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Impact of delay in admission on the outcome of critically ill patients presenting to the emergency department of a tertiary care hospital from low income country

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ORIGINAL ARTICLE

Impact of delay in admission on the outcome of critically ill patients presenting to the emergency department of a tertiary care hospital from low income country

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Abstract

Objective: To assess the impact of admission delay on the outcome of critical patients.

Methods: The retrospective chart review was done at Aga Khan University Hospital, Karachi, and comprised adult patients visiting the Emergency Department during 2010. Outcome measures assessed were total hospital length of stay, total cost of the visit and in-hospital mortality. Patients admitted within 6 hours of presentation at Emergency Department were defined as non-delayed. Data was analysed using SPSS 19.

Results: Of the 49,532 patients reporting at the Emergency Department during the study period, 17,968 (36.3%) were admitted. Of them 2356(13%) were admitted to special or intensive care units, 1595(67.7%) of this sub-group stayed in the Emergency Department for >6 hours before being shifted to intensive care. The study focussed on 325(0.65%) of the total patients; 164(50.5%) in the non-delayed group and 161(49.5%) in the delayed group. The admitting diagnosis of myocardial infarction ($p=0.00$) and acute coronary syndrome ($p=0.01$) was significantly more common in the non-delayed group compared to other diagnoses like cerebrovascular attacks ($p=0.03$) which was significantly more common in the delayed group. There was no significant difference in the hospital length of stay between the two groups ($p>0.05$). The Emergency Department cost was significantly increased in the delayed group ($p<0.05$), but there was no difference in the overall hospital cost between the groups ($p>0.05$).

Conclusions: There was no significant difference in the delayed and non-delayed groups, but long Emergency Department stays are distressing for both physicians and patients.

Keywords: Emergency department, Critical patients, Delays in admission, Karachi, Pakistan. (JPMA 66: 509; 2016)

Introduction

Critically ill patients are usually defined as patients who are physiologically unstable, requiring continuous monitoring and minute-to-minute titration of therapy in accordance with the evolution of disease process.[1] A study described that 8.5% of all patients presenting to the Emergency Department (ED) and >25% of admitted to the hospital are critically ill.[2]

ED boarding (patient who remains in ED after having been admitted but not transferred to an inpatient unit)[3] of critically ill patients awaiting for special care unit (SCU)/intensive care unit (ICU) beds is common and their frequency is increasing in both developing and developed countries.[2,4-11] American Hospital Association (AHA) survey in 2002 found mean waiting time for transfer from ED to an acute or critical care bed was 5.8 hours.[6] Report on future emergency care in US by the Institute of Medicine identifies delays in admission from ED as major concern for public health.[12]

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The main reason for these delays are increasing volume of critically ill patients,[13] complex comorbidities,[14] hospital admission policies, multiple inpatient service consultations,[15] opinion of inpatient team,[16] financial constraints, delay in investigations, hospital and ED overcrowding, and shortage/occupancy of well-equipped and staffed SCU/ICU beds.[6,8,16-19]

When ED boarding of critically ill patient causes a 'holdup', ED becomes the site for ongoing care in the acute phase of management, serving as expandable extensions of the ICU.[20,21] However, literature shows that EDs are not intended, equipped or staffed to provide continuity of care to these critically ill patients whose management needs multidisciplinary involvement of subspecialty expertise.[19,20]

Outcome of critical patients are assessed by a complex process determining not only the impact of delay in admission, but also by early recognition of patients at risk for deterioration, time-bound critical care interventions, aggressive medical care, close monitoring and facilitating access to SCU/ICU.[22-30] Progression of illness while patient is in ED is an important determinant of outcome in critically ill patients,[31-33] and, hence, impact of delays in admission to SCU/ICU on outcome could be substantial. Delay in transfer of patients to ICU bed was associated with increase mortality, morbidity or high cost.[4,16,34-41] However, few studies contradicted others and did not identify the association between delayed admission and hospital mortality, cost and length of stay.[10,16,26,42,43]

In our hospital, delay in admission of critical patients is a common phenomenon because of shortage and occupancy of SCU/ICU beds.[8] Furthermore, there is paucity of data from low middle income countries (LMICs) regarding the impact of delay in admission of critically ill patient from ED. The current study was planned to see the impact of admission delay on the outcome of critical patients. We hypothesised that outcome of critically ill patients in the delayed group would be significantly worse than similar group of patients with no delays.

