Admission And Discharge From ICU And ICU Crowding, Do We Have A Protocol?

Dr. Abid Haleem Khattak[1], Dr. Jawad Hameed[*2], Dr. Sheharyar Ashraf[3], Dr. Sajjad Orakzai[4]

[1,2,3,4]Assistant Professor department of Anesthesia and Critical Care Lady Reading Hospital Peshawar

*drjawadhameed@gmail.com

ABSTRACT

Objectives: This research was conducted to generate ICU admissions and discharge protocol for lady reading hospital- MTI hospital Peshawar. The purpose of conducting this research was to make an admission and discharge protocol for our hospital and measures the results of critically ill patients. This protocol helps us in predicting the efficacy of protocol by calculating outcomes.

Study type: A controlled trial study.

Duration and place: Critical care department of lady reading hospital Peshawar from January 2019 to December 2019

Methodology: All the demographic information e.g., age, the sex was observed during the study. Clinical outcomes in terms of signs, laboratory test results, in-stay hospital mortality, duration of mechanical ventilation, ICU mortality, ICU stay duration, initial cardiopulmonary resuscitation were extracted from the electronic medical records of patients. With the help of ICU physicians, we observed Acute Physiology and Chronic Health Evaluation II (APACHE II) scores. Data related to time of stay in the emergency department was collected from emergency department records.

Results: After the implementation of protocols, we observed mortality rate, and length of ICU stay and found a significant statistical difference in mortality and admission ratio of patients after implementation of ICU protocol.

Conclusion: Admission and discharge protocols help in reducing the time of hospital stay. There is a need for an admission protocol to secure more lives in fewer resources.

Keywords

ICU, Admission and discharge protocol, Emergency Department, Critical Ill patients.

Introduction

For critically ill patients, diagnosis and treatment are crucially important [1-3]. Patients suffering from septic shock [4-5], acute stroke [6], traumatic injury [7], acute myocardial infarction [8], pneumonia [9], cancer [10] with severe complications need the immediate ICU intervention. ICU helps to improve the condition of these critically ill patients. In case of delayed response for critically ill patients, the emergency department transferred patients to ICU in order to improve poor clinical outcomes [11-13]. The delayed transformation from the emergency department to the intensive care unit (ICU) after 6-hours increases the risk of ICU mortality, and in stay hospital mortality [14]. It also maximizes the length of the patient's hospital stay. A prospective cohort study revealed that a 1-hour delayed admission of critically ill patients into ICU enhances the risk of ICU mortality up to 1.5% for every patient [15]. The severity of the disease, application of a mechanical ventilator along with renal therapy causes obstruction in the ICU admission which

results in the death of the patient. These are all the basic treatments of emergency departments which they used to minimize the risk among critically ill patients before their admission to the ICU [3]. Overcrowding in emergency department and limited resources of ICU are major factors that cause a delay in admission and results in severe complications among patients and mortality rates [16,17]. Crowdedness of the ED has been found to hamper appropriate treatment and has been considered a critical problem of the medical service system for a long time [18,19]. Overcrowding in the emergency department has a high association with the mortality rate of critically ill patients [20]. In a systematic literature review, researchers found that more need for the emergency department creates overcrowding which results in poor clinical outcomes of patients [21]. They further revealed that overcrowding in ED causes delays in antibiotic treatment and conducting chest X-rays after a delayed-time interval, complicates the condition of patients suffering from extreme pneumonia [22].

The admission and discharge protocol of ICU is highly associated with the efficient management of hospitals and countries. In England, almost 50% of critically ill patients die in hospital whereas in the USA 1/3 person had contact with the hospital before death. In contrast, 10.1% of deaths occur in intensive care units of England whereas the death ratio in the USA was comparatively high (47.1%). Though the USA has a 5.7 times higher number of ICU's for chronic diseases than the United Kingdom still their outcomes are very poor. In the United Kingdom, the emergency department immediately shifts their patients to ICU due to their efficient admission and discharge protocols which decreases their mortality rate [23].

Pakistan has very limited resources of ICU and these can be managed by creating a protocol for the ICU department. With this efficient policy of the United Kingdom, we try to make an admission and discharge protocol for our hospital and measure the results of critically ill patients. This research aims to produce hospital protocol for lady reading hospital MTI hospital Peshawar and predict the efficacy of protocol by calculating the outcomes of patients.

