

Association between Time Spent in Emergency Department and Outcome of Patients Admitted to Intensive Care Unit

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ABSTRACT

Aim: To understand the effect of time spent or the delays in emergency department after presenting to emergency, before being shifted to ICU on the outcome of patients in terms of mortality, length of stay in ICU and in hospital.

Study design: Retrospective analysis of medical records

Method: This retrospective study was done in the Departments of Emergency and Intensive Care from 1st January 2019 to 30th November 2020. Nine hundred and forty patients were included. All the records were reviewed in terms of the time of admission, the reason of admission, and the waiting or stand-by times in the Emergency Department. All included patients were divided into three different groups depending upon their time of stay in Emergency Department.

Results: Four hundred and sixty (48.93%) were admitted to ICU within 6 hours, 227(24.14%) within 6 to 10 hours and 253 (26.93%) after 10 hours. Patients who were shifted to ICU in time span of 6 hours were young [49.0±23.3classified as group I], 52.6±22.6 were shifted after 6 but less than 10 hours were labelled as group II, and those who stayed in emergency for more than 10 hours before moving to ICU were 58.8±20.9 and collected in group III ($P=0.05$). Group I had less mechanical ventilation duration [6±8.7days as compared to group II 7.2±8.8 and group III 10.6±11.2 ($P=0.04$). Higher mortality was noted in group III [101(21.90%), 130(57.26%), 171 (67.55), $P=0.006$). Similarly, length of stay in ICU (ICU-LOS) was longer in group III, 9.55 days were noted for Group I, 12.3 days for Group II and 13.6 days were found for Group III, ($P=0.002$).

Conclusion: Longer duration of time stay in emergency department before shifting to ICU (> 3.0 hours) is found to be associated with rise in mortality, especially in patients who exhibited higher acute physiology and chronic health evaluation (APACHE) IV score.

Keywords: Mortality, Critically sick patients, APACHE IV, Emergency department, Intensive care unit,

INTRODUCTION

Usually, patients can be transferred to ICU from any department like postoperative patients who need vigilant monitoring or patients who deteriorate in wards, but most common source are patients who present to emergency department (ED). Shortage of Intensive care unit (ICU) beds is a known and common problem throughout the world. This reflects many aspects including aging population and complexity of diseases encountered with more advanced treatment options available. Although some EDs have systems in place which help enable them effective triaging and sorting of cases to be admitted to ICU sooner than others. Additionally, they have management plans and protocols for some daily encountered emergencies like acute stroke, acute coronary syndromes, sepsis and septic shock. Despite of these measures some patients still have to wait in the emergency department waiting for an empty bed in ICU. This phenomenon is common all over the world and results in prolonged time of

ED stay. There is a wide variation in waiting time for ICU admission all over the world and it ranges from two hours to few days.¹⁻⁴ This time delay in ED has adverse effects on patients' outcomes as evident by the available literature.⁵⁻⁷

MATERIALS AND METHODS

This is a retrospective cohort was conducted at Bahria International Hospital Lahore admitted directly from ED to ICU from 1st January 2019 to 30th November 2020. The priority to ICU is usually driven by need of some special interventions such as acute or urgent haemodialysis or requirement of urgent mechanical ventilation due to acute respiratory failure or if a patient is young and has any revivable or reversible problem. We reviewed medical records of all the cases who were directly moved to ICUs (Medical or Surgical) after presenting to ED. We excluded all those patients who were admitted from ED to ICU after any urgent surgical procedure as those cases were taken to the operation theatre (OT) for intervention directly from the emergency. Similarly, elective post operated patients were also not counted as they were pre-planned with booked beds.

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All cases were reviewed in terms of time of admission, primary diagnoses, co-morbidities, time spent in ED from presentation to reaching ICU, acute physiology and chronic health score IV (APACHE IV). All the cases were subsequently gathered into three groups depending upon their time of stay in the ED. The time of stay in the ED was defined as the time spent by patients from presentation in ED to transfer to ICU. Those shifted within 6 hours of presentation to ED were collected as Group I, between 6 and 10 hours as Group II and who reached ICU after more than 10 hours of stay in ED as Group III. It is important to clarify that COVID 19 cases were not included in this study. The hospital has extended COVID 19 critical care beds in separate vicinity and their admission and management process runs separately. The data was analyzed through SPSS version 20.

RESULTS

Four hundred and sixty (48.93%) were moved to ICU in 6 hours' time or less (group I), 227(24.14) in 6-10hours (group II) while 253(26.93%) after 10hours of their initial presentation to ED (group III). Patients shifted to ICU within 6 hours were young [49.0±23.3 years group I, 52.6±22.6

years group II, 58.8±20.9 years group III, P=0.05] and required less number (in terms of patients) and days of mechanical ventilation [121(26.3%), 160(70.4%), 188 (75.2%) in group I, group II and group III respectively (P=0.003)]. The main indication for admission was respiratory followed by cardiovascular, neurological and other miscellaneous medical conditions (Table 1).