Patients and Methods

The retrospective chart review was done at Aga Khan University Hospital (AKUH), Karachi, and comprised adult patients visiting ED during 2010. AKUH is a 570-bed, university-affiliated tertiary care referral centre. ED has 46 beds, with an annual patient volume of 55,000 patients. We triage all patients in ED using Emergency Severity Index (ESI) version 4.0. ESI is a five-level triage system (PI-PV); PI = life threatening, PII = critical, P-III = urgent, P-IV = stable, and P-V = walk-in patients. Patients falling in either P-I or P-II categories are seen immediately and moved to resuscitation or critical care area for immediate assessment and care.

ED physicians/consultants provide round-the-clock services and are experienced in managing critical patients. ED has a 4-bed resuscitation bay for P-1 and P-II patient. Patients requiring ventilatory and inotropic support are sent to Resuscitation step-down, equipped with 2 ventilators, while others are sent to either 16-bed critical care area, or 10-bed monitored area.

The hospital has 65 special care (high dependency) beds catering to both medical and surgical patients. ICU and cardiac care unit (CCU) have 14 beds each, while cardiac intensive unit (CICU) has 10 beds. ICU and CCU have nurse-to-patient ratio of 1:1, in SCU this ratio goes down to 1:2.5. However, in the Resuscitation bay, the ratio is 1:2, and in critical area it varies from 1:4 to 1:5, which may include more than one critically ill patient at a time.

Once a decision to admission in ICU/SCU is finalised, online admission request is generated and if a bed is available, patients are immediately admitted and shifted to the vacant bed. If the bed is not available, ED patient care coordinator (PCC) nurse, in communication with hospital shift supervisor, accommodates ED patients on a priority basis, Patients/attendants remain in the loop during the process and the nurse explains possible delays.[3]

For the purpose of the current study, the need to stay in ED for >6 hours pending diagnosis or waiting for SCU/ICU admission due to bed unavailability was considered an exposure, and defined as the "delayed group". Patients, admitted within or up to 6 hours, or non-exposed, were defined as the "non-delayed group". Six hours was selected as the benchmark of admission from ED to inpatient services in the light of literature.[4,6,8]

Our outcome measures were total hospital length of stay (LOS), total cost of the visit and in-hospital mortality. LOS was calculated from the registration at ED to the day of discharge or demise. In-hospital mortality was defined as death in the hospital course.

All adult patients (>16 years) presenting to ED and in need of critical care (SCU/CCU/CICU/ ICU) admission were included, while patients with documented do-not-resuscitate (DNR) code, those who had pre-hospital cardio-pulmonary resuscitation (CPR)/intubated prior to arrival in ED and those who were initially shifted to the ward and later on transferred to high dependency units were excluded. Patients who died in ED pending their admission or were transferred out or left against medical advice (LAMA) were also excluded. We used simple randomisation method to retrieve charts from the health information management system (HIMS) database after approval from the institutional ethics review committee.