Methodology

This Controlled trial study was conducted in critical care department of lady reading hospital Peshawar from January 2019 to December 2019. All the demographic information e.g., age, the sex was observed during the study. Clinical outcomes in terms of signs, laboratory test results, in-hospital mortality, duration of mechanical ventilation, ICU mortality, ICU stay duration, initial cardiopulmonary were extracted from the electronic medical records of patients. With the help of ICU physicians, we observed Acute Physiology and Chronic Health Evaluation II (APACHE II) scores. Data related to staying in the emergency department was collected from emergency department records.

ICU admission criteria was controlled by the two full-time attending ICU physicians When critically ill patients reached the emergency department after resuscitation, an emergency physician quickly transferred him to the ICU by direct consulting with the intensivists. To make this step effective we simply categorize patients into three levels for quick admission. In level I, all the patient who need ICU admission on the top priority. This includes the patients who survived after cardiopulmonary resuscitation. Patients with unstable signs, massive hemorrhage, severe electrolyte imbalance, endotracheal intubation without mechanical ventilation, high

probability of clinical deterioration, and going through renal therapy were classified into level II patients. Patients with terminal cancer or stage chronic disease with less possibility of clinical deterioration were classified into level III. Clinical decisions were made by the intensivists by observing the patient's conditions. Level III patients were admitted to the ICU on the behalf of availability of beds otherwise they were not admitted to the ICU [24].

All the collected information was analyzed through the IBM SPSS version 21.0. Nominal variables were presented in the form of percentages whereas continuous variables were presented in the form of mean and standard deviations. Variables that are beyond the normal distribution were analyzed through the Mann-Whitney U test whereas student t-test and Chi-square were used for normal distribution and nominal variables. p-value < 0.05 considered significant.

Results

During the study time period, 489 patients were shifted from the different department to the intensive care unit (ICU). Of the 489 patients, 262 patients were transferred to ICU in first 6-months of the implementation of the protocol whereas 227 patients were transferred after complete training of the protocol. The majority of the patients were male during the study period. A total of 147 (65%) males were admitted to ICU with the mean age of the pre-intervention group was 38.7 ($\pm$17.2) years. Whereas 162 (61.6%) males belonged to a post-intervention group with mean age 42.6 ($\pm$14.2). There was no significant difference found between the age and sex of both groups. The majority of the patients suffered from renal disease, Diabetic ketoacidosis (DKA) and infections that result in organ failure, septic shock, and sepsis. After the implementation of the protocol, we found that it helps in reducing the endotracheal intubation and mechanical ventilation in the ED.

Table 1. Demographic and Clinical baseline outcomes of both groups [24].

	First 6th months of 2019 n= 262	Last 6th months of 2019 n= 227	p-value
Age	38.7 ± 16.7	42.6 ± 14.2	0.579
Sex			0.557
Male	162 (61.6%)	147 (65%)	
Female	100 (38.16%)	80 (35.2%)	
Primary diagnosis at admission			0.344
Gynea Post-operative care	20 (7.6%)	11 (4.84%)	
Snake bite	10 (3.8%)	8 (3.52%)	
Infection	32 (12.21%)	22 (9.69%)	
Renal disease	58 (22.1%)	42 (18.5%)	
DKA	38 (14.5%)	42 (18.5%)	
Liver disease	10 (3.8%)	8 (3.52%)	
Drug intoxication	6 (2.29%)	8 (3.52%)	
Cancer	6 (2.29%)	6 (2.64%)	
CNS disease	16 (6.104%)	11 (4.84%)	
Cardiac disease	9 (3.43%)	14 (6.16%)	