Hospital mortality calculated in group I was less and showed a rise with longer duration of ED stay [101(21.9%), 130(57.26%), 171(67.5), P=0.006]. A prominent rise in ICU length of stay ICU-LOS in cases who had prolonged ED duration [9.5days (Group I), 12.3 (Group II) and 13.6 (Group III), (P=0.002)]. The time of mechanical ventilation was more in patients who stayed longer in ED [6.0±8.7days (Group I), 7.2±8.8 (Group II) and 10.6±11.2 (Group III), P=0.04] (Table 2).

According to multivariate analysis, delay in emergency before transfer to ICU was found to be an independent risk factor for ICU mortality (Odd Ratio calculated for group III vs group I is 1.90, P=0.04) and hospital mortality (Odd Ratio calculated for group III vs Group I is 2.11, P=0.005) (Table 3)

Table 1: Demographic data and baseline characteristics of three groups of patients admitted directly from ED to ICU

Variables	Group I (stay in ED less than 6 hours) n=460	Group II (stay in ED from 6 to 10 hours) n=227	Group III (stay in ED more than 10 hours) n=253	P- value
Age (years)	49.0±23.3	52.6 ± 22.6	58.8 ± 20.9	0.05
Female	170 (36.9%)	108 (47.5%)	76 (30.04%)	0.02
Male	290 (63.04)	119 (52.4%)	177 (69.96%)	
Mechanical ventilation	121 (26.3%)	160 (70.4%)	188 (75.2%)	0.003
APACHE IV score	19.8±9.7	22.1±9.8	22.8±8.2	0.38
Respiratory	186 (40.43%)	86 (37.88%)	76 (30.03%)	<0.0001
Cardiovascular	81 (17.60%)	94 (41.40%)	122 (48.22%)	
Neurological	99 (21.52%)	40 (17.62%)	32 (12.64%)	
Other medical	94 (20.43%)	07 (3.08%)	23 (9.09%)	

Table 2: Outcomes of three groups of patients according to time spent in ED

Variables	Group I (stay in ED less than 6 hours) n=460	Group II (stay in ED from 6 to 10 hours) n=227	Group III (stay in ED more than 10 hours) n=253	P- value
ICU mortality	86 (18.69%)	110 (48.45)	153 (60.47%)	0.14
Hospital mortality	101 (21.9%)	130(57.26%)	171 (67.5%)	0.0006
ICU-LOS	9.5±10.2	12.3±16.0	13.6±17.5	0.002
Hospital LOS	18.7±24	27.1±32.0	29.5±36.4	0.19
Ventilation duration	6.0±8.7	7.2±8.8	10.6±11.2	0.04
Total LOS(ICU+ED)	9.8±10.2	11.2±13.2	16.0±18.2	0.0001

Table 3: Multivariate analysis showing ED stay time is independently associated with poor outcomes

Outcome	Group I	Group II		Group III	
		Odd ratio (95% CI)	P value	Odd ratio (95% CI)	P value
ICU Mortality	Reference	1.77 (0.90, 3.40)	0.11	1.90 (1.02, 3.63)	0.04
Hospital Mortality	Reference	1.60 (0.90, 2.70)	0.12	2.11 (1.32, 3.66)	0.005

DISCUSSION

Our present study focused to find the link between time spent ED before patients are moved to ICU and its effects on outcomes especially on mortality in one centre over a period of two years. The data revealed that if patients spend longer time in ED before admission to ICU (> 3.0 hours) it is associated with higher mortality, especially in patients with the high APACHE IV scores. Our observations are similar to available literature with

evidence that increased ED to ICU transfer time is linked with higher hospital mortality.⁶⁻⁹

An important way of tackling this mortality and poor outcome is an established ED triage system managed by a senior clinician. As proper triage system is a practical way to affect ED to ICU time and has beneficial effects on patients transferred to ICU in terms of mortality.^{10,11}

Implementing or adding additional triage scoring systems can better identify more sick patients and lead to prompt admission to the ICU without unnecessary delay, resulting better outcomes by reducing mortality. One such

example is by Bilben et al¹² who considered National Early Warning Score (NEWS) in triaging patients along with the commonly used Manchester Triage System^{13,14} to detect those patients who were at increased risk of death or deterioration while in emergency and has shown considerable predictive value comparable to ward cases.