The sample size was calculated with the help of Epi-Info with 95% confidence interval (CI) and 80% power. We calculated our sample size keeping in view the findings from previous studies with ratio between exposed and unexposed group taken as 1:1, risk ratio for 30-day mortality in the delayed group as 2.5,[16] and 12.9% in the unexposed group.[4]

Study variables included demographic information, like age, gender, time of presentation and comparison with late-hour presentation (defined as time between 0000 hours and 0700 hours), ED triage category, vital signs, presenting complaints, comorbid conditions, laboratory values, radiological studies and procedures done in ED, severity of illness scores, ED length of stay (time from registration in ED to arrival in SCU/ICU), admitting diagnosis, time of transfer to the critical care unit, category of critical care unit, 30 days in-hospital mortality, hospital LOS (time from registration in ED to time of discharge from the hospital) and cost of the ED and hospital stay (cost were provided by the hospital finance department). Admission Acute Physiology and Chronic Health Evaluation (APACHE) II severity score was calculated for all patients and Mortality Probability Model (MPM) was calculated for patients requiring ICU admission to measure baseline severity of illness in the ED.

Care given in critical care units was not checked and only the information involving ED management and final outcome was noted. Outcome measures assessed were total hospital LOS, cost of ED, and ED stay and hospital mortality of 30 days or less. The total hospital LOS was calculated from the registration at ED to the day of discharge or demise.

Data was analysed using SPSS 19. For descriptive analysis, continuous variables were defined as mean ± standard deviation (SD) or median (Inter-Quartile Range [IQR]) and categorical variable as frequencies and percentages.

Demographic data, APACHE II scores, vital signs and outcomes were compared for the delayed and non-delayed groups. Pearson chi-square and t-test were used to see the association between groups for categorical and continuous variables respectively. The association between mortality and patient's characteristics were assessed using multivariate logistic regression technique. P<0.05 was considered statistically significant.

Results

Of the 49,532 patients reporting at the ED during the study period, 17,968 (36.3%) were admitted. Of them, 2356(13%) were admitted to SCU/ICU, and 1595(67.7%) of this sub-group stayed in the ED for >6 hours before being shifted to intensive care. Keeping in view sample size requirements, the study randomly picked 325(0.65%) of the total cases; 164(50.5%) in the non-delayed group and 161(49.5%) in the delayed group.

The two cohorts were well matched for baseline characteristics like age, gender, triage category, vitals, laboratory findings, presence of comorbidity and APACHE II/MPM score (p-value not significant). Significantly, more patients were noted in the non-delayed group with higher Glasgow Coma Scale (GCS) scores (p=0.033) and history of endocrine disease (p=0.005), but history of central nervous system (CNS) disorder (p=0.005), late-hour presentations (p=0.01) were more common in the delayed group (Table-1).

There was considerable similarity in the major organ/system involvement in both groups (Table-2).

Also, most of the commonest diagnosis in each group had a match within the other group. However, the admitting

Table-1: Patient Characteristics.