Sepsis	25 (9.54%)	15 (6.60%)	
Trauma	10 (3.8%)	22 (9.69%)	
Eclampsia	8 (3%)	3(1.32)	
Burn	4 (1.52%)	0 (0%)	
Others	10 (3.8%)	15 (6.6%)	
APACHE II score	19.7 ± 9.6	16.9 ± 7.6	0.486
Initial signs			
BT (°C)	36.8 ± 0.8	36.8 ± 0.9	0.537
SBP (mm Hg)	105.2 ± 27.6	109.6 ± 33.2	0.235
RR (rate/min)	22.7 ± 5.2	21.7 ± 4.2	0.081
MBP (mm Hg)	74.2 ± 27.1	79.4 ± 26.8	0.108
DBP (mm Hg)	65.8 ± 16.7	67.9 ± 18.4	0.318
HR (rate/min)	98.1 ± 24.9	98.2 ± 21.3	0.972
Initial laboratory results			
C-reactive protein (mg/dL)	8.3 (0.9–19.2)	6.7 (0.3–17.9)	0.379
White blood cell count	14,064.0 ± 8299.2	12,625.5 ± 8450.4	0.151
Lactate (mg/dL)	29.0 (18.0–53.0)	25.7 (13.6–53.6)	0.198
Hematocrit (%)	33.9 ± 7.3	33.0 ± 7.2	0.289
ALT (U/L)	28.5 (17.8–62.0)	24.0 (13.0–40.5)	0.161
Platelet (K)	200.0 ± 108	180.7 ± 97.1	0.400
AST (U/L)	42.5 (28.0–109.3)	38.0 (25.0–75.0)	0.146

After implementation of protocol, we observed mortality rate, and length of ICU stay. We found significant statistical difference in mortality and admission ratio of patients after implementation of ICU protocol.

Table 2. Comparison of ICU stay and clinical outcomes among both groups.

	Percentage % or N	Mean and standard deviation	p-value
ICU outcomes			0.0001
ICU Recovery	307 (62.7%)	25.5 ± 5.19	
ICU mortality	180 (36.8%)	14.41 ± 3.75	

Table 3. Time duration of the admission and discharge criteria

Variables	Outcomes in terms of days	Mean and Standard deviation	p-value
ICU length of stay (days)	3369 days	280.75± 33.05	0.015
Time to admission orders	231.0 (149.3–334.5)	311 (195.3–952.5)	<0.001
Time between admission orders and ICU admission	124.0 (72.3–241.5)	290 (119.3–749.8)	<0.001

Discussion

Admission of critically ill patients in an intensive care unit (ICU) reduces the length of stay in the emergency department. Observations reflect that after application of the admission protocol length of the emergency department stay reduce to 650 min. Application of admission protocol also helps to minimize the required time of decision and admission preparation. The new protocol also minimizes the length of ICU stay of two groups which were selected according to age, sex, and APACHE II score at ICU admission. The results depict that early discharge is only possible when critically ill patients were received early intensive care by shifting them immediately from the different department to the intensive care unit. These results are in accordance with many past studies in which researchers explore that early shifting of critically ill patients to ICU influence the length of stay [4-10]. During the study, the researcher observed that in some cases late resuscitation and late admission to the relevant department cause many other complications which may result in severe complications at different time intervals. Different studies examine negative consequences of late process of admission by ward physicians and relevant department for the multiple reason patients [16,17]. There are very fewer protocols regarding admission and discharge that were implemented which lengthened the stay in the intensive care unit [16,17].Lady hospital MTI Peshawar is one of the biggest territory hospitals in Khyber Pakhtunkhwa. Unfortunately for every 82 beds of the critical care department, there is the only one medical specialist to deal with the situation. So, we prepared an admission and discharge protocol for the efficient utilization of resources. After preparation of the protocol, we educate hospital staff and secure ICU beds especially for level 1 patients who need quick admission in ICU. This protocol was implemented and on the top priority, we shift level 1 patients who survived after cardiopulmonary resuscitation from the wards to ICU.

Another important thing observed that delaying the process of ICU admission and discharge threatened the life of patient. This reason is highlighted in the studies of Trzeciak [18], Schafermeyer [19] in 2003, and also highly noticeable in the study of Jeong [20], Carter [21], and Pines [22]. During research physicians of the relevant department performed all initial treatment including endotracheal intubation, mechanical ventilation, continuous renal replacement therapy, extracorporeal membrane oxygenation to rescue patients before admission to ICU. Though the intentions are to saving life still it causes a chaotic situation for those department. After the implementation of protocol, we observed comparatively high mortality rate (97 deaths) in first six months due to improper training of medical staff. After proper training we reported 83 deaths in last six months of 2019 with overall 36.8% mortality rate. To minimize the mortality ratio and burden on the wards we educate emergency physicians, medical staff, and intensivists. With the collaboration of these department, we observed significant results in a stay of critically ill patients. We observed that the early intensive care shortens the length of ICU stay that is not only beneficial to patient health but also affects the length of ED stays. We try to admit only level 1 critical patients and shift improved patients to the common wards.

