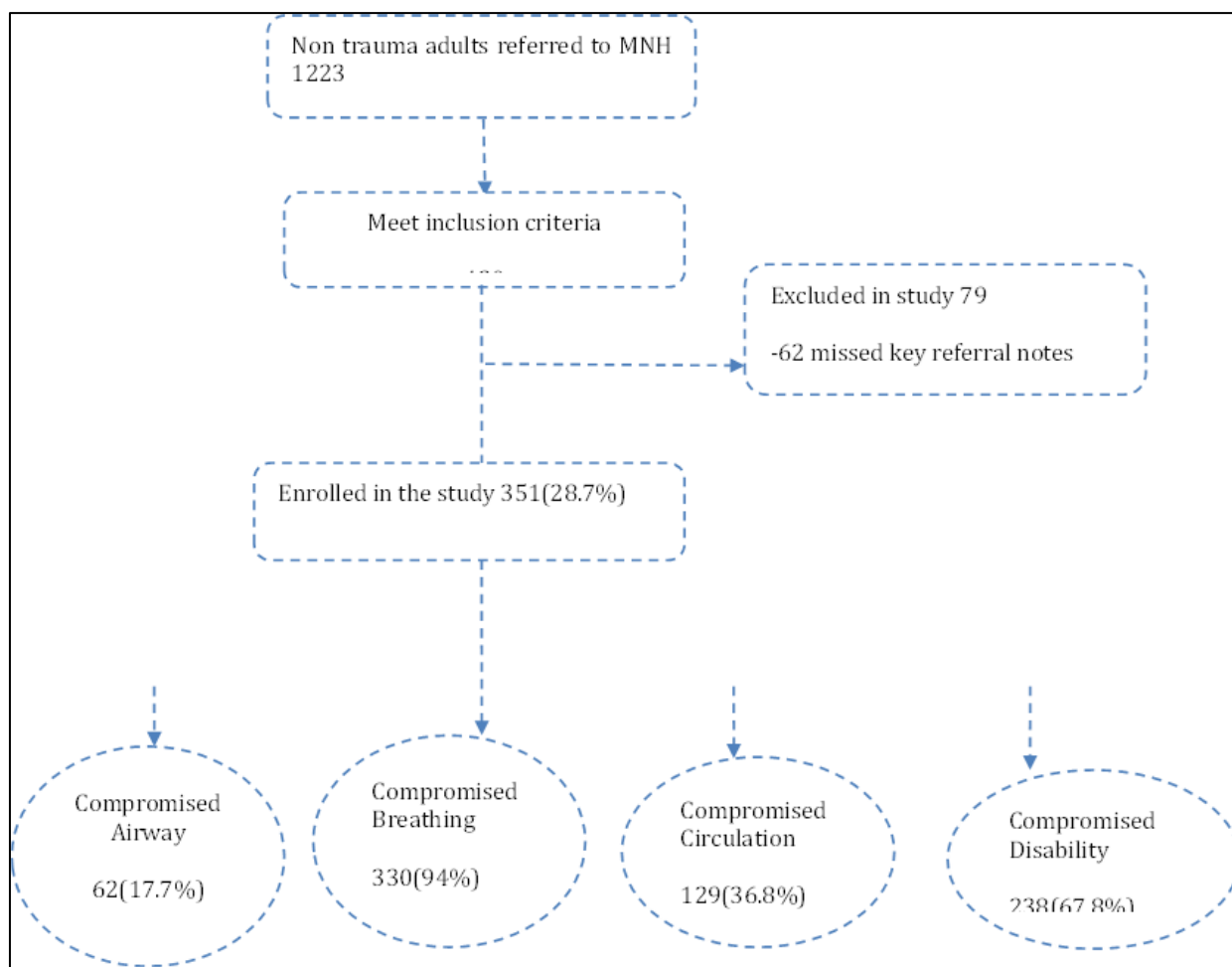


Figure 1 Above most patients had more than one system compromised. The system that was compromised in majority of patients was the respiratory system

Among 351 study participant 190(54.1%) were males, median age was 51(18-97), 329(92.9%) transported by ambulance. Altered mental status was the commonest complaint counting for 215(61.3%) and hypertension was the common co morbid 154(43.9%).