	Non Delayed Group (n=164)	Delayed Group (n=161)	P-value
Age (years)			
Mean ± SD	57.7 ± 15.3	57.2 ± 16.1	0.79
Median (IQR)	58 (49.0, 69.0)	58 (47.5, 70.0)	
Gender			
Male; n (%)	99 (60)	99 (61.5)	0.84
Female; n (%)	65 (40)	62 (38.5%)	
Triage category ESI IV,			
P1; n (%)	82 (50.0)	77 (47.8)	0.92
Out of hour . Presentation			
0000 to 0700 hours (%)	28 (17.1)	47 (29.2)	0.01
ED length of Stay hours)			
Mean ± SD	3.3 ± 1.4	12.9 ± 7.4	<0.001
Median (IQR)	3.3 (2.0, 4.0)	10.5 (8.0, 16.0)	
APACHE II severity score			
Mean ± SD	11.1 ± 5.7	11.9 ± 6.4	
Median (IQR) (N)	11.0 (7.0, 15.0) 163	11.0 (7.0, 15.0) 161	0.39
MPM score (ICU Patients)			
Mean ± SD	1.23 ± 0.48	1.52 ± 0.94	0.019
Median (IQR) (N)	1.0 (1.0, 1.0) 83	1.0 (1.0, 2.0) 52	
Past Medical History			
Cardiac	113 (68.9)	107 (66.5)	0.64
Respiratory	20 (12.2)	23 (14.3)	0.58
CNS	4 (2.4)	16 (9.9)	<0.01
Renal	5 (3.0)	8 (5.0)	0.38
Gastrointestinal	9 (5.5)	8 (5.0)	0.83
Malignancy	9 (5.5)	8 (5.0)	0.83
Endocrine	77 (47.0)	52 (32.3)	<0.01
Haematological	14 (8.5)	9 (5.6)	0.3
Others	17 (10.4)	19 (11.8)	0.68
Vitals at presentation			
Pulse	87.8± 24.9	95.8± 23.6	0.003
Respiratory rate (N)	24.3± 7.3 (162)	24± 6.3 (158)	0.75
Temperature (N)	36.9± 0.4(164)	37± 0.4 (160)	0.003
Pulse Oxymetry (N)	95± 8.4 (163)	94.9± 8.7 (161)	0.91
Systolic blood pressure (N)	137.2± 28.5 (162)	129.7± 32.7 (160)	0.03
Diastolic BP (N)	77.7± 16 (162)	76.4± 20.8 (160)	0.51
GCS	14.4± 2.1	13.6± 2.8	
Mild	151	129	0.007
Moderate	5	20	
Severe	8	12	
Laboratory Findings	12.5± 2.4 (155)	12.1± 2.4 (157)	
Hb (mg/dl)	37.7± 7	36.7± 7.2	0.12
Hct (%)	154	147	0.12
WBC (x10^9/l)	11.8± 7.2 (153)	12.4± 6.8 (155)	0.41
BUN	24.5± 22.8 (149)	30.5± 27.8 (157)	0.04
Cr (mg/dl)	1.6± 1.9 (148)	1.8± 2.3 (157)	0.34
Na (meq/dl)	134.3± 6.1(147)	132.1± 6.5 (158)	0.002
K (meq/dl)	4.5± 3.1(148)	4.5± 0.9 (158)	0.76
HCO3 (mg/dl)	19.6± 4.5 (147)	17.6± 4.9 (154)	<0.001
pH	6.8± 0.9 (25)	7.2± 0.4 (42)	0.03
PHCO3	23.6± 4.2 (03)	12.7± 5.2 (05)	0.02
PO2 (mmHg)	96± 45.9 (17)	116± 90.7 (38)	0.4
PCO2 (mmHg)	40.4± 18.8 (17)	35.2± 14.7 (38)	0.28
RBS mg/dL	175.3±109.1 (138(44-745) n= 113	184.5±109.4 (148(62-631) n = 95	0.549

IQR: Inter-Quartile Range. ESI IV: Emergency Severity Index. ED: Emergency Department
APACHE II: Acute Physiology and Chronic Health Evaluation. GCS: Glasgow come Scale.

Table-2: Admitting diagnosis (organ/ system involvement).

	Non Delayed Group (n=164) n (%)	Delayed Group (n=161) n (%)	P-value
Respiratory	18 (11)	28 (17.4)	0.1
Cardiovascular	101 (61.6)	54 (33.5)	<0.001
Trauma	3 (1.8)	0 (0)	0.25
Neurological	19 (11.6)	33 (20.5)	0.03
Sepsis/ infection	9 (5.5)	15 (9.3)	0.19
Renal/metabolic	12 (7.3)	19 (11.8)	0.17
GI	8 (4.9)	17 (10.6)	0.06
Endocrine	2 (1.2)	7 (4.3)	0.1
Malignancy	3 (1.8)	4 (2.5)	0.72
Intoxications	4 (2.4)	8 (5)	0.25
Haematological	1 (0.6)	3 (1.9)	0.37

GI: Gastrointestinal.

Table-3: Emergency Department (ED) Management.