Increase demand for ICU admission and shortage of ICU needs efficient management of resources [15,17,28]. By applying protocol decrease the length of ICU stay which automatically increases the ICU bed turnover ratio which helps to admit more critical patients in that time interval. The application of the new protocol as mentioned in methodology is the best solution for the operation ICU [25,26,27].

Admission criteria in ICU are in the hand of physicians and intensivists. There are no scientific criteria to observe a need for ICU admission. Physicians carefully observed the condition of patients and then decide whether to shift them in ICU or not immediately [28,29, 30]. The condition of patient judge by experienced physicians gave more accurate results as compared to prediction done by any formula or objective numerical. In the recent study, researchers observed that for those critically ill patients for which physicians predict the condition on the basis of hospital mortality and 6th-month mortality ratio had more accurate results as compared to the patients for which they use formula [31].

The major concern of protocol made for the intensive care unit (ICU) admission is to select those patients whose condition would be controlled due to admission rather to admit patients who may not get any benefit or have less chance of survival. In order to effectively utilize our resources, we assure that patients with chronic terminal cancer or stage chronic disease or having less possibility of clinical deterioration occupy less space in ICU. Patients who had poor outcomes submitted DNR consent and very less possibility of clinical deterioration were classified into level 3 and avoid to admit in ICU. This procedure was already implemented in recently conducted studies in which researchers classified their patients in two groups; one who did not get any benefit from ICU admission e.g., less probability of survival; and the other group with patients who had a great chance of survival and can be further treated into wards [32]. Patients having less chance of survival was the fundamental reason for delaying the admission of other patients because they were treated withmeaningless life-sustaining treatment which never helps to recover their condition [33].

Conclusion

Low-income countries including Pakistan have very limited resources of ICU which burdened the healthcare sector and advance the mortality ratio of a country. With this shortage, the management of ICU resources is the best solution. Admission and discharge protocols help to reduce the hospital stay. There is a need for an admission protocol to secure more lives in fewer resources.

Conflict of interest

There was no conflict of research during studies.

References

[1] Engoren M. (2005). The effect of prompt physician visits on intensive care unit mortality and cost. Crit Care Med, 33(4), 727–732.

[2] Junhasavasdikul D, Theerawit P and Kiatboonsri S. (2013). Association between admission delay and adverse outcome of emergency medical patients. Emerg Med J, 30(4), 320–323.

[3] Duke G, Green J and Briedis J. (2004). Survival of critically ill medical patients is time-critical. Crit Care Resusc, 6(4), 261–267.

[4] Lundberg JS, Perl TM, Wiblin T, et al. (1998). Septic shock: an analysis of outcomes

for patients with onset on hospital wards versus intensive care units. Crit Care Med, 26(6), 1020–1024.

[5] Rivers E, Nguyen B, Havstad S, et al. (2001) Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med, 345(19), 1368–1377.

[6] Adams HP Jr, del Zoppo G, Alberts MJ, et al. (2007). Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: the American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. Circulation, 115(20), e478-e534.

[7] Raj R, Siironen J, Kivisaari R, et al. (2013). Factors correlating with delayed trauma center admission following traumatic brain injury. Scand J Trauma Resusc Emerg Med, 2, 67.

[8] Antman EM, Hand M, Armstrong PW, et al. (2008). 2007 focused update of the ACC/AHA 2004 guidelines for the management of patients with ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the Canadian Cardiovascular Society endorsed by the American Academy of Family Physicians: 2007 writing group to review new evidence and update the ACC/AHA 2004 guidelines for the management of patients with ST-elevation myocardial infarction, writing on behalf of the 2004 writing committee. Circulation, 117(2), 296–329.

[9] Phua J, Ngerng WJ and Lim TK. (2010). The impact of a delay in intensive care unit admission for community-acquired pneumonia. Eur Respir J, 36(4), 826–833.

[10] Lee DS, Suh GY, Ryu JA, et al. (2015). Effect of early intervention on long-term outcomes of critically Ill cancer patients admitted to ICUs. Crit Care Med, 43(7), 1439–1448.

[11] Goldhill DR, McNarry AF, Hadjianastassiou VG, et al. (2004). The longer patients are in hospital before intensive care admission the higher their mortality. Intensive Care Med, 30(10), 1908–1913.