Another significant aspect affecting death of patients admitted to the ICU is the level of care provided in the ED. In most cases, the nursing and paramedical staff in ED is already over occupied and do not have enough time to provide the required attention and provision of care to the critically sick patients.¹⁵ Moreover, usually the stress and strain of clinical needs outweighs the clinical resources at different places, and this may have negative impact on outcome.¹⁶

Furthermore, presence of established care pathways led by multidisciplinary team for day-to-day emergency cases acute coronary syndrome whether it is thrombolysis or mobilizing the patient to primary percutaneous coronary intervention (PCI), thrombolysis of acute stroke or managing septic can help decreasing ED occupancy and provision of immediate care has proven beneficial effects on patients' outcome.

Harris et al¹⁷ demonstrated that quick transfer of emergency patients to the ICU led to lower 90-day mortality (median delay of 11 hours; IQR, 6–26) when compared to ward cases. These rapid admissions were possible when the vacant beds available in ICU were two or more compared with one or no bed ($p < 0.001$). This calls for a proper and continuous reassessment of the bed occupancy by bed management staff in liaison with senior ED triage personnel preferably a physician to lower the strain and facilitate more prompt admissions of ICU patients.

Our study found another interesting fact behind the delay in admission and that was reluctance and refusal of families which has already been pointed in literature¹⁸ to get their patient admitted to ICU. This has multiple aspects including fear of ICU, financial constrains (being a private sector hospital all the expenses have to be borne by the family) and absence of decision maker at site to admit the patient to ICU. Most of the time was ruined in waiting for a decision maker to either arrive from another place or to come in contact from another country where the time difference was another hindrance in making contact to them.

CONCLUSION

A longer stay in emergency department before transfer to intensive care unit (>3.0 hours) is invariably related to higher number of deaths (hospital mortality) in the critically sick patients.

REFERENCES

1. Sprung CL, Danis M, Iapichino G, et al. Triage of intensive care patients: Identifying agreement and controversy. *Intensive Care Med* 2013; 39:1916-24.
2. Simchen E, Sprung CL, Galai N, Zitser-Gurevich Y, Bar-Lavi Y, Gurman G, et al. Survival of critically ill patients hospitalized in and out of intensive care units under paucity of intensive care unit beds. *Crit Care Med* 2004;32(8):1654.
3. Garrouste-Orgeas M, Montuclard L, Timsit JF, et al. Triaging patients to the ICU: a pilot study of factors influencing admission decisions and patient outcomes. *Intensive Care Med* 2003; 29:774-81.
4. Derlet RW. Overcrowding in emergency departments: increased demand and decreased capacity. *Ann Emerg Med* 2002;39(4):430-2.
5. Cardoso LT, Grion CM, Matsuo T, Anami EH, Kauss IA, Seko L, et al. Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. *Critical Care (London, England)* 2011;15:1-R28.
6. Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit Care Med* 2007;35(6):1477-83.
7. Goldhill DR, McNarry AF, Hadjianastassiou VG, et al. The longer patients are in hospital before intensive care admission the higher their mortality. *Intensive Care Med* 2004; 30:1908-13.
8. Cardoso LT, Grion CM, Matsuo T, et al. Impact of delayed admission to intensive care units on mortality of critically ill patients: A cohort study. *Crit Care* 2011; 15:R28.
9. Al-Qahtani S, Alsultan A, Haddad S, et al. The association of duration of boarding in the emergency room and the outcome of patients admitted to the intensive care unit. *BMC Emerg Med* 2017; 17:34.
10. Christ M, Grossmann F, Winter D, et al. Modern triage in the emergency department. *Dtsch Arztebl Int* 2010; 107:892-98.
11. Tam HL, Chung SF, Lou CK. A review of triage accuracy and future direction. *BMC Emerg Med* 2018; 18:58.
12. Bilben B, Grandal L, Søvik S. National Early Warning Score (NEWS) as an emergency department predictor of disease severity and 90-day survival in the acutely dyspneic patient - a prospective observational study. *Scand J Trauma Resusc Emerg Med* 2016; 24:80.
13. Mackway-Jones KMJ, Windle J. *Emergency Triage*. Hoboken, NJ, John Wiley & Sons, 2014.
14. Subbe CP, Kruger M, Rutherford P, et al. Validation of a modified Early Warning Score in medical admissions. *QJM* 2001; 94:521-6.
15. Trzeciak S, Rivers EP. Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. *Emerg Med J* 2003; 20:402-5.
16. Groenland C, Termorshuizen F, Rietdijk W, van den Brule J, Dongelmans D, de Jonge E et al. Emergency Department to ICU time is associated with hospital mortality. *Crit Care Med* 2019;47(11):1564-71.
17. Harris S, Singer M, Sanderson C, et al. Impact on mortality of prompt admission to critical care for deteriorating ward patients: an instrumental variable analysis using critical care bed strain. *Intensive Care Med* 2018; 44:606-15.
18. Metcalfe MA, Sloggett A, McPherson K. Mortality among appropriately referred patients refused admission to intensive-care units. *Lancet* 1997;350(9070):7-11.