	Delayed Group (n=161)	Non Delayed Group (n=164)	P-value
Radiology			
X-Ray	132 (82%)	121 (74%)	0.075
CT scan	29 (18%)	12 (7%)	0.004
MRI	18 (11%)	12 (7%)	0.229
Ultra Sound	19 (12%)	4 (2.4%)	0.001
ED interventions			
Central venous Lines	11 (7%)	2 (1%)	0.01
Endotracheal tube placement	12 (7.4%)	4 (2.4%)	0.04
Dialysis	0	2 (1%)	0.16

CT: Computred tomography
MRI: Magnetic resonance imaging.

diagnosis of myocardial infarction (p<0.0001) and acute coronary syndrome (p=0.01) was significantly more common in the non-delayed group compared to all other common ED diagnoses, cerebrovascular accidents (p=0.03) was significantly more common in the delayed group. In the delayed group, 108(67%) were admitted to SCU, while 84(51.2%) were admitted to ICU in the non-delayed group (p=0.001).

Significant delays were observed in patients with radiological intervention and emergency procedures in the ED (p<0.05) (Table-3).

There was no significant difference in the in-hospital LOS between the two groups (p>0.05). However, the ED cost was significantly increased in the delayed group (p<0.05), but there was no difference in the in-hospital cost of both the groups (p>0.05) (Table-4).

Patients who died in the hospital had higher mean

Table-4: Overall outcome.

Outcomes	Non Delayed Group (n=164)	Delayed Group (n=161)	P-value
Hospital LOS (in hours)			
Mean ± SD	96.8 ± 147.3	107.6 ± 116.4	0.46
Median (IQR)	48 (22, 96)	67 (24, 136)	
In hospital mortality			
n (%)	34 (20.7)	44 (27.3)	0.16
Cost (in Rs.)			
Emergency Department	14684.2±11691.5 10751 (8996-15705) n=164	22577.3±17967.7 16308 (10601- 30041) n= 158	< 0.001
Hospital	251958.2±333934.8 83848 (42400- 392979) n=162	196493.7±288328.1 95105 (51151- 210497) n=158	0.113

LOS: Length of stay.

Table-5: Mortality by Different Factors (Odds Ratio [OR] with 95% Confidence Interval [CI]).

Indicators; (N=325)	Mortality (%)	Un Adjusted OR with (95% CI)	Adjusted OR* with (95% CI)
Age Group			
16-65 years; n=221	44 (19.9)	1	1
66 years & above; n=104	34 (32.7)	1.95 (1.15, 3.31)	2.36 (1.31, 4.25)
p-value	0.012	0.013	0.004
Triage Category			
P2/P3; n=166	31 (18.7)	1	1
P1; n=159	47 (29.6)	1.82 (1.09, 3.07)	1.91 (1.08, 3.38)
p-value	0.022	0.023	0.027
CO MORBIDITY: Renal			
No; n=312	71 (22.8)	1	1
Yes; n=313	7 (53.8)	3.96 (1.29, 12.16)	3.63 (1.02, 12.89)
p-value	0.01	0.016	0.046
DISCHARGE DIAGNOSIS: Respiratory			
No; n=227	61 (22.0)	1	1
Yes; n=48	17 (35.4)	1.94 (1.01, 3.71)	1.85 (0.87, 3.93)
p-value	0.045	0.047	0.112
DISCHARGE DIAGNOSIS: Sepsis/Infection			
No; n=290	62 (21.4)	1	1
Yes; n=35	16 (45.7)	3.10 (1.51, 6.37)	2.35 (1.06, 5.21)
p-value	0.001	0.002	0.036
DISCHARGE DIAGNOSIS: Malignancy			
No; n=318	73 (23.0)	1	1
Yes; n=7	5 (71.4)	8.39 (1.60, 44.15)	12.73 (2.09, 77.40)
p-value	0.003	0.012	0.006
RADIOLOGY: CT Scan			
No; n=284	59 (20.8)	1	1
Yes; n=41	19 (46.3)	3.29 (1.67, 6.49)	3.18 (1.46, 6.92)