Table 1 The Demographics, Clinical profile and characteristics of patients

Demographics, and clinical profile of patient	Frequency n(N=351)	Percent (%)
Sex		
Male	190	54.1
Female	161	45.9
Age		
18-25	23	6.6
26-44	96	27.4
45-60	122	34.8
61-75	78	22.2
76-90	29	8.3
More than 90	3	0.9
Residence		
Dar es salaam	313	89.2
Outside Dar es salaam	38	10.8
Level of referring facilities		
Zonal hospital	2	0.6
Regional referral hospital	251	71.5
District hospital	43	12.3
Private hospital	14	4.0
Other level of health facility	8	2.3
Mode of transport		
Ambulance	329	92.9
Private car	25	7.1
Chief complaint		
Altered mental status	215	61.3
Difficulty in breathing	140	39.9
Convulsion	28	8.0
Headache	8	2.3
Vomiting blood	6	1.7
Chest pain	4	1.1
Comorbidities		
Hypertension	154	43.9
Diabetes mellitus	62	17.7
Cardiac disease	17	4.8
Sickle cell disease	4	1.2

Among 24 patients with secretion 3(13.5) had suctioning. Oxygen therapy was given only in 71(46.4) among 153 with hypoxia and no patient with gasping or bradypnea had mechanical ventilation and dextrose was given in 1(16.7) among 6 patients with hypoglycaemia

Table 2 Initial Primary assessment and pre referral stabilization done

Category	Cause and interventions	Frequency	Percent
Compromised airway		62	17.7
	Secretions	24	38.7
	Suctioning done	3	13.5
	No suctioning	21	86.5
	Inability to protect the airway	43	61.3
	Airway adjuncts placement	3	6.9
	No intervention	40	93.1
Compromised breathing		153	43.6
	Hypoxia	153	100.0
	Oxygen therapy	71	46.4
	No oxygen therapy	82	53.6
	Gaspings and bradypnea	15	9.8
	Mechanical ventilation	0	0.0
Compromised circulation		164	45.8
	Hypotension	70	42.6
	Intravenous fluid	27	38.6
	Inotropes	1	1.4
	No intervention	42	60.0
	Hypertension	94	57.4
	Antihypertensive	33	35.1
	No intervention	61	64.9
Disability	Hypoglycemia (RBG $\leq$ 3.0mmol/l)	6	3.9
	Intravenous Dextrose	1	16.7

The median timeliness of referral (time from decision of referral to time of arrival at MNH) was found to be 2hrs (IQR 1-3). Timeliness of referral, breathing and circulation stabilization has shown to have association with occurrence of adverse event with p value of 0.008, 0.002 and 0.017 respectively. After multiple logistic regression analysis only breathing stabilization has shown to be predictor of adverse event with p - value of 0.007

Table 3 Association between predictors and adverse events

Category	Predictor	Adverse event	No adverse event	P value
Timeline	<2 hour	15(44.1%)	223(70.4%)	0.008
	2-4	14(41.2%)	72(22.7%)	
	>4 hour	5(14.7%)	22(6.9%)	
Airway stabilization	Unstabilized	16(94.1%)	34(77.3%)	0.125
	Stabilized	1(5.9%)	10(22.7%)	
Breathing stabilization	Unstabilized	2(14.3%)	60(43.2%)	0.002
	Stabilized	12(85.7%)	79(56.8%)	
Circulation stabilization	Unstabilized	17(50%)	25(19.3%)	0.017
	Stabilized	17(50%)	105(80.7%)	

Hypoglycemia	Uncontrolled	1(100.0%)	4(85.0%)	0.624
	Controlled	0(0.0%)	1(25%)	

Table 4 Multiple logistic regressions

Predictor	OR(95% CI)	P value
Timeline	0.016(0.996-1.332)	0.395
Breathing stabilization	0.063(1.778-3.79)	0.007
Circulation stabilization	0.395(0.643-3.063)	0.179

4. Discussion

In this prospective study, we observed that the majority of referrals to Muhimbili National Hospital (MNH) originated from within Dar es Salaam, accounting for more than three-quarters of the total referrals. Notably, a significant portion of these patients was referred from regional referral hospitals, making up more than half of the cases. This pattern aligns with findings from a study by Simba et al., which examined the referral patterns of patients received at MNH. Their research similarly revealed that the majority of referrals came from within Dar es Salaam, with regional referral hospitals being the primary source, followed by direct referrals from health centers and dispensaries. This alignment in findings emphasizes the crucial role that regional referral hospitals play in the patient transfer process to tertiary care centers like MNH, as well as the importance of effective communication and coordination within the healthcare system to improve patient outcomes. Understanding these referral patterns can help in developing targeted strategies to enhance pre-referral stabilization and facilitate timely transfers for critically ill patients(40). This finding can be explained by the structure of the Tanzanian referral system, which requires patients to be transferred through a tiered network of healthcare facilities. This system is designed to ensure that patients receive appropriate levels of care and stabilization at each stage of their journey.

Beginning with community health services, patients may first visit dispensaries, then health centers, followed by district hospitals, and ultimately regional referral hospitals before reaching tertiary hospitals like Muhimbili National Hospital (MNH). This stepwise approach is critical in ensuring that patients are adequately stabilized before being referred to a higher level of care, allowing for a more efficient use of resources and expertise within the healthcare system.

Moreover, this structured referral pathway can help mitigate potential delays in treatment and ensure that patients with more complex medical needs are directed to hospitals equipped to handle such cases. By understanding and optimizing this referral pattern, healthcare facilities can improve overall patient outcomes and streamline the process of care delivery within the Tanzanian health system(14).