[12] Bing-Hua YU. (2014). Delayed admission to intensive care unit for critically surgical patients is associated with increased mortality. Am J Surg, 208(2), 268–274.

[13] Rapoport J, Teres D, Lemeshow S, et al. (1990). Timing of intensive care unit admission in relation to ICU outcome. Crit Care Med, 18(11), 1231–1235.

[14] Chalfin DB, Trzeciak S, Likourezos A, et al. (2007). Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. Crit Care Med, 35(6), 1477–1483.

[15] Cardoso LT, Grion CM, Matsuo T, et al. (2011). Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. Crit Care, 15(1), R28.

[16] Ward NS and Chong DH. (2015). Critical care beds and resource utilization: current

trends and controversies. Semin Respir Crit Care Med, 36(6), 914–920.

[17] Perez d'Empaire PA and Kajdacsy-Balla Amaral AC. (2012). Year in review 2011: critical care–resource management. Crit Care, 16(6), 244.

[18] Trzeciak S and Rivers EP. (2003). Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. Emerg Med J, 20(5), 402–405.

[19] Schafermeyer RW and Asplin BR. (2003). Hospital   and   emergency department crowding in the United States. Emerg Med (Fremantle),15(1), 22–27.

[20] Jo S, Jeong T, Jin YH, et al. (2015). ED crowding is associated with inpatient mortality among critically ill patients admitted via the ED: post hoc analysis from a retrospective study. Am J Emerg Med, 33(12), 1725–1731.

[21] Carter EJ, Pouch SM and Larson EL. (2014). The relationship between emergency department crowding and patient outcomes: a systematic review. J Nurs Scholarsh, 46(2), 106–115.

[22] Pines JM, Hollander JE, Localio AR, et al. (2006). The association between emergency department crowding and hospital performance on antibiotic timing for pneumonia and percutaneous intervention for myocardial infarction. Acad Emerg Med, 13(8), 873–878.

[23] Levy MM, Artigas A, Phillips GS, Rhodes A, Beale R, Osborn T et al. (2012). Outcomes of the surviving sepsis campaign in intensive care units in the USA and Europe: a prospective cohort study. Lancet Infectious Diseases, 12(12), 919–924.

[24] Kim EJ, Lee S, Jeuong J,   Lee DH. (2018). Intensive care unit admission protocol controlled by intensivists can reduce transfer delays from   the emergency department in critically ill patients. Hong Kong Journal of Emergency Medicine, pp. 1-7.

[25] Guidelines for Intensive Care Unit Admission, Discharge, and Triage. (1999). Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine. Crit Care Med, 27(3), 633–638.

[26] Kwak SH, Jeong CW, Lee SH, et al. (2014). Current status of intensive care units registered as critical care subspecialty training hospitals in Korea. J Korean Med Sci, 29(3),431–437.

[27] Ward NS and Levy MM. Rationing and critical care medicine. (2007). Crit Care Med, 35(2 Suppl.), S102–S105.

[28] Edbrooke DL, Minelli C, Mills GH, et al. (2011). Implications of ICU triage decisions on patient mortality: a cost-effectiveness analysis. Crit Care, 15(1), R56.

[29] Sprung CL,   Artigas   A, Kesecioglu   J, et   al. (2012). The Eldicus   prospective, observational study of triage decision making in European intensive care units. Part II: intensive care benefit for the elderly. Crit Care Med, 40(1), 132–138.

[30] Sinuff T, Adhikari NK, Cook DJ, et al. (2006). Mortality predictions in the intensive care unit: comparing physicians with scoring systems. Crit Care Med, 34(3), 878–885.

[31] Detsky ME, Harhay MO, Bayard DF, et al. (2017). Discriminative accuracy of physician and nurse predictions for survival and functional

outcomes 6 months after an ICU admission. JAMA, 317(21), 2187–2195.

[32] Bone RC, McElwee NE, Eubanks DH, et al. (1993). Analysis of indications for intensive care unit admission. Clinical efficacy assessment project: American College of Physicians. Chest, 104(6), 1806–1811.

[33] Griner PF. (2014). Treatment of acute pulmonary edema: conventional or intensive care? Ann Intern Med 1972; 77(4): 501506. 32. Huynh TN, Kleerup EC, Raj PP, et al. The opportunity cost of futile treatment in the ICU*. Crit Care Med, 42(9), 1977–1982.