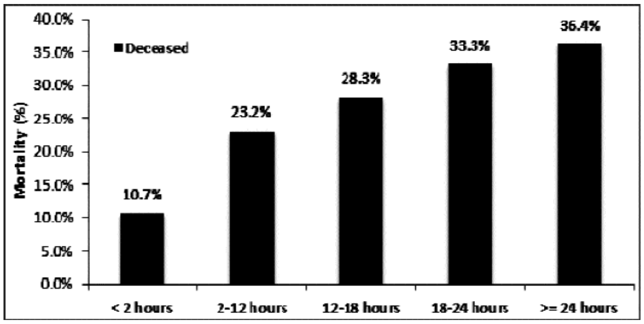

Figure: Mortality rate among patients by time spent in emergency department.

APACHE score 14.04±6.8 compared to those who survived 10.63±5.6 ($p<0.001$). Mortality was found relatively high 26(33.8%) in delayed patients that were mostly triaged P1 compared to 16(23.5%) in P2 and 2 (12.5%) in P3. Similarly, there was 18 (34%) mortality in age 66 or more compared to 9 (29%) and 17 (22.1%) in 16-45 years and 46-65 years respectively (Table-5). Similarly, higher mortality rate was related to the number of hours spent in ED (Figure).

Discussion

Impact of delays in ED for critically ill patients will lead to bad outcome as has been elaborated in literature.[44] Delay of >6 hours in ED has direct correlation with poorer outcome.[45] Delays in ED are multifactorial ranging from higher patient influx, hospital policies, availability of in-patients beds, financial constraints, associated comorbidities, multiple visits, consultation requirements and need for necessary laboratory investigations and management.[46,47] There was no significant difference in hospital LOS between the two groups, but mortality was found to be higher in delayed group. Similarly, the hospital cost was higher in the delayed group though not statistically significant. Radiological and procedural interventions in ED lead to significant delay in admission or there may be a possibility that because of non-availability of hospital beds these interventions were done in ED while the patients were waiting for admission.[45]

We used six hours as the standard benchmark for admission from ED to the hospital as practised in literature.[45] Two cohorts of critically ill patients admitted to SCU/ICU from ED during the study period were analysed; 161 critically ill patients took longer than 6 hours (mean 12.9±7.4) to be shifted to SCU/ICU. The median ED LOS for critically ill patient before being shifted to SCU/ICU for the study period was 10.5 hours.[45] There are multiple reasons behind this delay, including age, initial triage category, disease severity score, delays due to ordering multiple radiological and other test, need for added specialty consults, associated co-morbidities, availability of hospital beds and late hour presentation.[45,48]

Time of presentation in ED is important and can itself lead to an increased ED LOS. Patients presenting to ED during the service hours (0800 to 2000 hours) had more and easily available beds, timely consultants' response with less decision time, but during late hours (2000 to 0800 hours) presentation in a busy ED may lead to delay in admission to the hospital because of full hospital occupancy for the said factors. Few other factors also interfere with timely admission, like added sub-specialty consultations from admitting services and reluctance on the part of junior faculty on floor which may delay the decision.[49]

Patients with (CVS) were triaged as P1, managed and consulted immediately and mostly transferred to cath. lab on a priority bases as in Chalfin et al.[45] This could be justified as patients with acute ST elevation myocardial infarction (MI) are immediately transferred to the cath lab for primary percutaneous intervention (PCI). However, patients with neurological diseases were significantly delayed in spite of P1 category, because they need computed tomography (CT) scan, magnetic resonance imaging (MRI) and other labs before being admitted. In fact, patients with acute ischaemic infarct who fulfilled the criteria had to receive thrombolytic therapy in ED due to less number of beds in Neurology SCU, and the patients had to wait longer for bed availability.