Altered mental status has been identified as one of the most common presentations among critically ill non-trauma adult patients, with findings indicating that it occurs in more than half of such cases. This observation aligns with the research conducted by Engebretsen, which reported that altered mental status was the predominant presenting complaint in critically ill patients, followed closely by respiratory complaints.

This prevalence of altered mental status highlights the importance of thorough assessment and prompt intervention in critically ill patients, as it can serve as an indicator of underlying physiological disturbances or systemic issues. Understanding the commonality of this presentation can aid healthcare providers in prioritizing diagnostic work-ups and implementing appropriate treatment strategies to stabilize patients effectively. Enhanced awareness of clinical patterns not only guides immediate patient management but also informs resource allocation and training for healthcare personnel in critical care settings(19). The high number of patients presenting with altered mental status can often be attributed to insufficient investigation at referring facilities, which may lead to a delayed or missed diagnosis of the underlying cause. In many cases, these patients are ultimately found to have a cerebrovascular accident (CVA) after undergoing a CT scan of the head.

This trend highlights the critical need for thorough initial assessments in referring hospitals, including appropriate imaging and laboratory tests, to identify potential etiologies of altered mental status early on. Early and accurate diagnosis can significantly affect the management and outcomes of these patients, particularly in cases of stroke, where

timely intervention is crucial. Improving diagnostic protocols in referral centers could enhance the overall quality of care for critically ill patients and reduce the burden on specialist units tasked with managing complex cases.

In our study, we observed that a significant proportion of critically ill patients presented with compromised airways; however, none of these patients had undergone endotracheal intubation. This finding raises concerns about the management of airway stability prior to transfer to intensive care or specialized units.

Dunn et al. have highlighted in their systematic review on critical care in the emergency department that proactive airway management is essential, especially for patients at risk of airway compromise during transport. They recommend that patients who demonstrate a possibility of airway instability should be electively intubated with an endotracheal tube (ETT) that is properly cuffed and secured after confirming its correct placement. This preventive measure can help mitigate the risks associated with airway compromise, such as hypoxia or respiratory failure.

Furthermore, in certain cases, the placement of a nasogastric tube is advised to prevent the aspiration of gastric contents during transfer, as aspiration can lead to serious complications, including pneumonia.

Overall, our findings underscore the need for enhanced protocols for airway management in critically ill patients, particularly before inter-facility transfers. Implementing these strategies could improve patient safety and outcomes during transport, ensuring a higher standard of care in critical situations(41).

Contrary to our study findings, where patients were inappropriately stabilized, no patient had either a nasogastric tube or an endotracheal tube in place. Effective ventilation should be ensured, with optimization of arterial blood gas values prior to the transfer of critically ill patients. Our study revealed that more than three-quarters of patients had compromised breathing, and notably, three-quarters of them did not receive oxygen therapy. Furthermore, no patients were placed on mechanical ventilation. These findings stand in contrast to several studies that report that elective endotracheal intubation and mechanical ventilation can significantly improve oxygenation during transport(42,43).

It is essential that the patient has at least two wide-bore intravenous (IV) cannulas in place before transfer, especially when there is a need to treat any form of shock. This ensures that intravenous fluids and/or vasopressors can be administered promptly and effectively during transportation(42). Our study has shown that most patients did not receive intravenous fluids or inotropes, and among those with hypertensive emergencies, 63.3% did not receive antihypertensive treatment. This lack of intervention can be attributed to the unavailability of intravenous antihypertensive medications and the absence of a CT scan to confirm the type of cerebrovascular accident the patient had sustained.

The time interval for transferring critically ill patients from referring facilities to Muhimbili National Hospital was 2 hours (range 1-12 hours), with 86% of patients taking between 2 to 4 hours. This delay may be attributed to the distance from the referring facilities to Muhimbili National Hospital, a scarcity of ambulances, and traffic congestion in the city.

This delay is similar to findings from a study conducted in Kigoma by Simba et al., which reported that half of all referral patients experienced travel time delays approaching or exceeding 1 hour(44). This delay in transfer has been associated with a delay in patient care and an increased economic burden on the patient, as highlighted by Schmitz et al. Such delays can adversely affect patient outcomes and contribute to higher healthcare costs due to prolonged hospital stays and additional treatments needed as a result of delayed intervention(40).

Our study found that the time from the decision to refer a patient to the time of arrival at Muhimbili National Hospital (MNH), as well as the stabilization of breathing and circulation, were significant predictors of adverse outcomes. Similar findings have been reported by Sunda et al., Patel et al., Engerbresten et al., and Nwani et al., emphasizing the critical importance of timely referral and stabilization in improving patient outcomes(19,31,35,45).

5. Conclusion

This study was done in tertiary hospital which receives most of critically ill patient from costal and central region of the country. Our study found that pre referral stabilization of breathing was an independent predictor of adverse events. Pre referral stabilization checklist should be adapted at referring facilities and further studies are needed to assess the transport capacity of critically ill patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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