Patients in the delayed group had significantly more diagnostic procedures (CT scans, MRI and ultrasound) and therapeutic interventions (CVC, Endotracheal Tube [ETT] placement) done during their ED course. Diagnostic tests require considerable waiting and could have been a cause of delay in admission. However, there is also a possibility that the ED boarding may have led to this increased diagnostic and therapeutic interventions. Chalfin et al.[1] identified significantly higher rates of mechanical ventilation and CVC in ICU setting in the delayed group with no differences in utilisation of dialysis between the two cohorts similar to our ED findings. With increasing LOS in ED, other than the number of investigations and consultations the total ED cost was significantly higher in the delayed group compared to the other group.

The outcomes measured in this study i.e. hospital LOS, total cost of the visit and in-hospital mortality, do not significantly differ in both groups, but values were higher in all categories in the delayed group. Studies[1-3,34,50] have demonstrated harmful effects of increased ED LOS. Mortality and morbidity of critical patients can be reduced when the admission from ED to critical beds are expedited regardless of the setting as observed by Rivers et al.[51] That study demonstrated that mortality was significantly reduced amongst patients with septic shock when early goal-directed therapy was instituted as soon as the diagnosis was made.[52] Similarly, patients with ischaemic cerebrovascular events[5] who meet criteria for reperfusion therapy have better outcomes when treatment is expeditiously administered.

Most EDs of developing countries are deficient in required facilities like equipment, skilled staff and trained physicians and for proper care these patients need to be transferred to ICU/SCU as early as possible. In the study centre, however, all necessary facilities are available in the ED and the inability to admit critically ill patients does not imply the absence of critical care assessment and treatment and, hence, we consider this to be the reason of no significant difference in outcome between both the groups. Our data suggests that well-trained ED team, even when caring for patients at extended ratios, are able to provide a level of care that is sufficient (in fact equal with regard to outcome) until critical care beds are available as evident in a study.[53]

This has been studied that ED is neither designed nor staffed to provide extended longitudinal care for the critically ill patient[45] and prolonged ED LOS is neither beneficial nor helpful for patient care.

We used APACHE II severity score for all patients and MPM score for patients requiring ICU admission, both of which are generally used in ICU setting. By doing so, we tried to remove clinician bias in the accuracy of the assessment of the severity of illness in ED patients. However, as most of our critically ill patients stayed in ED for longer period and received interventions other than resuscitation, we assume this scoring system is equally effective in an ED setting and patients were more stabilised when they reached SCU/ICU where the same scoring system gives a much lower score. Patients who died in ED were not included in the study and we assume that these patients may have benefited if they were transferred to ICU earlier.

There may be some patients in whom adverse outcomes were experienced as a direct consequence of delay in the decision to admit in SCU/ICU by either ED or consult service physician. It was not possible to track the delay in decision-making, rather we were only able to record the time when the bed was available in SCU/ICU. This can also differ from the real time as in some patients it may take a longer time to shift the patient. This can happen when the ED physician or staff got engaged with other critical/sicker patients and patient handover details to the admitting team was delayed or if the patient was not stable enough to be shifted or required further resuscitation or interventions in ED. Hence, ED boarding time (real) cannot be calculated and we were unable to identify the cause of delay in such patients. We have an online admission system in our institution where we are able to calculate the total ED boarding time. Further work is also needed to identify the specific factors responsible for prolonged ED stay and the unique needs of the critically ill ED patients.

In terms of limitations, this was a single-centre study with limited external validity. The study was based on retrospective chart review and, hence, missing data was not retrievable. Patients who died in ED were not included and we assume that these patients may have benefited if transferred to ICU earlier.

We recommend prospective multi-centre studies that may include public-sector hospitals to identify various causes of delay in admission of critical patients from ED.

Conclusion

Critically ill patients had similar outcomes whether they remained in the ED for more than or less than 6 hours before in-hospital admission. This could be due to the fact that the study centre is well equipped with trained emergency physicians and staff. Prolonged ED stays are distressing for both physicians and patients and this information may be reassuring to them. Managing critical patient in ED does not necessarily mean inferior critical care.

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